

17 Assessment of Potential Effects on Birds

Birds (*kopanoak*) are important to Inuit because they provide sustenance from their harvest and their eggs, provide down used for insulating clothing, and the presence and departure of migratory species signify the changing of the seasons (Banci and Spicker 2024). This is why birds and their habitats were identified as a Valued Component (VC) in the Nunavut Impact Review Board (NIRB) guidelines for the Grays Bay Road and Port Project (Project). The scope of the assessment considers a variety of sources, including Inuit, Indigenous, and Community Knowledge, and western science, to evaluate potential project-related effects on birds and bird habitat within defined local and regional boundaries.

Given the variety of birds in the Project area and differences in species' ecology and habitat use, birds were grouped into guilds to facilitate assessment of potential effects. The bird groupings included passerines, waterbirds (composed of seabirds, shorebirds, and waterfowl), and cliff-nesting raptors. These bird guilds are composed of species that generally share similar nesting and foraging strategies, and the observed outcomes are broadly applicable to most guild members.

The birds and bird habitat assessment is linked to the following VCs:

- Vegetation (see Volume 6, Section 15): Vegetation provides habitat for feeding, reproduction, and young-rearing for birds, as well as cover/protection from predators.
- Air Quality (see Volume 5, Section 11): A change in air quality may affect the quality of bird nesting and foraging habitat.
- Noise and Vibration (see Volume 5, Section 13): A change in noise and vibration may affect the quality of bird nesting and foraging habitat.
- Terrain, Soils, and Permafrost (see Volume 6, Section 14): A change in terrain, soils, and permafrost may affect the quality of bird nesting and foraging habitat.
- Water Resources (see Volume 7, Section 19): The quality and quantity of water are important to the health and well-being of birds, especially for migratory birds that require ponds and lakes for foraging, nesting, and/or staging areas during migration.

The birds and bird habitat assessment supports the following VCs:

- Traditional Land, Marine, and Resource Use; Food Security and Food Sovereignty; and Community Health and Well-being (see Volume 9, Sections 24–26): Birds, such as some waterbirds, are valuable to Inuit and other Indigenous groups for sustenance and other cultural purposes.

17.1 Scope of Assessment

This section defines and describes the scope of the assessment of potential effects on birds and bird habitat. It is based on the NIRB's guidelines for the Project (NIRB 2026). The assessment is informed by Inuit, Indigenous, and Community Knowledge, as well as scientific information compiled to identify baseline conditions for birds and their habitats. The assessment occurs within defined local and regional spatial boundaries for birds and bird habitat to evaluate project-related interactions and effects.

17.1.1 Influence of Engagement and Inuit, Indigenous, and Community Knowledge on the Assessment

West Kitikmeot Resources Corp. (WKR) continues to engage with Inuit of the Kitikmeot Region (hereinafter referred to as the Kitikmiut), other Indigenous groups, and other potentially affected communities regarding the Project. A summary of engagement activities conducted between 2016 and 2025 is presented in Volume 3, Section 6 (Public Engagement). In addition to these activities, WKR conducted community-based primary research with residents and organizations in the Kitikmeot communities of Cambridge Bay (*Ekaluktutiak*), Gjoa Haven (*Ursuqtuq*), Kugaaruk, Kugluktuk, and Taloyoak, as well as with organizations in Yellowknife. An Inuit Advisory Group (IAG) was established to advise WKR on potential environmental and socio-economic effects or concerns related to the Project, planned mitigation approaches, and aspects of the environmental assessment, including, but not limited to, baseline conditions, significance determination, and the consideration and integration of Inuit and Community Knowledge. The Kitikmeot Inuit Association and WKR selected members based on their knowledge of many aspects of the natural and human environment, including but not limited to wildlife, fish, land use and access, archaeology, and water in the project area.

To further inform the project design, a project-specific Inuit Knowledge report titled *Kitikmeot Knowledge of the Proposed Kogloktokyo (Grays Bay) Port and Road Project Final Report* (Banci and Spicker 2024) was commissioned by WKR. This report, based on Inuit Knowledge contained in the Naonaiyaotit Traditional Knowledge Project (NTKP) database, was made available to WKR through a licensing agreement with the Kitikmeot Inuit Association.

In addition, publicly available sources of Inuit and Indigenous Knowledge were reviewed to provide further context about baseline conditions and how conditions are changing, as well as potential mitigation measures recommended on previous projects that could be considered for the Project. Results from monitoring studies and other community-based research were also reviewed.

Through the project-specific engagement program, Kitikmiut, other Indigenous groups, and other potentially affected communities shared comments, perspectives, concerns, and recommendations related to birds. WKR commits to continued engagement with Kitikmiut, other Indigenous groups, and other potentially affected communities during the advancement of project design, planning, and monitoring, throughout the life of the Project.

17.1.1.1 *Influence of Inuit, Indigenous, and Community Knowledge on Assessment Boundaries*

Information obtained through Inuit, Indigenous, and Community Knowledge was reviewed with consideration to the proposed spatial boundaries. The Project-specific Inuit Knowledge report, compiled from the NTKP database, provided spatial information about birds in the context of the Project and this assessment includes those habitats where effects from the Project (both direct and indirect) are expected to occur (see Section 17.1.4.1).

Inuit Knowledge established the geographical scope and extent of the study area considered in the Project-specific Inuit Knowledge report by identifying locations of traditional use and ecological importance, making certain the assessment included all potentially affected regions. Areas identified included Grays Bay, Hepburn Island, Wentzel River, and around Contwoyto Lake (Banci and Spicker 2024).

By incorporating this body of spatially referenced Inuit Knowledge, the assessment's boundaries reflect the complex patterns of human and ecological use over generations, lending cultural relevance and robustness to the assessment's spatial boundaries. See Figure 17.2, which represents the distribution of bird habitats identified through the Project-specific Inuit Knowledge report and influenced the resulting assessment boundaries used in this assessment (Section 17.1.4.1).

17.1.1.2 *Influence of Inuit, Indigenous, and Community Knowledge on Baseline Conditions*

WKR collected baseline condition information by combining Inuit-led and collaborative knowledge gathering (including the Project-specific Inuit knowledge from the NTKP database and IAG workshops), publicly available information from Indigenous groups considered in the context of the Project, and engagement feedback shared by Kitikmiut, other Indigenous groups, and other potentially affected communities, with technical studies based on western scientific methods. Pertinent baseline information from Inuit, Indigenous, and Community Knowledge sources has been considered and summarized in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A) as well as this effects assessment in Section 17.2.1.1, Table 17.6. The information obtained included bird species of cultural importance, important habitats for birds, and seasonal patterns (see Section 17.2).

17.1.1.3 *Influence of Inuit, Indigenous, and Community Knowledge on the Assessment of Project Effects*

WKR discussed with Kitikmiut, other Indigenous groups, and other potentially affected communities how project activities (e.g., clearing, blasting, etc.) and project infrastructure could affect socio-economic conditions and culturally important interests, including birds and bird habitat, within the Local Assessment Area (LAA) and Regional Assessment Area (RAA). Through community meetings, IAG workshops, and public engagement opportunities, Kitikmiut, other Indigenous groups, and potentially affected communities provided perspectives and values that were considered and integrated into the potential effects. Inuit, Indigenous, and Community Knowledge helped to identify bird habitat of importance and

project concerns, such as effects on birds as a result of sensory disturbances or habitat loss (see Sections 17.4 and 17.5).

17.1.1.4 *Influence of Inuit, Indigenous, and Community Knowledge on the Assessment of Cumulative Effects*

Through workshops and regional discussions, Kitikmiut Knowledge Holders, other Indigenous groups, and other potentially affected communities assisted WKR in identifying culturally important areas, species and traditional food sources, and practices that may experience combined effects from the Project and other projects and activities in the Project's RAAs.

WKR wove Inuit, Indigenous, and Community perspectives with Western science to develop a holistic view of how multiple changes could affect land-based livelihoods, traditional land, marine, and resource use (TLMRU), and environmental integrity over time. The analysis recognizes the importance of long-term monitoring, where local, Inuit co-developed and co-implemented data collection will track combined effects to inform adaptive management plans. For example, monitoring will be used to monitor bird occurrence and distribution in relation to the Project during and document any bird mortalities directly caused by the Project (see Section 17.9).

17.1.1.5 *Influence of Inuit, Indigenous and Community Knowledge on Assessing Significance of Effects*

Significance criteria were informed with consideration of the priorities and values identified through Inuit, Indigenous, and Community Knowledge (see Volume 3). The concept of significance in the assessment was guided by Inuit, Indigenous, and Community values and detailed ecological observations about resource health, along with understanding of socio-economic conditions and TLMRU. Members of the IAG provided criteria to consider when Identifying whether a project is likely to have significant, or unacceptable, effects (see Sections 17.1.5 and 17.7).

To be considered "non-significant" or acceptable, IAG members advised WKR to implement comprehensive measures and commitments that align with Inuit, Indigenous, and Community priorities and values.

- **Proactive Protection Measures:** WKR's commitment to avoiding or strictly mitigating known high-risk activities is crucial. This includes actions like identifying appropriate timing windows for bird nesting, as well as following recommended setback distances from active nests for various species.
- **Incorporation of Inuit, Indigenous, and Community Knowledge into Management:** The commitment to incorporate Inuit, Indigenous, and Community Knowledge and Western Science in all assessment sections, as appropriate, from baseline to monitoring, fostered dialogue and an inclusive Project. The request for Inuit monitors to enforce mitigation measures in real-time shows that inclusion requires active Inuit participation in the Project's management (IAG 2025a, 2025b).

- Adaptive Management: The use of adaptive management plans that can be revised based on ongoing monitoring and the ongoing sharing of Inuit, Indigenous, and Community Knowledge is seen as essential for success and acceptability, given the unpredictable nature of climate (IAG 2025a, 2025b).
- Holistic Approach to Benefits: The Project's success is tied to its broader social and economic benefits, such as contributing to more resilient supply chains and providing job/training opportunities for Inuit and other Indigenous groups. The protection of all wildlife and water resources, beyond just caribou, was also a key part of the holistic equation for acceptability (IAG 2025b).

17.1.1.6 *Influence of Inuit, Indigenous, and Community Knowledge on the Development of Mitigation, Management, and Enhancement Measures*

Through engagement activities, community-based primary research, IAG workshops, and the review of publicly available literature, measures to reduce negative effects from the Project and enhance its benefits were identified. For example, during IAG workshops, participants stated that WKR should implement mitigation measures that have proven successful on other projects in Nunavut rather than inventing new measures (IAG 2025b). Feedback also helped focus the Project's design on sensitive timing and locations for monitoring and mitigation.

Proposed mitigation, management, and enhancement measures were discussed and reviewed with Inuit community representatives during IAG workshops and community meetings with the intent of developing and implementing measures that consider both the biophysical and human environment. Adjustments were made as appropriate, based on advice from IAG members and the Kitikmeot Inuit Association, as well as from Indigenous groups and other potentially affected communities through engagement. . Inuit co-developed and co-implemented monitoring and reporting were incorporated to support ongoing involvement and accountability. While available information obtained through Inuit, Indigenous, and Community Knowledge has not identified mitigation measures specific to birds, the mitigation measures listed in Sections 17.4.1.3 and 17.4.2.3 are designed to avoid and reduce effects on birds and bird habitat, recognizing their importance for ecosystem health and traditional land, marine, and resource use.

17.1.1.1 *Influence of Inuit, Indigenous, and Community Knowledge on Transboundary Effects*

WKR engaged with and received feedback from Indigenous groups and other potentially affected communities, governments, and organizations in regions outside of the Kitikmeot Region to understand if project activities could affect socio-economic conditions, resources, wildlife, or culturally important areas shared between regions. This feedback has been integrated into the transboundary effects assessment (Volume 10, Section 33) and is not discussed further in this section.

17.1.2 Regulatory and Policy Setting

In Canada, bird protection is primarily afforded through two federal statutes: the *Migratory Birds Convention Act* (MBCA) and the *Species at Risk Act* (SARA) (see Table 17.1). The MBCA broadly safeguards most migratory bird species, along with their nests and eggs, from intentional or unintentional harming, disturbance, or killing, regardless of their conservation status. This protection applies across Canada. The SARA protects listed bird species at risk listed as extirpated, endangered, or threatened (see Table 17.1).

Table 17.1 Federal Legislation Applicable to the Assessment of Birds

Name	Description
<i>Migratory Birds Convention Act, 1994</i> , S.C. 1994, c. 22 (GOC 1994) and Migratory Bird Regulations	The <i>Migratory Birds Convention Act</i> , created in 1917 and updated in 1994, protects and conserves migratory birds, eggs, and nests through the implementation of the Migratory Birds Regulations and the Migratory Birds Sanctuary Regulations. According to the Act, removal of migratory birds, their eggs, or nests from a site is only permissible if the migratory birds are causing or may cause damage to property and equipment (subject to permitting).
<i>Species at Risk Act</i> , S.C., 2002, c. 29	The <i>Species at Risk Act</i> (SARA) provides general prohibitions to protect species listed as endangered, threatened, or extirpated under Schedule 1 that occur on federal lands. The general prohibitions apply to all listed migratory birds and aquatic species, no matter where they occur (i.e., on federal lands, provincial/territorial lands, or private lands. For wildlife listed under the SARA, a federal recovery strategy or action plan is required for that species, which identifies their critical habitat for the SARA's general prohibitions to apply on non-federal lands. All environmental assessments must identify any species at risk or critical habitat that is likely to be affected, and "...must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans" (SARA; Subsection 79 (2)). Additionally, if the Project is likely to affect a listed wildlife species, the proponent must promptly notify the relevant minister.

Territorial legislation also has powers of protection for birds. The Nunavut (NU) *Wildlife Act* protects bird nests and eggs and identifies raptor species protected by the legislation. The *Nunavut Land Claims Agreement Act* provides for the protection and management of bird habitat. The *Nunavut Planning and Project Assessment Act* respects land use planning and acknowledges conservation areas for birds and bird habitat (see Table 17.2).

The *Nunavut Land Claims Agreement Act*, Statutes of Canada 1993, c. 29 (herein referred to as the Nunavut Agreement, and amended in 2010) establishes the boundaries of the NU Territory and its governance structure. It creates the Government of Nunavut (GN) and Institutions of Public Governance, including the Nunavut Wildlife Management Board, the NIRB, the Nunavut Planning Commission, the Nunavut Surface Rights Tribunal, and the Nunavut Water Board. The Nunavut Agreement directly impacts bird protection through provisions for conservation areas, wildlife management, and Inuit participation in decision-making processes related to wildlife, including birds, and their habitats.

Table 17.2 Territorial Legislation Applicable to the Assessment of Birds

Name	Description
Nunavut <i>Wildlife Act</i> , S.Nu. 2003, c. 26 (GN 2003)	The Nunavut <i>Wildlife Act</i> outlines the management and conservation of wildlife, including birds, in Nunavut. The Act provides guidelines for managing hunting, establishing wildlife areas, and addressing activities that could harm wildlife or their habitats, all of which relate to bird protection. The Act translates the decisions of the Nunavut Wildlife Management Board (NWMB) into enforceable regulations. Associated regulations include the Wildlife General Regulations (1999) and the Wildlife Licenses and Permits Regulations (1999).
Nunavut <i>Land Claims Agreement Act</i> , S.C.1993, c. 29	The <i>Nunavut Land Claims Agreement Act</i> directly relates to bird protection through its provisions for wildlife management and habitat protection, particularly within the Nunavut Settlement Area. The agreement establishes a framework for managing wildlife (including birds) and ensures Inuit participation in decision-making processes related to land use and resource management. This framework includes establishing the NWMB and provisions for protecting key bird habitats.
Nunavut <i>Planning and Project Assessment Act</i> , S.C. 2013, c. 14, s. 2	The <i>Nunavut Planning and Project Assessment Act</i> provides the legal framework for land use planning and project assessment, which inherently includes considerations for wildlife and their habitats, including bird habitats in Nunavut. The <i>Act</i> formally establishes the NIRB and grants it legal authority to screen, review, and assess the potential ecosystem and socio-economic effects of proposed projects that may impact bird populations in Nunavut.

The Nunavut Agreement also lays out principles for wildlife conservation and compensation, the establishment of parks and conservation areas, land and resource management, land-use planning, resource royalty sharing, Inuit impact and benefit agreements, and taxation.

Essentially, the Nunavut Agreement provides a framework for collaborative wildlife management that recognizes Inuit rights and knowledge, ensuring the protection of bird populations and their habitats within the Nunavut Settlement Area.

In accordance with the guidance provided by the Inuit Advisory Group to WKR, and a suggestion to not “re-create the wheel” when it comes to protection measures (IAG 2025a), best management practices to avoid or reduce Project-related effects on the land, water, and the animals that use it were adapted from previously approved major development projects in the Arctic. The projects considered by WKR to be relevant sources of best practices for birds included the Mackenzie Valley Highway, the Sabina Gold and Silver Corporation’s Back River Project, the Agnico Eagle Mines Limited – Meadowbank Complex and associated access roads, and the Baffinland Mary River Project. Developed with Inuit, Indigenous, and Community Knowledge, best practices from these projects, along with information shared with WKR in workshops with the IAG and engagement with communities, form the basis of the mitigation, enhancement, and management measures presented in this Impact Statement (IS) to avoid or reduce adverse effects on birds.

In addition, the assessment of effects on bird habitat is guided by Inuit, Indigenous, and Community Knowledge (as outlined in Section 17.1.1). Inuit Knowledge may also be referred to as Inuit *Qaujimaningit*, which encompasses “Inuit traditional knowledge (and variations thereof or Inuit *Qaujimajatuqangit*), local and community-based knowledge, as well as Inuit epistemology as it relates to Inuit Societal Values and Inuit Knowledge (both traditional and contemporary)” (NIRB 2018). Inuit Societal

Values, including traditional values, beliefs, and principles, are referred to as Inuit *Qaujimajatuqangit* principles (NIRB 2018). For more details, see Volume 3. The Kitikmeot Inuit Association recommended using the term Inuit Knowledge in the IS. WKR has adopted this terminology and understands that Inuit Knowledge encompasses the principles of Inuit *Qaujimajatuqangit*, which have been incorporated into the assessment of effects on birds.

17.1.3 Potential Effects, Pathways, and Measurable Parameters

The Project has the potential to affect birds from populations that interact with the Project through the activities and infrastructure associated with the Construction and Operations and Maintenance phases of the Project (see Table 17.3).

Table 17.3 Potential Effects, Effects Pathways, and Measurable Parameters for Birds

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Habitat	- Direct habitat loss caused by vegetation clearing and ground disturbance during Construction. - Indirect habitat loss due to sensory disturbances that reduce the effectiveness of adjacent habitat during Construction and Operations and Maintenance.	- Area (km²) of direct habitat loss within the PDA boundaries. - Area (km²) of indirect habitat loss within the ZOI boundaries.
Change in Mortality Risk	- Incidental take of birds (i.e., disturbance or destruction of nests) during Construction. - Collisions with vehicles, equipment, aircraft, and marine vessels during Construction and Operations and Maintenance activities. - Collisions with infrastructure due to Project lighting during Construction and Operations and Maintenance activities. - Project-related changes in habitat and access during Construction and Operations and Maintenance phases may increase hunting, egg collection, and/or predator-prey dynamics, thereby affecting indirect mortality risk	Predicted changes to mortality based on the potential for incidental take via nest disturbance and destruction, and potential collisions with vehicles, equipment, aircraft, marine vessels, and infrastructure (qualitative).

Construction of the Project will cause direct habitat loss where infrastructure is proposed. Indirect habitat loss may occur due to project-related activities during Construction and Operations and Maintenance that displace birds from an area through sensory disturbance, thereby reducing the effectiveness of adjacent habitat. The Zone of Influence (ZOI) is the distance within which human activities may alter bird behaviour or habitat use.

The change in mortality risk for birds relates to project-related activities that can cause incidental take (i.e., nest disturbance or destruction) as well as collisions with vehicles/equipment/aircraft/marine vessels, and Project infrastructure. Indirect mortality risk to birds could result from hunting and/or egg collection by Inuit and non-Inuit, and from how the Project may indirectly influence predator-prey dynamics.

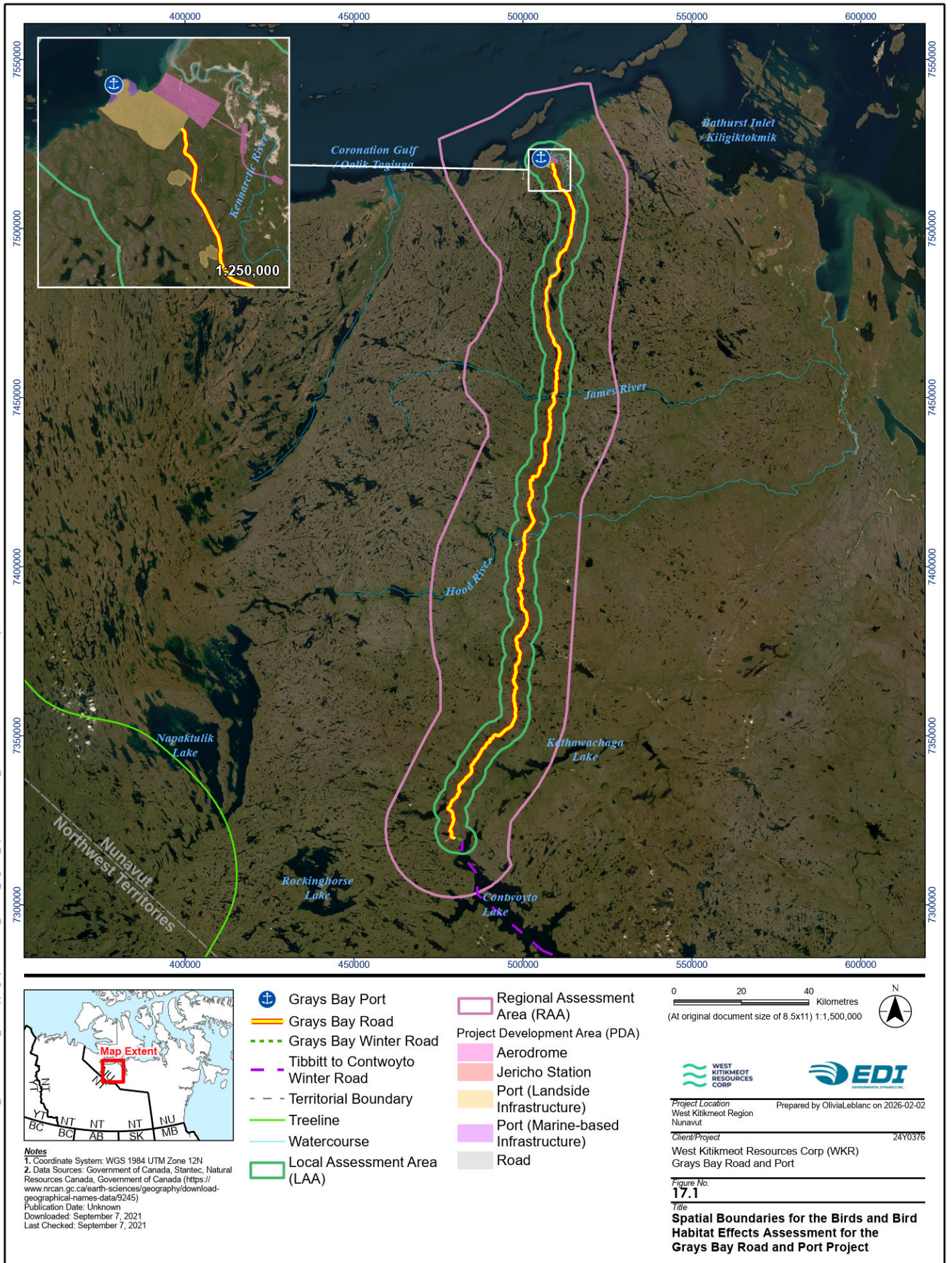
The Project is not expected to introduce contaminants into the environment at levels that would adversely affect bird health. An ecological risk assessment was completed as part of the Human Health and Ecological Risk Assessment Technical Data Report (Appendix 26A). The assessment reviewed Project-related emissions and considered how wildlife might be exposed to these emissions in the air, soil, water, and food. While some emissions are expected during Project construction and operation, these emissions are limited in magnitude and managed through standard controls and mitigation measures. Importantly, the assessment did not identify Project-related chemical contamination to the air, soil, and water. As a result, there are no exposure pathways by which wildlife would come into contact with Project-related emissions at concentrations that would constitute an ecological risk. The assessment concludes that Project-related emissions are likely to result in a negligible ecological risk to terrestrial wildlife (e.g., caribou, birds, other terrestrial animals) and aquatic wildlife (e.g., freshwater and marine fish, marine mammals, and other aquatic wildlife), and vegetation. Accidental spills, which could pose a risk to birds' health, are addressed in Accidents and Malfunctions (see Volume 10, Section 34).

The NIRB guidelines identify a comprehensive list of different Project components and activities that should be considered for birds in the Impact Assessment (NIRB 2026). Some of the listed items were not included in this effects assessment for various reasons. For example, an analysis component to consider was “*Potential disruption or alteration of migration routes due to proposed project phases or activities*”. This Project is located at the end of some migratory birds' migration paths, and migrating birds have previously been exposed to similar disturbances along their migration routes; the influence of the Project on their migration has already been captured in the Baseline Conditions from these exposures and interactions. Where the Project will influence birds migrating into the area is through changes in their breeding habitat, which are evaluated in this effects assessment (see Section 17.4.1 for details). The NIRB guidelines also include “*Potential direct and indirect effects on marine bird behaviour, distribution, abundance, migration patterns species health and reproduction from marine shipping*”. Marine vessels will be using an existing shipping route through the Northwest Passage during the open water shipping season (see Volume 2, Section 1). The Project's primary interaction with marine birds will be the marine habitat shoreline at the Grays Bay port. This was included in the effects assessment of habitat change and how marine birds may interact with the Project (see Section 17.4.1 for details).

17.1.4 Boundaries

17.1.4.1 Spatial Boundaries

The spatial boundaries encompass the areas where the Project is expected to interact with bird habitat and are relevant to culturally and ecologically important regions where Inuit camp, travel, and harvest (described in Section 17.1.1.1). Each spatial boundary represents the anticipated extent of different interactions with the Project. The assessment includes the Project Development Area (PDA), LAA, and RAA (see Figure 17.1).



Project Development Area

The PDA encompasses the physical footprint of all Project components, including both permanent and temporary disturbances (e.g., extent of Project infrastructure, planned clearing, and laydown areas). The PDA includes six sub-areas based on the types of components to be developed: the Port (which is further divided into marine and landside infrastructure), Road, Aerodrome, Jericho Station, and Winter Road PDAs. The boundary of the PDAs were created by applying buffers around where the Project components will be sited, and varies by each of the sub-areas depending on necessary flexibility for final siting of certain Project components based on conditions on the ground. For the Road PDA and Winter Road PDA, a 75 m buffer was applied to the roads centreline, for the Port PDA and the Aerodrome PDA, the areas were subdivided based on the conceptual Project component locations and then buffered approximately 1,000 m for the landside Port PDA, approximately 300 m for the marine Port PDA, and 500 m for the Aerodrome PDA. The Jericho Station PDA was buffered based on the existing development from the old Jericho Mine site that will be used for the Project and the need for additional space to accommodate the Project components that will be developed as part of the Project for this location. The Winter Road PDA will only exist annually between the beginning of February and end of March, will be built on land where the existing Jericho Station road ends, at the southeastern portion of Jericho Station, to the shoreline of Contwoyto Lake where it will connect to the TCWR. For the purposes of the impact assessment, the PDA is the same as the Site Study Area identified in the IS Guidelines (see Figure 17.1).

Local Assessment Area

The LAA encompasses the PDA and the maximum predicted extent of project-related environmental effects, both direct and indirect, on wildlife and birds that can be predicted or measured with a reasonable degree of accuracy and confidence. The predicted expected extent of direct and indirect effects is based on a 4-kilometre (km) radius buffer around the PDA, which is established from studies completed on wildlife and their responses to human activities (Weir et al. 2007; Polfus et al. 2011; GNWT 2015; Prichard et al. 2020, 2022; ECCC 2023; ERM Consultants Canada Ltd. 2025). The total area within the LAA is approximately 1,981 square kilometres (km²) (see Figure 17.1).

Regional Assessment Area

The RAA encompasses the PDA and LAA and provides a regional context for how the project-related effects may influence birds, and how these effects may interact cumulatively with those of other past, present, or reasonably foreseeable projects. The Project has the potential to interact with a wide variety of birds, including raptors, waterbirds (i.e., shorebirds, waterfowl, and seabirds), and passerine birds that migrate and/or are full-time residents of the area. The RAA extends at varying distances between 15 and 20 km on either side of the PDA and is 9,433.9 km² (see Figure 17.1).

17.1.4.2 *Temporal Boundaries*

The temporal boundaries for assessing potential project effects on birds include the time periods during which the Project is likely to interact with them. These periods encompass the Construction and Operations and Maintenance phases. Onsite works for the Project are scheduled to begin in 2029, with major construction commencing in 2030. The major construction activities are anticipated to span approximately five years. Operations and maintenance is anticipated to commence in 2035 and continue indefinitely, as the Project components are considered permanent infrastructure with a design life of 75 years.

17.1.4.3 *Residual Effects Characterization*

The characterization of residual effects on birds and bird habitat is based on reviewing baseline conditions (see Section 17.2), assessing project-related effects and the extent to which they can be mitigated, and considering relevant Inuit, Indigenous, and Community Knowledge, scientific information, and professional judgment. All residual effects from the Project are carried forward to the cumulative effects assessment (CEA). The residual effects are characterized by direction, magnitude, geographic extent, timing, duration, frequency, and reversibility (see Table 17.4). Some criteria for assessing residual effects are further explained, especially regarding the methods used to evaluate potential effects. This includes criteria related to magnitude and timing. Additional details about these criteria are provided below.

Currently, no established thresholds exist for evaluating bird habitat loss or alteration, ; however, research suggests that maintaining 10% to 30% of habitat can sustain a population, with negative consequences arising beyond these limits (Andrén 1994; Swift and Hannon 2010). Considering the upper end of the habitat thresholds identified in the literature, alongside natural variability among species, landscapes and professional judgment, threshold values were identified for the magnitude of changes to bird and bird habitat: no measurable change is <1%, low magnitude habitat change is 1% to 15%, moderate magnitude habitat change is between >15% to 30%, and high magnitude habitat change is >30%.

Migratory birds nests are protected when they have a live bird or viable egg (GOC 2022). Taking this into account, change in habitat and change in mortality risk were assessed at three different levels of sensitivity about the timing of project activities (see Table 17.4).

Table 17.4 Characterization of Residual Effects on Birds

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	Positive – a residual effect that moves measurable parameters in a direction beneficial to birds and bird habitat relative to baseline. Adverse – a residual effect that moves measurable parameters in a direction detrimental to birds and bird habitat relative to baseline. Neutral – no net change in measurable parameters for birds or bird habitat relative to baseline.
Magnitude	The extent of a change in measurable parameters for birds and bird habitats from baseline conditions.	<u>Change in Habitat (quantitative)</u> Considers both direct loss and indirect habitat effect Negligible – <1% change of suitable habitat Low – 1% to 15% change of suitable habitat. Moderate – >15% to 30% change of suitable habitat. High – >30% change of suitable habitat. <u>Change in Mortality Risk (qualitative)</u> Negligible – no detectable change from baseline conditions. Low – a detectable change from baseline conditions but within the range of natural variation and/or accepted standards. Moderate – a detectable change to baseline conditions slightly outside the range of natural variation or accepted standards and may become a management concern. High – a detectable change to baseline conditions well outside the range of natural variability or accepted protective standards and represents a management concern.
Geographic Extent	The spatial area(s) in which an effect is predicted to be detectable.	PDA – residual effects are restricted to the PDA LAA – residual effects extend into the LAA RAA – residual effects interact with those of other projects in the RAA
Timing	Considers when an effect is predicted to occur, where relevant to birds and bird habitat.	No sensitivity – the effect does not occur during a critical life stage (i.e., outside the bird nesting season). Moderate sensitivity – the effect may occur during a lower sensitive period of a critical life stage; for many species this is the start (i.e., several days before nesting for birds) or end (i.e., periods when birds have fledged but remain in proximity to their nest) of the critical life stage (i.e., the nesting season). High sensitivity – the effect occurs during the critical life stage for birds (i.e., nesting season: mid-May to mid-August).

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The time required until the measurable parameter or the VC returns to its original condition, or the residual effect can no longer be measured or otherwise perceived.	Short-term – the residual effect is restricted to the Construction phase. Medium-term – the residual effect returns to baseline condition within two years of the end of the Construction phase. Long-term – the residual effect persists for the life of the Project.
Frequency	How often an effect is predicted to occur.	Single event – occurs once. Multiple irregular event – occurs at no set schedule. Multiple regular event – occurs at regular intervals. Continuous – occurs continuously.
Reversibility	The degree to which birds or bird habitat can be returned to baseline conditions or other established reference point after relevant activities have ceased.	Reversible – the residual effect is likely to be reversed. Irreversible – the residual effect is unlikely to be reversed.

17.1.5 Significance Definition

For this assessment, a significant adverse residual effect on birds is defined as a residual effect that is expected to result in an adverse change to bird population viability and persistence, of bird populations that interact with the RAA, beyond an acceptable level (e.g., where it is not sustainable or is unavailable to contribute to biodiversity and ecosystem function or is not available for managed harvest).

Furthermore, during the September 2025 IAG workshop, participants discussed effects that members consider acceptable or unacceptable. Through the discussion, a holistic suite of considerations emerged that must be integrated into the Project's social, environmental, and economic plans. With respect to birds and bird habitat, feedback received from IAG members identified the following priorities, when considering unacceptable changes as a result of the Project:

- That Inuit perspectives are considered and addressed in project design
- That the Project provides access to hunters and supplies for hunters at both Grays Bay and Jericho Station
- That the Project does not negatively affect peoples' ability to put food on the table
- That water and wildlife are protected

17.2 Baseline Conditions

17.2.1 Methods

The development of the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A) involved collecting and collating information from several data sources, including Inuit, Indigenous and Community Knowledge, species accounts, regional surveys and other regional literature, discussions with regional biologists, field surveys, and habitat classification and modelling for select species.

17.2.1.1 *Previous Studies*

Since the early 2000s, the Project has been studied by former proponents under two separate project descriptions: the High Lake Project and the Izok Corridor Project. The High Lake area was the main focus from 2004 to 2008, while studies involving the Izok Corridor Project area began in 2007. Currently, the Project is solely focused on developing Grays Bay Road and the Port. However, the baseline data included in this report comprises both project-specific Inuit Knowledge collection and field survey data, reflecting bird baseline studies carried out intermittently since 2004. Some earlier studies covered areas outside the current project Regional Study Area (RSA; see Section 17.2.1.3). Therefore, for this report, data from outside the current RSA were excluded from project-focused summaries; nevertheless, as this information is valuable, regional-level details are included throughout this document where relevant for context.

An inquiry was made to Environment and Climate Change Canada (ECCC) for any supplemental information or programs for analyzing automated recording unit (ARU) data from Arctic birds. No additional information or specific programs for analyzing ARU data were received from ECCC pertaining to birds (Rausch 2025).

17.2.1.2 *Literature Review*

The literature review focused on bird studies in the West Kitikmeot and the surrounding region. This included regional-level studies completed by government organizations such as ECCC Canadian Wildlife Service (ECCC-CWS), the U.S. Fish and Wildlife Service, Government of Nunavut, Department of Environment, Government of Northwest Territories, Environment and Natural Resources, and other research bodies and academic institutions. Species-specific reports produced by the Committee on the Status of Endangered Wildlife in Canada are available online. Regional biologists from the GN and ECCC-CWS assisted in designing field studies and compiling baseline information.

17.2.1.3 *Field Studies*

Project-specific bird surveys were completed to document species occurrence and habitat use within the terrestrial and marine RSAs. (Note: the RSA used during the baseline field studies is different from the RAA identified in Section 17.1.4.1. See the Grays Bay Road and Port Project Bird Baseline Report [Appendix 17A] for further details on the RSA).

- **Raptor Surveys:** Aerial surveys were completed from 2004 to 2008 and in 2012 throughout the RSA to document nest sites for cliff-nesting raptors. Surveys typically consisted of an early-to-mid-June aerial occupancy survey and a late-July/early-August productivity survey.
- **Seabird Surveys:** Seabird surveys were completed in 2004, 2008, 2012, and 2025. These included aerial and ground-based surveys to document species occurrence, abundance, distribution, and habitat use during breeding, moulting, and fall staging periods.
- **Inland Waterfowl Surveys:** Aerial surveys were conducted in 2008 and 2012 using a helicopter along systematic transects to document the occurrence, abundance, and breeding distribution of waterfowl and other waterbirds in the terrestrial RSA. Waterfowl and other waterbirds were also documented during ground surveys in combination with tundra breeding bird surveys.
- **Tundra Breeding Bird Surveys:** Surveys were completed in 2004, 2008, 2012, and 2025 to document species occurrence, abundance, distribution, and habitat use of passerine, shorebird, and upland game species.

For tundra breeding bird surveys, belt transects (adopted from Johnson et al. 2000 and Bibby et al. 1992) were completed in 2004. In 2008 and 2012, the Program for Regional and International Shorebird Monitoring (PRISM) Rapid Plot method was implemented to better capture uncommon shorebird species and was effective for documenting nearly all breeding bird species in tundra environments. In 2025, additional breeding bird belt transect surveys were completed within the Port PDA and the Aerodrome PDA to document species occurrence, abundance, and habitat use. Automated recording units were deployed throughout the RSA in proximity to the Project PDA to document tundra breeding bird and shorebird occurrence and distribution.

17.2.1.4 *Habitat Assessment*

Habitat suitability ratings were completed for select species guilds within the terrestrial RSA based on an ecological land classification (ELC).

- **Raptors:** Peregrine falcon (*kilgaviit*; *Falco peregrinus*) was used as the indicator species. Habitat ratings were based on a function of both foraging habitat (based on passerine densities from the 2012 PRISM surveys) and distance from known nesting sites. Habitats within 2 km of known nests were classified as highly suitable. All other habitat classifications were based on the passerine densities.
- **Waterbirds and Shorebirds:** Habitats were classified according to the regionally defined strata (wetland, moist, or upland types) used by the ECCC-CWS PRISM program.
- **Passerines:** A map of passerine habitats was created based on observed densities from the 2012 PRISM surveys to assess habitat availability.

These habitat rankings used a four-tier system (High, Moderate, Low, and Nil) based on the habitat's ability to support breeding, foraging, or high densities of bird species (as determined by field-based observations).

17.2.2 Overview

17.2.2.1 Inuit, Indigenous, and Community Knowledge and Engagement Feedback

Through the project-specific engagement program delivered between 2016 and 2025, including community meetings, workshops, community-based primary research, the Project-specific Inuit Knowledge report compiled from the NTKP database, and through a review of publicly available information, Kitikmiut, other Indigenous groups, and other potentially affected communities shared information, expressed concerns, and provided recommendations related to birds. This feedback has been considered and summarized in Table 17.5 and, where applicable, has been integrated into the assessment of potential effects on birds that follows.

Table 17.5 Summary of Inuit, Indigenous, and Community Knowledge and Engagement Feedback

Comment	Source	WKR Response	Where Addressed
Inuit were keen observers and possessed detailed knowledge of the ecology of the birds in their area. They knew which birds arrived in the spring and the order in which they came, where they nested in the summer and when they departed in the fall. The arrival and departure of the birds was also how Inuit kept track of the yearly calendar.	Banci and Spicker 2024	Inuit Knowledge on bird ecology is informative in understanding baseline conditions. This is reflected in the Bird Baseline Report (see Appendix 17A)	Bird Baseline Report (see Appendix 17A)
NTKP consultants identified bird species of cultural importance as well as important bird habitat and bird harvesting areas. NTKP consultants harvest all geese species in their area, including Canada goose, greater white-fronted goose, snow goose, Ross's goose and brants.	Banci and Spicker 2024	WKR recognizes the importance of birds, including geese for hunting by Inuit. This is reflected in the Bird Baseline Report (see Appendix 17A) as well as change in mortality risk section of the effects assessment.	Bird Baseline Report (see Appendix 17A); Section 17.4.2 Change in Mortality Risk; Section 17.4.2.4 Project Residual Effect; Section 17.4.2.4 Waterbirds.

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Comment	Source	WKR Response	Where Addressed
NTKP consultants reported that birds were an important food source for ocean and coastal Inuit, because of the large concentrations of nesting waterfowl on the ocean coast, especially during spring migration. They explained that sandhill cranes are fatty so harvested once they arrive. Eider ducks and loon are hunting while resting on open water.	Banci and Spicker 2024	Waterfowl are recognized as an important food source for Inuit. This is described in the Bird Baseline Report (see Appendix 17A), and Section 17.3 Assessment of Project Effects on Birds.	Bird Baseline Report (see Appendix 17A); Section 17.4.2 Change in Mortality Risk; Section 17.4.2.4 Project Residual Effect; Section 17.4.2.4 Waterbirds..
NTKP consultants reported that snow buntings followed by Canada geese, brants, swans, and sandhill cranes are the first birds to arrive. They stated that the birds that arrive first also leave first.	Banci and Spicker 2024	This is useful information that is included in the Bird Baseline Report (see Appendix 17A) that provides information about bird migration in the region.	Bird Baseline Report (see Appendix 17A); Section 17.2 Baseline Conditions; Section 17.2.2 Overview.
NTKP consultants stated that Bathurst Inlet and the Queen Maud Gulf area were best known for large abundances of birds, and the Oalik Tagiuga coast (Coronation Gulf) was also a common area for birds. They added that in the Bathurst Inlet area, geese and eider ducks stay on small islands and eider ducks and seagulls lay their eggs there. Arctic terns also nest on islands. Consultants reported that they often would harvest eggs in June.	Banci and Spicker 2024	WKR recognizes the importance of Bathurst Inlet, the Queen Maud Gulf, and the Coronation Gulf area for eider ducks and geese. The Bird Baseline Report (see Appendix 17A) summarizes the Coronation Gulf survey findings. The Project has the potential to interact with eider ducks and geese in the Coronation Gulf, and this is addressed in the change in mortality risk effects assessment. Information about abundance and occurrence of shorebirds and other waterbirds, as well as waterbirds' nesting sites helps inform the Project's baseline conditions. The cultural practices of collecting eggs from ducks, geese and gulls helps inform Baseline Conditions on how Inuit value these birds. This is reflected in the Bird Baseline Report (see Appendix 17A) as well as in the effects assessment.	Bird Baseline Report (see Appendix 17A); Section 17.2 Baseline Conditions; Section 17.2.2 Overview; Section 17.4.2 Change in Mortality Risk; Section 17.4.2.4 Project Residual Effect; Section 17.4.2.4 Waterbirds..
NTKP consultants explained that cliffs are important nesting habitat for a variety of raptors (rough-legged hawk, gyrfalcon and peregrine falcon) and other colonial nesting birds such as gulls and cliff swallows and other birds such as ravens, geese, and some ducks. While raptors are not commonly hunted, consultants will use the feathers, meat, and eggs.	Banci and Spicker 2024	This information informs how Inuit value raptors and is reflected in the Bird Baseline Report (see Appendix 17A). Understanding how cliffs are used for nesting by raptors and gulls also informs the Bird Baseline Report (see Appendix 17A).	Bird Baseline Report (see Appendix 17A); Section 17.2 Baseline Conditions; Section 17.2.2 Overview.

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Comment	Source	WKR Response	Where Addressed
NTKP consultants identify that ravens, ptarmigans, rough legged hawks, white hawk, gyrfalcon, peregrine falcons, gray jays, and snow buntings, barn owls, snowy owls remain in the Kitikmeot Region year round.	Banci and Spicker 2024	Local information about different groups of birds that stay year-round is helpful for the baseline conditions.	Section 17.2 Baseline Conditions; Section 17.2.2 Overview.
NTKP consultants have observed changes in the distribution and abundance of birds, including new species arriving in the north. They explained that the population of local birds, once abundant, are declining, including passerines, Lapland longspurs, snow buntings, larks, sandpipers, songbirds, and shorebirds. However, redpolls (who stay all year in willows), robins, speckled eider, red crested warblers, yellow warblers, mountain bluebirds, tree swallows, house finches (red and blue species), white winged scoters, northern shovelers, long billed curlews, and a white bird with a large bill are more recent birds in the region. Consultants attribute this change to changes in the weather.	Banci and Spicker 2024	Changes in the abundance and occurrence of birds in the region help inform baseline conditions.	Abundance, changes in distribution and information about migratory and resident birds can be found in Section 17.2 Baseline Conditions, Section 17.2.2 Overview.
During a public scoping meeting for the NIRB, Taloyoak community members inquired about Avian flu impacting birds.	NIRB 2025	Avian flu is monitored and managed by Environment and Climate Change Canada. No evidence was identified during baseline studies. WKR will notify regulatory agencies if there's any bird disease mortalities or sick individuals identified near the Project.	This is not addressed in this Application.
During a public scoping meeting for the NIRB, Gjoa Haven community members expressed concern regarding the effects on birds during the use of explosives.	NIRB 2025	The Project will protect birds by completing a wildlife sweep prior to using explosives.	Section 17.4.2 Change in Mortality Risk
During a public scoping meeting for the NIRB, Cambridge Bay community members shared that migratory birds nest near the proposed port.	NIRB 2025	Migratory birds are known to nest near the proposed port is reflected in the Bird Baseline Report (see Appendix 17A). WKR will protect all nests identified unless the nest may cause damage to human life or property. WKR will consult with Environment and Climate Change Canada and the GN if any instances arise.	Bird Baseline Report (Appendix 17A); Section 17.4.2 Change in Mortality Risk

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Comment	Source	WKR Response	Where Addressed
IAG members expressed concern for potential effects on migratory birds. They reported seeing raptors, such as bald eagles and golden eagles migrating north, and attributed this to the effects of climate change. About 15 years ago (c. 2010), IAG members observed eagles moving into the Contwoyto Lake area. The eagles frighten wolves, and they are attacking caribou. Wildfires seem to be exacerbating warming conditions and the presence of eagles.	IAG 2025b	This information on how climate change is influencing raptor occurrence is included in Section 17.4.4 Effects of Climate Change on Birds.	Section 17.4.4 Effects of Climate Change on Birds.
During engagement on a previous project, Kitikmeot Inuit Association expressed concerns regarding potential effects on birds from project infrastructure, sensory disturbances, habitat loss, and the presence of industrial or other waste.	NIRB 2024	The potential effects of the Project on habitat loss, sensory disturbances, and project infrastructure are addressed in the Change in Habitat evaluation. The presence of industrial or other waste is addressed in the Accidents and Malfunctions section (see Volume 10, Section 32).	Section 17.4.1 Change in Habitat; Volume 10, Section 32: Accidents and Malfunctions
During engagement on a previous project, Inuvialuit have identified harvesting ducks, geese, brant geese, Canada geese, and ptarmigan.	Nagy 1999	Information obtained during engagement for this Project has identified the importance of these species to Inuit harvest, as reflected in the Bird Baseline Report (Appendix 17A) and the effects assessment evaluation of bird mortality risk.	Bird Baseline Report (see Appendix 17A); Section 17.4.2 Change in Mortality Risk.
During engagement on a previous project, the Tłı̨chǫ Government identified ducks and geese as culturally important birds.	Tłı̨chǫ Government 2014	Information obtained during engagement for this Project has identified the importance of these species to Indigenous harvest, as reflected in the Bird Baseline Report (Appendix 17A) and the effects assessment evaluation of bird mortality risk.	Bird Baseline Report (see Appendix 17A); Section 17.4.2 Change in Mortality Risk.
During engagement on a previous project, North Slave Métis Alliance identified ptarmigan, grouse, and geese as culturally important birds.	North Slave Métis Alliance 2001	Information obtained during engagement for this Project has identified the importance of these species to Indigenous harvest, as reflected in the Bird Baseline Report (Appendix 17A) and the effects assessment evaluation of bird mortality risk.	Bird Baseline Report (see Appendix 17A); Section 17.4.2 Change in Mortality Risk.

Additional Inuit Knowledge on birds was received during engagement from 2012 to 2025. According to recorded Inuit Knowledge, ptarmigan and common ravens (*tulugakyoak*; *Corvus corax*) are the most common winter residents (Banci and Spicker 2024). Snow buntings (*amaolikak*; *Plectrophenax nivalis*) and snowy owls (*okpik*; *Bubo scandiacus*) are found during winter in some areas, and hawks, falcons, and eagles are occasionally seen as well. Redpolls (*haghagiak*; *Carduelis flammea*) are sometimes observed near the treeline during winter (Banci and Spicker 2024).

The ptarmigan are always around during the winter, just like the ravens. I think that snowy owls stay during the winter... but the ptarmigan and ravens are the main ones that stay (Perry River and Cape Colborne areas) ... (NTKP 2018)

The ravens and snowy owls don't migrate south. They spend all winter long around Killinik (Victoria Island) and here (coastal area by Kolgayok (Tingmeak River) and Kunayok (Ellice River). Those are the main two among the birds that don't leave. There are also ptarmigan that stay year round ... (Banci and Spicker 2024).

All the land has ptarmigans, ravens and snowy owls, rough-legged hawks and peregrines. These are the ones that are around Kingaok (also north end, south shore of Beechey Lake and mouth of Hivogahik (Hood River)), they don't leave during the winter (Banci and Spicker 2024).

... All the lands (north central-east Tahikyoak) have those types of birds that don't leave. They don't leave Killinik shores (mouth of Ekilivik and islands south of Koyapik [Stromness Bay]) at all, also at Kolgayok (mouth of Kugakyoak) ... (NTKP 2018)

The snowy owls eat hares, even ptarmigan. Also the gyrfalcons don't leave during the winter. (NTKP 2018)

The snow buntings and ravens and eagles winter around this land (Elu Inlet near Kent Peninsula isthmus). Sometimes the rough-legged hawks winter and the snowy owls stay around here too. Snowy owls, snow buntings, eagles and ravens winter around here. (NTKP 2018)

Those snow buntings seem to not really leave this area (Kent Peninsula – Elu Inlet). Sometimes the birds that we call the snow buntings are seen flying around during the winter following the warm weather patterns... (NTKP 2018)

Sometimes during the winter there are different birds around. Now most birds stay around where there are trees and willows. The ones that are called common redpoll are found around the trees during the winter. (NTKP 2018)

Migrant bird species occupy wintering areas extending from the Canadian boreal forest to the southern extent of South America. Many of these species migrate vast distances between breeding and non-breeding habitats, so some populations can be affected by factors occurring far beyond their breeding range. However, environmental factors within the breeding range are undoubtedly a key component for the survival of all these species breeding within the region.

Birds are prominent in Inuit culture (Priest and Usher 2004). The arrival and departure of the birds was once how Inuit knew what time of the year it was (Banci and Spicker 2024). Birds also have considerable importance to Inuit as food, and several species, including ducks, geese, and ptarmigan, are regularly hunted (Priest and Usher 2004). Birds are particularly important as food for coastal Inuit because of the large concentrations of nesting waterfowl along the Arctic coast, on coastal islands, and along Bathurst Inlet. Coastal Inuit collected eggs during the nesting season and hunted waterfowl during the spring and fall migrations and the summer moulting season (Banci and Spicker 2024). The abundance of breeding waterfowl was less on the mainland, and inland Inuit did not depend on waterfowl as much for food; however, they did hunt some species, particularly when caribou (*tuktuit*; *Rangifer tarandus*) were absent during summer (NTKP 2018).

Birds in this area [Period II (1916-1955) in the Tree River Area] were usually hunted along the shoreline and among the islands. Ducks of various kinds were common, and there were also geese, loons, cranes and gulls. Ducks of various kinds were common, and there were also geese, loons, cranes and gulls. (NTKP 2018)

This area [Period II (1920-1955) in the Bathurst Inlet – Old Area] was also good for bird hunting. In early spring, Canada geese were abundant along Burnside and Western rivers and, during summer and fall, the Gordon Bay and Hiuktak area was good for duck hunting. Eider ducks were known to nest on a few small islands, south of Quadyuk Island, east of Tinny Hills, and north of Manning Point, and their eggs were considered a great delicacy. During summer, the whole of Bathurst Inlet was rich in ducks and other waterfowl. (NTKP 2018)

Eider and other ducks were hunted along the coast. They hunted geese inland, especially up Hood River. [Period II (1920-1955) in the Arctic Sound and Daniel Moore Bay Area] (NTKP 2018)

Bird hunting was seasonally important. Huge flocks of ducks and geese descended on the inlets, islands and inland lakes in spring and summer, providing a plentiful supply of eggs and meat. The Perry River area in the east offered still better waterfowl hunting. [Period II (1920-1955) in the Elu Inlet and Kent Peninsula Area] (NTKP 2018)

Most of the birds taken were trapped during their summer moult. Not many birds were shot in these inland locations. [Period II (1916-1955) in the Contwoyto Lake Area] (NTKP 2018)

I've hunted ducks, loons and geese by the lakes (inland), because in the month of July sometimes there are no caribou around. (NTKP 2018)

Information obtained through project engagement activities, the Project-specific NTKP report, and a review of publicly available literature has been considered in this assessment. Several placenames documented by the Kitikmeot Heritage Society and the Tuktu and Nogak Project (Thorpe et al. 2001) refer to birds, particularly in Bathurst Inlet. The available Inuit Knowledge information is incorporated into this report's relevant sections, including observations about bird behaviour, nesting habitat and locations, and migration timing.

According to Inuit Knowledge holders, ducks and loons follow the open water north during the spring migration. Similarly, in the fall, they will remain on the ocean, waiting for the ice to form before they leave, and will follow the ice as it freezes, looking for open water on their migration south.

That point (Aoulativikyoak or Whitebear Point) is very shallow so the ice melts quickly. There are animals and birds like the long-tailed ducks and eider ducks that wait there for the rest of the ice to melt... Waterfowl like that area because they like to be in the water. When there are no other places to land or that are clear of ice, they land there... (NTKP 2018)

Every fall Eiders, long-tailed Ducks, red-throated loons and seagulls are the last birds to leave (Cape Colborne area). I don't know which of these birds leave first because they all wait for ice to form on the ocean before they leave. (NTKP 2018)

Studies at the Daring Lake Research Station, which is located approximately 100 km southeast of Jericho Station, in the Northwest Territories (NT), have found that spring weather conditions heavily influence the first annual sightings of migratory birds and that the timing of snow melt and ice breakup in this region can vary up to three or four weeks (Obst 2011). According to recorded Inuit Knowledge, the arrival of the Lapland longspur (*nahaoliit*; *Calcarius lapponicus*) indicated the start of spring melt (NTKP 2018).

Long ago the elders went by these birds (as indicators). They let them know that (the snow and ice) was finally going to start to melt. The seagulls and snow buntings are (always) around... They are the first birds to arrive at Keetlinik (Victoria Island). The last bird to arrive, the Lapland longspur, tells them it's going to melt. That is what they used to say. (NTKP 2018)

Most migratory bird species generally arrive in the region between mid-May and mid-June, although some species can arrive as early as the end of March or April (Obst 2011). Inuit Knowledge holders have stated that Canada geese (*oloagolik*; *Branta canadensis*), cranes, and eider ducks can start arriving in the area in late April (Jimmy Oniak [050219] in High Lake Draft Environmental Impact Statement).

The birds start to arrive around May. The first ones to arrive are the snow buntings in April. (NTKP 2018)

The first ducks start to arrive around the end of April. We start looking for them... around the month of April. The geese and the eider ducks arrive last when the ice cracks are wide. That is the time they start to arrive, so that they can use the ice cracks. The eider ducks are the last to arrive. (NTKP 2018)

The sandhill cranes arrive first too at our land. The swans and sandhill cranes are first to be seen in the spring. Those snow, Canada, white-fronted and brant geese all arrive at the same time. They are like that here and at our land (Kugyoak). (NTKP 2018)

The sandhill cranes arrive first before the ducks; the swans are next... then the ducks, followed by the geese a few days later. You see the sandhill cranes and swans first. Long after the geese have arrived the small birds start to arrive, maybe ten days later after all the geese have come in. The small birds arrive last but the snow buntings arrive first before the other small birds, even before the sandhill cranes or swans. (NTKP 2018)

The sandhill cranes and swans are the first birds to be seen. The seagull is the first bird to arrive, before the sandhill crane. You see the seagull before the sandhill crane. The jaegers arrive next after the sandhill cranes and the swans arrive after the sandhill cranes. The geese start to arrive soon after the sandhill cranes. (NTKP 2018)

Nesting for most bird species begins in June and continues through July, although ravens and some raptors will start nesting earlier, often in April.

During summer around here (Elu Inlet) ducks have nests around the islands (a number of locations in Elu Inlet and islands in Campbell Bay west of the mouth of Kunayok or Ellice River). They also molt there. That is why it's our bird sanctuary (Queen Maud Bird Sanctuary). There are lots of geese molting and birds of different species that nest and molt there, like the Canada geese, snow geese and regular ducks. There are all different kinds of ducks there. Canada and snow geese also nest and have eggs at these islands. These are major molting and nesting areas. These are major molting and nesting areas. (NTKP 2018)

There are lots of wetlands there (large area on west Kent Peninsula; and large area encompassing coast and inland from the isthmus east to the mouth of Kunayok or Perry River). These are major nesting and molting areas. (NTKP 2018)

There are wetlands ... near Etibliakyok (Kilingoyak isthmus) and near Kugyoak (Perry River) ... There are wetlands just above Etibliakyok (at Parry Bay) and part of Katimanak (an area further east on Banks Peninsula and an area at the mouth of Ekalivik (Footprint River)). These areas are used for nesting by Canada geese, white-fronted geese, and brants. These ducks pretty well all nest together where it's wet and grassy. " (NTKP 2018)

(Important wetlands for waterfowl are found) around Perry Island (Hinakhakvik; he mapped the mainland across from the island) Ellice River (Kunayok mouth), Kugyoak (Perry River) and around here (Bathurst Inlet coast from Omingmaktok south to Huikitak ... (NTKP 2018)

All types of ducks can be seen during the summer, such as snow and Canada geese. There are others like the red-throated loon, eider and long-tailed ducks. (NTKP 2018)

Arctic loon, yellow-billed loon, and sandpiper (higyagiak) (are commonly seen in the summer). (NTKP 2018)

Bird fall migration begins in mid-July and extends until mid-September (Obst 2011), although waterfowl and seabirds may be present in open water areas along the coast until freeze freeze-up.

Arctic loon, yellow-billed loon, and sandpiper (higyagiak) (are commonly seen in the summer). (NTKP 2018)

Ducks like the brants, snow geese, white-fronted geese, eider ducks, long-tailed ducks, loons and even the swans start to gather together around September when they are going to start heading south. When they are going to start heading south they gather in large groups. They can be found around here anywhere (two areas south of Aoulativikyok or Whitebear Point and one area west of Kugyoak or Perry River). (NTKP 2018)

Birds like Lapland longspur, horned larks, killdeers, common redpoll and taakauhaut (American robin) (leave first in the fall) ... They start to leave here around September. When the geese start heading south then all the rest of the small birds start to migrate. (NTKP 2018)

Among all the other small birds these snow buntings are the last to be seen leaving this area (Kent Peninsula). The loons and the snow buntings are the last birds to leave, even the eider ducks. These loons and even the eider ducks don't leave right away but go further west where there is open water or leads that stay open during the winter. Sometimes the loons just about winter up here. When the water freezes, then they are gone. (NTKP 2018)

The birds that arrive first... leave first, like the Canada geese. I know this lake because I used to travel around there. It's called Tahialok (mapsheet 77A). The birds come from their land and then return in the fall. The birds that arrive first leave first from around Etibliakyok (on Kent Peninsula isthmus, including Tahialok), Kunayok (Ellice River) and from near Naoyak (Parry Bay) and Omingmaktok. (Banci and Spicker 2024)

The sandhill cranes leave first for the south because they are the first to arrive in the spring. The geese follow soon after because those ducks are the first to arrive in the spring. (NTKP 2018)

Canada geese and white-fronted geese leave first in the fall. (NTKP 2018)

Inuit Knowledge acquired for birds and bird habitat for the Project has been compiled in a report (Banci and Spicker 2024). A summary of bird occurrence and distribution from Inuit Knowledge is presented in Figure 17.2. This information influenced the Bird LAA and RAA boundaries.

17.2.2.2 Species Present

Based on the results of Inuit, Indigenous, and Community Knowledge, project field surveys, other studies within the region, a review of regional literature, and documented species ranges until March 2025, a total of 92 species were observed or have the potential to occur in the marine and terrestrial study areas (see Grays Bay Road and Port Project Bird Baseline Report [Appendix 17A] for species list). Twenty-four bird species were confirmed to be present in the marine Local Study Area (LSA) during project field surveys.

Within the terrestrial RSA, 84 species are potentially present: 59 species were documented during project field surveys or studies conducted at Jericho Mine or the Ulu property, of which 28 were confirmed to breed. An additional 25 species may potentially occur in the terrestrial RSA.

Figure 17.2 Kitikmiut Knowledge of Kopanoak (Birds) in the Kogloктоаkyok (Grays Bay) Project Area
(reproduced from Banci and Spicker 2024)

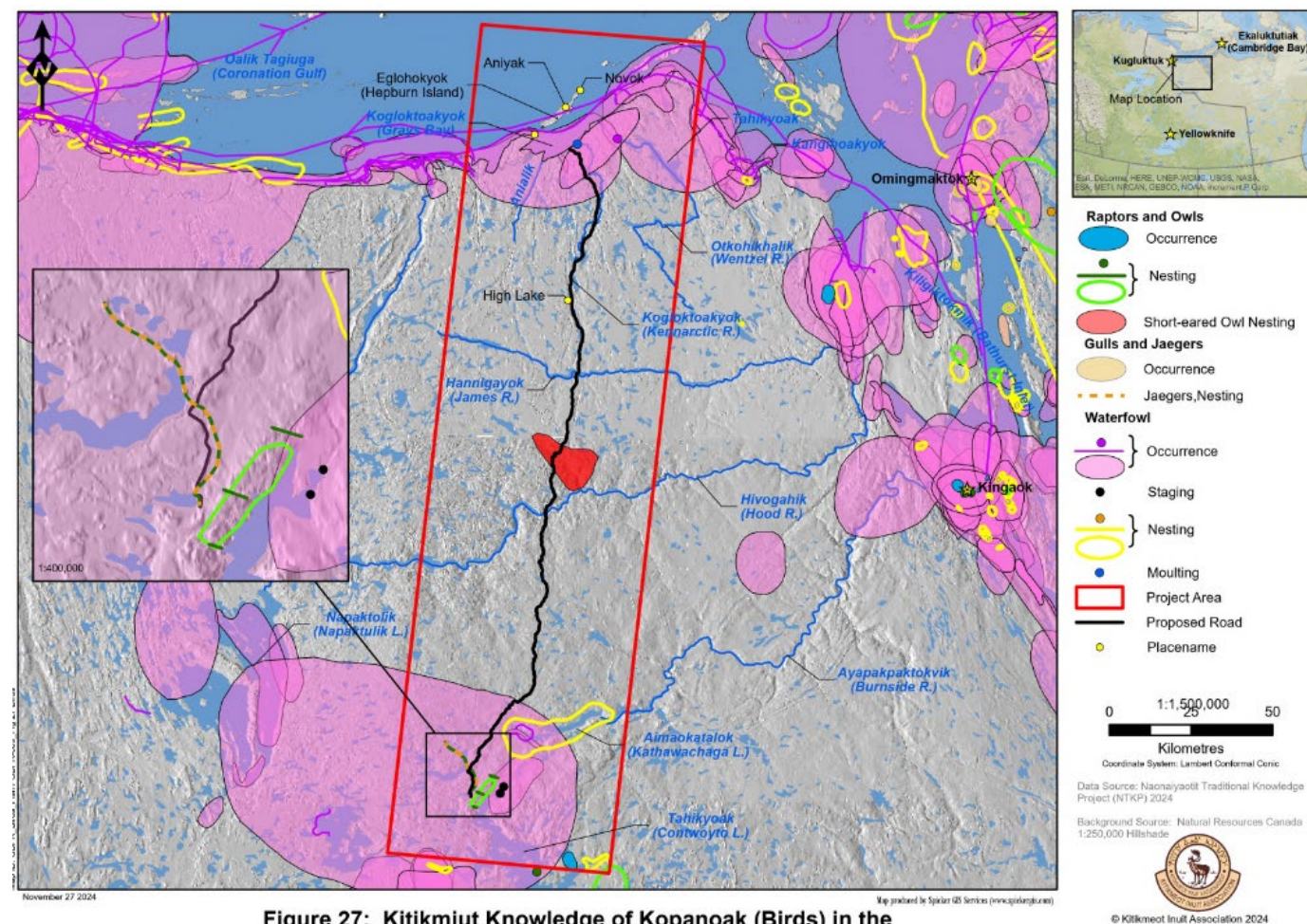


Figure 27: Kitikmiut Knowledge of Kopanoak (Birds) in the Kogloктоаkyok (Grays Bay) Project Area

17.2.2.3 Species at Risk

Eight species, confirmed or potentially present in the terrestrial and marine study areas, are federally listed as endangered, threatened, or special concern under the SARA, including:

- Short-eared owl (*nipaingaktak*; *Asio flammeus*)
- Ivory gull (*naujavaaq*; *Pagophila eburnea*)
- Ross's gull (*Rhodostethia rosea*)
- Red knot *rufa* subspecies (*maamaati*; *Calidris canutus rufa*)
- Buff-breasted sandpiper (*qursuqtaq siqjariarjuk*; *Calidris subruficollis*)
- Red-necked phalarope (*qalunguq*; *Phalaropus lobatus*)
- Barn swallow (*uummuq*; *Hirundo rustica*)
- Harris's sparrow (*Zonotrichia querula*)

Additionally, 21 species are identified as either critically imperiled, imperiled, or vulnerable by the GN. Most of the species are designated as vulnerable due to perceived small populations on the periphery of natural ranges, although some show declining population trends (Canadian Endangered Species Conservation Council 2022). Further details on listed bird species that may occur in the vicinity of the Project and where they were observed during baseline studies is described in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A).

17.2.2.4 Passerines

Fifteen passerine species and two ptarmigan species have been identified within the terrestrial RSA during baseline surveys. Arctic passerine species assemblages are less diverse than in more southerly locations; however, the terrestrial RSA has a relatively high diversity of passerine species compared to other Arctic regions. This is due to the presence of several southerly species which are nearing the northern extent of their breeding range. The most common species observed in the terrestrial RSA were savannah sparrow (*Passerculus sandwichensis*), Lapland longspur, American tree sparrow (*Spizelloides arborea*), redpoll, and horned lark (*kopanoakpagyuk*; *Eremophila alpestris*). These five species accounted for more than 90% of all individuals observed in 2012. Work completed at Ekati Diamond Mine between 1996 and 2003 found a similar species assemblage, with Lapland longspur, savannah sparrow, American tree sparrow, Harris's sparrow, and horned lark as the five most common passerine species detected there (Smith et al. 2010).

Species diversity was determined from the PRISM surveys. The number of species detected per PRISM plot ranged from 2 to 10 (mean = 5.8). Vegetation cover classes were grouped into seven broad habitat categories, and PRISM plots were assigned a broad habitat category based on the dominant vegetation type within each plot. The analysis suggested that species richness may be greatest in shrub and heath/sedge habitats, but there was a relatively large range of variability (i.e., a large standard error), and therefore the results were not conclusive. The assessment of species evenness also showed high variability within each broad habitat type. The total combined value for the Simpson's Inverse Index was

4.37, which is comparable to findings at the Ekati Diamond Mine, where a mean value of 4.31 was documented at control sites around the mine between 1996 and 2003 (Smith et al. 2010).

Passerine regional density across all habitat types during the 2012 field surveys was 191.8 birds/km², and this included a total of 1,864 individuals observed on 81 PRISM plots. In comparison, surveys completed at Ekati between 1996 and 2003 found a mean density of 228.4 birds/km² across all years (Smith et al. 2010).

17.2.2.5 Passerine Habitat Suitability Rating

Habitat ratings were not completed for passerine species. However, to assess habitat availability for passerine birds, a map of passerine habitats was created based on observed densities within the different vegetation types (i.e., ELC units). The analysis of the 2012 PRISM data produced a table of passerine densities by vegetation type, with observed densities ranging from 129.6 birds/km² to 260.0 birds/km². Observed densities were grouped into one of four classes: High (>220 birds/km²), Moderate (160 to 220 birds/km²), Low (10 to 160 birds/km²), and Nil (<10 birds/km²), and applied to the ELC map coverage.

Habitat ratings suggests that about 37.7% of the RAA is suitable habitat composed of high- and moderate-quality habitat (see Table 17.6). Approximately 7.4% (712.7 km²) of the RAA contains high-quality habitat for passerines, and about 30.3% (2,913.5 km²) of moderate-quality habitat. Within the PDA boundaries, 59.7% of the area is considered suitable habitat, comprising 10.8 km² of high-quality habitat and 19.2 km² of moderate-quality habitat. Further details on the habitat mapping can be found in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A).

Table 17.6 Amount of Passerine Habitat Available within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	712.7	7.4	217.4	10.9	10.8	21.4
	Moderate	2,913.5	30.3	773.7	38.9	19.2	38.3
	Total	3,626.2	37.7	991.1	49.9	30.0	59.7
Non-Suitable Habitat	Low	3,796.6	39.5	690.4	34.8	17.2	34.2
	Nil	2,009.4	20.9	299.9	15.1	3.0	5.9
	Total	5,806.0	60.4	990.3	49.9	20.2	40.2
No Data		1.7	0.0	0	0.0	0	0.0
Grand Total		9,433.9	100.0	1,986.5	100.0	50.3	100.0

17.2.2.6 Waterbirds

Marine Local Study Area

Twenty-seven sea duck, waterfowl, and other waterbird species were documented in the marine LSA. None of the species identified are federally listed as species at risk under SARA, although several are considered vulnerable in NU.

During spring migration, long-tailed duck (*ahangik*; *Clangula hyemalis*) was the most frequently observed species during a June 2008 aerial survey, followed by common merganser (*nuyagalik*; *Mergus merganser*), red-breasted merganser (*Mergus serrator*), and common eider (*mittik* (female), *amaolik* (male); *Somateria mollissima*). During the breeding season, the baseline surveys indicated that, except for a couple isolated gull colonies, the marine LSA does not support a large nesting population of seabirds. No nesting seabirds or other waterfowl were identified along the coastline during the breeding season. For the summer and moulting season, the most common species documented were long-tailed duck, white-winged scoter (*Melanitta deglandi*), greater scaup (*qimmiq*; *Aythya marila*), common eider, common merganser, red-breasted merganser, glaucous gull (*nauyavik*; *Larus hyperboreus*), and Thayer's gull (*Larus glaucoides thayeri*). Birds are typically concentrated along shoreline areas during summer. Large concentrations of seabirds were not observed in the main LSA or RSA during the fall staging period. Larger group observations of 20 to 110 individuals consisted of geese or ducks, such as common eider or long-tailed duck.

Terrestrial RSA

Based on a variety of regional sources, 35 waterfowl (geese, swans, and ducks) and other waterbird species (loons, cranes, gulls, and jaegers) may be present within the terrestrial RSA. Thirteen waterfowl and nine waterbird species have been documented within the terrestrial RSA and breeding has been confirmed for eight of these species during baseline studies. Arctic-breeding species, such as the long-tailed duck dominate the waterfowl species observed within the terrestrial RSA. However, several waterfowl species typically associated with the boreal forest reach the northern extent of their breeding range within the terrestrial RSA. These may include mallard (*Anas platyrhynchos*), northern pintail (*kekak*; *Anas acuta*), green-winged teal (*Anas carolinensis*), greater/lesser scaup (*qimmiq*; *Aythya marila/affinis*), common merganser, and red-breasted merganser.

Waterfowl densities were low across all aerial surveys. The overall density of waterfowl observed within the terrestrial RSA was 0.41 birds/km². These findings were similar to other waterfowl densities across the Arctic. Further details on the waterfowl densities can be found in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A).

Eleven shorebird species were identified in the terrestrial RSA, which includes one listed shorebird species (red-necked phalarope). The most common shorebird species within the terrestrial RSA was least sandpiper, but the American golden-plover (*Pluvialis dominica*), semipalmated plover (*Charadrius semipalmatus*), and red-necked phalarope were also relatively common. The species assemblage observed is similar to those reported for other areas near the treeline and tundra boundary including studies at Ekati Diamond Mine (located approximately 150 km southeast of Izok; Smith et al. 2010).

In general, the terrestrial RSA does not contain extensive marsh or wetland habitats typically associated with high densities of shorebirds. As a part of the 2012 PRISM surveys, habitats within the region were classified as high (sedge wetlands), moderate (a variety of moist sites) and low (typically drier upland sites) quality shorebird habitat based on regionally defined strata (see Appendix 17A for further details). To assess the distribution of shorebird habitat, these rankings were then applied to vegetation classes to create a habitat rating map.

17.2.2.7 Waterbird Habitat Rating

Habitat ratings suggest there is a low amount of suitable habitat (i.e., both high- and moderate-quality habitat) available for waterbirds (i.e., shorebirds) within the RAA (see Table 17.7). Approximately 2.8% (263 km²) of the RAA contains high-quality habitat for shorebirds, and 13.6% (1,308 km²) of moderate-quality habitat. Within the PDA boundaries, about 20% of the PDA area is considered suitable habitat for shorebirds, consisting of 6 km² of high-quality habitat, and 13.8 km² of moderate-quality habitat. Further details on the habitat mapping can be found in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A).

Table 17.7 Amount of Waterbird Habitat Available Within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	262.6	2.8	71.3	3.6	3.2	6.3
	Moderate	1,308.2	13.9	330.9	16.7	6.9	13.8
	Total	1,570.9	16.7	402.1	20.3	10.1	20.1
Non-Suitable Habitat	Low	5,894.6	62.5	1,280.1	64.6	37.4	74.5
	Nil	1,968.5	20.9	299.1	15.1	2.7	5.4
	Total	7,863.1	83.3	1,579.3	79.7	40.1	79.9
Grand Total		9,434.0	100.0	1,981.4	100.0	50.2	100.0

17.2.2.8 Raptors

Nine raptor species occur within the terrestrial RSA. Six species are common cliff-nesters which includes golden eagle (*kopanuakpak*; *Aquila chrysaetos*), bald eagle (*kunakpik*; *Haliaeetus leucocephalus*), gyrfalcon (*kiligavikpak*; *Falco rusticolus*), peregrine falcon, rough-legged hawk (*kalaak*; *Buteo lagopus*), and common raven (common raven is notably not a true raptor but is included as a predatory bird species). Short-eared owl, snowy owl, and northern harrier (*Circus hudsonius*) are three ground-nesting raptor species known to occur in the area. Cliff-nesting raptors nest on most cliffs that occur within the terrestrial RSA. Metrics used to track raptor nesting success included the number of occupied sites, the number of productive sites (also reported as a percentage of occupied sites), mean brood size of nests (where the number of near-fledged chicks could be counted), and productivity (the number of chicks fledged or assumed to have fledged per occupied nest site). The number of occupied nest sites observed

varied from 29 in 2004 to 101 in 2012. Changes in the number of occupied raptor sites were, in large part, a result of changes in survey area, increased survey intensity, cumulative nest site knowledge, and increased familiarity with the study area. Peregrine falcons were the most common of the raptors observed, with 34 to 38 occupied territories observed during 2008 and 2012, and most suitable nesting cliffs occupied. Gyrfalcons, golden eagles, and rough-legged hawks were less common, but still relatively abundant. The greatest number of occupied and productive gyrfalcon sites to date were documented within the survey area in 2012. The proportion of occupied sites that were productive varied among years for all species, with wide differences for peregrine falcons (24–82%) and gyrfalcons (14–91%) and less variability for golden eagles (47–62%). Mean brood size showed less variability among years, being on average highest for peregrine falcons, moderate for rough-legged hawks, and lowest for golden eagles. Productivity varied widely among years for peregrine falcons and rough-legged hawks, with lower annual variability for golden eagles.

The highest occurrence of raptor nest sites was from Grays Bay to south of Ulu and in the cliffs around the north end of Contwoyto Lake. The density of peregrine falcons within the entire survey area in 2008 and 2012 was 1 pair/120–125 km². Densities in other regions of the mainland NT and NU in the early 1980s ranged from 1 pair/97–320 km² (Bromley 1988). Peregrine falcon densities within the terrestrial RSA therefore compare favourably to other high-density areas. For example, the Rankin Inlet area in the Kivalliq region is unique in having one of the highest densities in the tundra biome at 1 pair/15 km² (Franke et al. 2010).

The density of gyrfalcons within the project survey area in 2012 was 1 pair/250 km², similar to other high-density areas. For instance, Shank and Poole (1994) estimated gyrfalcon densities between 1 pair/175–875 km² for the mainland coast NT/NU, and up to 1 pair/2,000 km² for the mainland interior. Nesting density in Alaska ranged from 1 pair/200–1,000 km² (Swem et al. 1994).

Golden eagle nesting density averaged 1 pair/165 km² within the project survey area in 2012. However, much higher densities occur in other tundra areas, like in Denali National Park in Alaska where nesting density is 1 pair/28 km² (McIntyre and Adams 1999). Densities of rough-legged hawks vary widely with prey population cycles; thus, a range of densities of occupied sites were observed within the terrestrial RSA during 2004 to 2012 (1 pair/190–480 km²). For comparison, in a different study east of Bathurst Inlet, rough-legged hawk densities over a 4-year span ranged from 1 pair/50–180 km² (Poole and Bromley 1988).

17.2.2.9 Raptor Habitat Suitability Rating

Habitat ratings suggest that just under half of the RAA contains suitable habitat (i.e., both high- and moderate-quality habitat) for raptors (see Table 17.8). Approximately 10.5% of the RAA contains high-quality habitat, and 34.1% contains moderate-quality habitat. Within the PDA boundaries, the proportion of suitable raptor habitat available is higher (i.e., 74.9%) than the proportions found in either the LAA (60.8%) or the RAA (44.6%). Approximately 33.2% of the PDA contains high-suitable habitat and 41.7% is moderate-suitable habitat. Further details on the habitat mapping can be found in the Grays Bay Road and Port Project Bird Baseline Report (see Appendix 17A).

Table 17.8 Amount of Suitable Raptor Habitat Available Within the Project Assessment Areas.

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	986.3	10.5	386.1	19.5	16.7	33.2
	Moderate	3,220.9	34.1	818.0	41.3	20.9	41.7
	Total	4,207.2	44.6	1,204.0	60.8	37.6	74.9
Non-Suitable Habitat	Low	3,434.8	36.4	539.2	27.2	11.2	22.3
	Nil	1,792.0	19.0	238.2	12.0	1.4	2.8
	Total	5,226.7	55.4	777.3	39.2	12.6	25.1
Grand Total		9,433.9	100.0	1,981.4	100.0	50.2	100.0

17.3 Project Interactions with Birds

The Project has the potential to interact with birds as outlined in Table 17.9. These interactions are indicated by a check mark (potential interaction) or a dash (no interaction). They are discussed in detail in the following sections, in the context of effects pathways, standard and project specific mitigation measures, and residual effects.

Table 17.9 Project Interactions with Birds

Project Activities	Effects	
	Change in Habitat	Change in Mortality Risk
Construction		
Mobilization/demobilization of machinery /equipment, vehicles, materials, and fuel (e.g., by barge, sea lift, boat, or road)	✓	✓
Staging and storage of materials, fuel, equipment and pre-fabricated components	✓	✓
Chemical and hazardous material transport, storage and management (including explosives)	✓	✓
Establishment and operation of camps (e.g., mobile camps and permanent accommodations), maintenance yards, and laydowns	✓	✓
Machinery/equipment and vehicle refueling / fuel storage handling	–	✓
Site preparation and earthworks of disturbance area (e.g., vegetation clearing, stripping and stockpiling of organic and overburden materials, grading, blasting, drilling)	✓	✓
Construction of port landside facilities, aerodrome, road, and Jericho Station (e.g., buildings/facilities, fuel storage, laydown areas; public use area; access roads; water intake; power generation - diesel (may include wind turbine or solar array); all-season gravel airstrip)	✓	✓

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Project Activities	Effects	
	Change in Habitat	Change in Mortality Risk
Borrow source and quarry development (e.g., blasting, crushing, sorting, stockpiling of temporary and permanent areas)	✓	✓
Water withdrawal to support construction activities (e.g., winter road construction, dust control, material compaction)	–	–
Watercourse crossing construction (e.g., bridge and culvert installation)	✓	✓
Ground based transportation (e.g., workforce, materials, supplies)	✓	✓
Air transport (e.g., personnel transport, resupply)	✓	✓
Waste management and sewage facilities (e.g., development and use of a permanent waste management facility and on-site landfill; handling and storage of hazardous and non-hazardous waste; incineration of domestic waste; open air burning; management of black and grey water)	✓	–
Construction of marine-based infrastructure (e.g., construction of large vessel wharves, medium vessel wharf, small craft harbour, barge landing area, desalination line, vessel refuelling line / fuel line to bulk fuel storage, including nearshore dredging, infilling, pile driving, blasting)	✓	✓
Taxes, contracts, purchases (e.g., procurement of goods and services; employment of workers)	–	–
Closure and reclamation of temporary borrow sources/quarries, camps, workspaces, laydowns (e.g., erosion stabilization, revegetation, restoration of natural drainage patterns, prevention of future vehicular access)	✓	✓
Operations and Maintenance		
Port landside operations (e.g., use and maintenance of accommodations, borrows, roads, power generation; aerodrome operations including use and maintenance of airstrip and facilities; and Jericho Station operation and maintenance).	✓	✓
Marine port use and operations (e.g., vessels and cargo loading/unloading, barge landing operations, small craft harbour operations, maintenance dredging)	✓	✓
Borrow source and quarry operations (e.g., blasting, crushing, sorting, and stockpiling of permanent areas)	✓	✓
Desalination operation and wastewater treatment (e.g., marine water use and effluent discharge)	–	–
Water withdrawal / use (e.g., potable water, dust control, maintenance)	–	–
Road maintenance / use (e.g., transport of equipment, workers, and supplies; maintenance of bridge/culverts; snow clearing; grading and gravel replacement; dust control)	–	✓
Bulk fuel storage (e.g., operation of permanent fuel facilities)	–	–
Vessel fuel line / refueling (e.g., directly offloading from east wharf or use of floating fuel pipeline; above ground insulated pipeline to bulk fuel storage tanks)	–	–
Equipment maintenance	–	
Chemical and hazardous material transport, storage and management (including explosives)	–	✓
Winter road construction and use (e.g., annual winter road construction and maintenance)	–	–

Project Activities	Effects	
	Change in Habitat	Change in Mortality Risk
Air transport (e.g., personnel transport, resupply)	✓	✓
Waste management (e.g., use of a permanent waste management facility and on-site landfill; handling and storage of hazardous and non-hazardous waste; incineration of domestic waste; open air burning; management of black and grey water)	–	✓
Taxes, contracts, purchases (e.g., procurement of goods and services; employment of workers)	–	–

Notes:

✓ = Potential interaction

– = No interaction

Some project-related activities will not affect birds or their habitats. These include financial and administrative activities such as taxes, contracts, and purchases. Activities related to water, fuel, and equipment, such as water withdrawal for various purposes (e.g., construction, potable use), bulk fuel storage, vessel fuel line/refuelling, and equipment maintenance, also have no anticipated potential effects. Lastly, certain waste management activities, specifically the broad category of waste management are unlikely to affect habitat but in some cases, specific hazardous-material and waste-related activities may change mortality risk.

17.4 Assessment of Project Effects on Birds

17.4.1 Change in Habitat

17.4.1.1 Analytical Assessment Techniques

The assessment of change in habitat considers the effects of both direct habitat loss (from the PDA) and indirect habitat alteration from sensory disturbances (e.g., noise, dust, human activity) on suitable habitat for three guilds of birds: passerines, waterbirds/shorebirds, and cliff-nesting raptors. The change in habitat can be quantified based on the results of bird habitat suitability ranking, the area removed by the PDA (direct habitat loss), and adjacent habitat influenced by sensory disturbances within the LAA (indirect habitat alteration or loss). Suitable habitat rankings are based on how current conditions meet a birds' life requisites, such as breeding or foraging. For passerines, habitat ranking was based on bird densities; for waterbirds, the habitat rankings were developed for shorebird breeding habitat; for raptors, habitat rankings were based on cliff-nesting raptors' breeding and foraging habitat. These habitat rankings used a four-tier system: High, Moderate, Low, and Nil, based on the habitat's ability to support breeding, foraging, or high densities of bird species (as determined by field-based observations). These rankings were grouped into Suitable (High and Moderate) and Unsuitable (Low and Nil). More details about the habitat rankings can be found in the Grays Bay Road and Port Bird Baseline Report (Appendix 17A).

To determine the change in habitat suitability, rankings were downgraded based on assumptions about how the Project will influence the guild of birds' use of these habitats. Habitat within the PDA was downgraded to 'Nil' since all habitats will be removed by the Project (i.e., direct habitat loss caused by the Project). Habitats adjacent to the PDA were downgraded for different bird guilds, forming the ZOI. The ZOI considers how Project components and activities may influence bird behaviour and/or use of habitat, as request in the NIRB Guidelines (NIRB 2026). The ZOI varied among the bird guilds, ranging from 250 to 1,500 metres (m) (see Table 17.10). The habitats within the ZOI were downgraded by one ranking down to a minimum of Low suitability. Indirect habitat loss is where existing Moderate habitat (i.e., suitable habitat) is downgraded to Low habitat (i.e., unsuitable habitat). Indirect habitat alteration involves existing High-ranking habitat being downgraded to Moderate, but the habitat still remains suitable for birds to use.

Table 17.10 The Rationale for Disturbance Zones of Influence for Passerines, Waterbirds and Shorebirds, and Raptors

Species Group	ZOI Distance	Rationale
Passerines	300 m	Passerine bird density is substantially lower within 100 m to 300 m of a compressor station (Bayne et al. 2008). The density of territorial willow warblers (<i>Phylloscopus trochilus</i>) was much lower within 200 m of a highway (Reijnen and Foppen 1994). Songbird density reduced by 20% to 98% within 250 m of a road (Reijnen et al. 1995).
Waterbirds	250 m	Waterfowl initiate flight in response to human presence and noise that occurs within 100 m to 250 m (Miller et al. 1998; Rodgers and Schwikert 2002). A setback distance of 250 m from waterfowl, diving ducks, wading birds, and shorebirds may lessen the disturbance effects on the most sensitive species (Borgmann 2011). Shorebird flight initiation distances ranged from 61 m to 186 m due to anthropogenic disturbances (Koch and Paton 2014).
Cliff-nesting Raptors	1,500 m	A setback of 1,500 m is recommended for general raptors nesting sites (GNWT 2015).

17.4.1.2 Project Effects Pathways

Inuit, Indigenous, and Community Knowledge identified different habitats used by birds. This knowledge was taken into consideration for identifying the Project effects pathways. NTKP consultants explained that cliffs are important nesting habitat for a variety of raptors (rough-legged hawk, gyrfalcon and peregrine falcon) and other colonial nesting birds such as gulls and cliff swallows and other birds such as ravens, geese, and some ducks (Banci and Spicker 2024). During engagement on a previous project, Kitikmeot Inuit Association expressed concerns regarding potential effects on birds from project infrastructure, sensory disturbances, habitat loss, and the presence of industrial or other waste (NIRB 2024).

There are two types of habitat loss: direct and indirect. Direct habitat loss will occur during the Construction phase through site preparation (i.e., ground clearing and vegetation removal) within the PDA. Indirect habitat loss or habitat alteration will occur through human-made sensory disturbances, such as noise (from equipment and human activity) and dust, during the Project's Construction and Operations and Maintenance phases. These disturbances can influence bird behaviour and habitat use as described below.

Noise and human activity from vehicle and equipment operation, as well as blasting activities, can influence bird occurrence and habitat use. Noise and activity may disrupt bird behaviour, communications, and overall reproduction success (Barber et al. 2010; Blickley and Patricelli 2010). Noise from the construction of port facilities and ship engines can affect the foraging behaviour of seabirds and sea ducks (Goodship and Furness 2022). During both Project phases, effects are more likely to occur in the northern portion of the RAA near the Grays Bay Port, due to higher traffic volume, air traffic, and overall higher levels of sensory disturbance (see Volume 5, Section 13).

Human activity during the Construction and Operations and Maintenance phases may influence bird occurrence and habitat use. During the Construction phase, personnel will be stationed at two stationary camps (i.e., Grays Bay and Jericho Station) as well as four mobile camps as road construction progresses. Each stationary camp will accommodate up to approximately 80 people and each mobile camp will accommodate up to approximate 40 people, including construction, supervisory, and technical personnel. During the Operations and Maintenance phase, there will be approximately 20 personnel at the port. Approximately 12 personnel will be stationed at Jericho Station, with facilities to accommodate up to 40 persons (see Volume 2, Section 1). The presence and activities of project personnel will cause some changes in avian behaviour and habitat use in the vicinity of human activity.

Dust may be generated from Construction and Operations and Maintenance activities, such as land clearing, blasting, and the movement of vehicles and equipment, which may cause adverse effects on birds (Barton et al. 2023). These effects may cause a bird to avoid areas where dust generation occurs.

Some avian species, however, have adapted to anthropogenic environments. For example, some birds use human-made structures for nesting and artificial light for foraging. Passerines have demonstrated increased fledging success (Wang et al. 2021) and higher occupancy rates (Rodríguez et al. 2021) in response to anthropogenic influences. Additionally, some raptors, such as peregrine falcons, have adapted to nesting on artificial structures like building ledges, bridges, and smokestacks in high-traffic areas (Cade and Bird 1990; Cade et al. 1996; Septon et al. 1996), and show little effect from industrial activities (Franke et al. 2010; Coulton et al. 2013).

17.4.1.3 *Mitigation, Management, and Enhancement Measures*

The Project has incorporated several mitigation strategies into its design and operational procedures to avoid and reduce the extent of the effect on bird habitat. Mitigation, management, and enhancement measures aim to reduce disturbance areas and safeguard birds during sensitive time periods.

Direct Habitat Loss

- The PDA will be confined to a specific design layout to reduce the Project's potential effect on habitat loss and effectiveness.
- Vegetation clearing and ground disturbance will be completed, where practicable, outside the migratory bird nesting period of May 15 to August 18 (Zone N9; ECCC 2018).
- Wildlife sweeps will be completed to identify wildlife sensitivities (i.e., active nests, dens, other wildlife features) ahead of construction activities. No-disturbance buffers will be established around any sensitivities identified. If disturbance within a no-disturbance buffer is unavoidable, site-specific protection measures will be developed by a Qualified Professional.
- The Wildlife Mitigation and Monitoring Plan (WMMP) will outline general timing windows for bird nesting, as well as recommended setback distances from active nests for various species.
- Quarries will not be situated on sensitive habitat features like watercourses, water bodies, or land bridges.

Indirect Habitat Loss

- Dust will be actively suppressed from roads water and/or other dust suppressants) when necessary to manage excessive dust from affecting the surrounding environment. Dust suppression will follow NU's *Environmental Guideline for Dust Suppression on Unpaved Roads* (GN 2014).
- Any wildlife features identified during Construction or Operations and Maintenance activities will be avoided, and a buffer will be established around them.
- Vehicles and equipment will be equipped with manufacturer-recommended noise muffling equipment.
- All permanent outdoor light fixtures at the port will be pointed downwards where practicable to reduce light disorientating flying birds, except where required for safety reasons.
- Turn off or dim deck and exterior lights on vessels except those used for navigation during low visibility periods (e.g., fog, rain, nighttime periods).

17.4.1.4 Project Residual Effect

Direct habitat loss from the PDA will permanently remove existing habitat from the landscape. Indirect habitat loss (whereby habitat is downgraded from baseline conditions) will occur in areas adjacent to the PDA which may still be used by birds but to a lesser degree. Overall, the amount of bird habitat influenced by the Project ranges from 2.1% to 7.9% of the RAA, depending on the bird guild (as detailed in the following sections).

The Project's direct effects on the change in habitat occur during the Construction phase. The Construction and Operations and Maintenance of the Project will result in indirect habitat loss due to human-made sensory disturbances (e.g., increased noise levels, dust, and human activity). The indirect effects will reduce during the Operations and Maintenance phase. Dust deposition on vegetation at the Project is anticipated to be limited to within 40 m of the PDA (see Volume 6, Section 15). Sound levels from construction activity are expected to return to baseline levels within 1 km of the PDAs for the Port

and Jericho Station, as well as quarry and bridge construction activities located within the Road PDA. Sound levels from other road construction are expected to return to baseline levels just beyond 1 km of the Road PDA (see Volume 5, Section 13). Human activity from the Project is anticipated to be the same between the Construction phase and the Operations and Maintenance phase.

The direction of the residual effects of the Project on a change in habitat for birds is adverse, but low in magnitude, due to the overall amount of bird habitat influenced by the Project. Among the bird guilds evaluated, cliff-nesting raptor habitat is most influenced by the Project (12.3%), as the raptor ZOI is five to seven times larger than the waterbird and passerine ZOIs, respectively (see Section 17.4.1.4 for details). The geographic extent of the residual effects will be limited to within the LAA. Residual effects may occur during sensitive periods for birds (e.g., the breeding season), resulting in a high rating for timing sensitivity that will persist throughout the Project's duration and constitute a long-term effect. The frequency of residual effects is expected to remain continuous throughout the Project and the effects will be irreversible. Overall, the Project's residual effects will not substantially influence the amount or quality of bird habitat within the RAA. Further details on the Project's residual effects on habitat change for each bird guild are provided below.

Passerines

Baseline conditions identified that suitable passerine habitat occurs within 40% of the RAA (see Table 17.11 and see Figure 17.3). Site clearing within the PDA during construction is anticipated to influence 30.0 km², representing 0.83% of the RAA. A further 64.1 km² of indirect habitat loss during both the Construction and Operations and Maintenance phases is predicted due to sensory disturbances, contributing to an additional 1.8% loss of suitable habitat. Overall, the total amount of suitable passerine habitat influenced by the Project amounts to 2.6% of baseline suitable habitat within the RAA, which is considered a low-magnitude residual effect (see Table 17.4). A further 22.1 km² of habitat was predicted to experience indirect habitat alteration due to the Project (i.e., a reduction in rating from High to Moderate) but remains suitable for birds; this represents 0.6% of the RAA.

Table 17.11 Direct and Indirect Passerine Habitat Loss Influenced by the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	3,626.2	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	30.0	0.8
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	64.1	1.8
Total Habitat Loss			94.1	2.6

Waterbirds

As with passerines, the Project's residual effects on habitat loss and alteration for waterbirds will be evident during their breeding and migration periods. Baseline conditions identified approximately 1,572.7 km² of suitable habitat for waterbirds within the RAA, which represents about 16.9% of the RAA. The change in habitat for waterbirds is most noticeable in the north portion of the RAA (see Figure 17.4). Development of the Project's PDA will result in a direct habitat loss of 0.65% for waterbirds within the RAA that will occur during the Construction phase (see Table 17.12). Indirect habitat loss within the waterbird ZOI is more than double the direct habitat loss, resulting in a 1.4% loss. The overall residual effects of the Project on waterbird habitat loss is 2.1% of the RAA (see Table 17.12), which is considered a low magnitude residual effect (see Table 17.4). A further 5.6 km² of habitat was predicted to experience indirect habitat alteration due to the Project (i.e., a reduction in rating from High to Moderate) but remains suitable for birds; this represents 0.4% of the RAA. Some upland habitats that waterbirds may use for nesting purposes will be lost as a result of the Project. For example, port site and road construction will remove some upland habitat that waterbirds may use for nesting purposes. Similarly, the Aerodrome PDA includes wetlands and watercourses that will be removed or altered during construction. Sensory disturbances caused by aerodrome operations during the breeding and migration seasons are anticipated to influence waterbird use of suitable habitat within the Aerodrome PDA.

Table 17.12 Direct and Indirect Waterbird Habitat Loss Influenced by the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	1,572.7	100
Construction	PDA	Direct Habitat Loss	10.2	0.7
Construction and Operations and Maintenance	ZOI within the LAA	Indirect Habitat Loss	22.1	1.4
Total Habitat Loss			38.0	2.1

Raptors

The Project's influence on bird habitat is calculated to be most noticeable to raptors. This is due to the raptor ZOI being 5 to 7 times larger than the ZOI for waterbirds and passerines, respectively. Because of this, the overall amount of change in habitat calculated for raptors is higher than that of the other bird guilds evaluated.

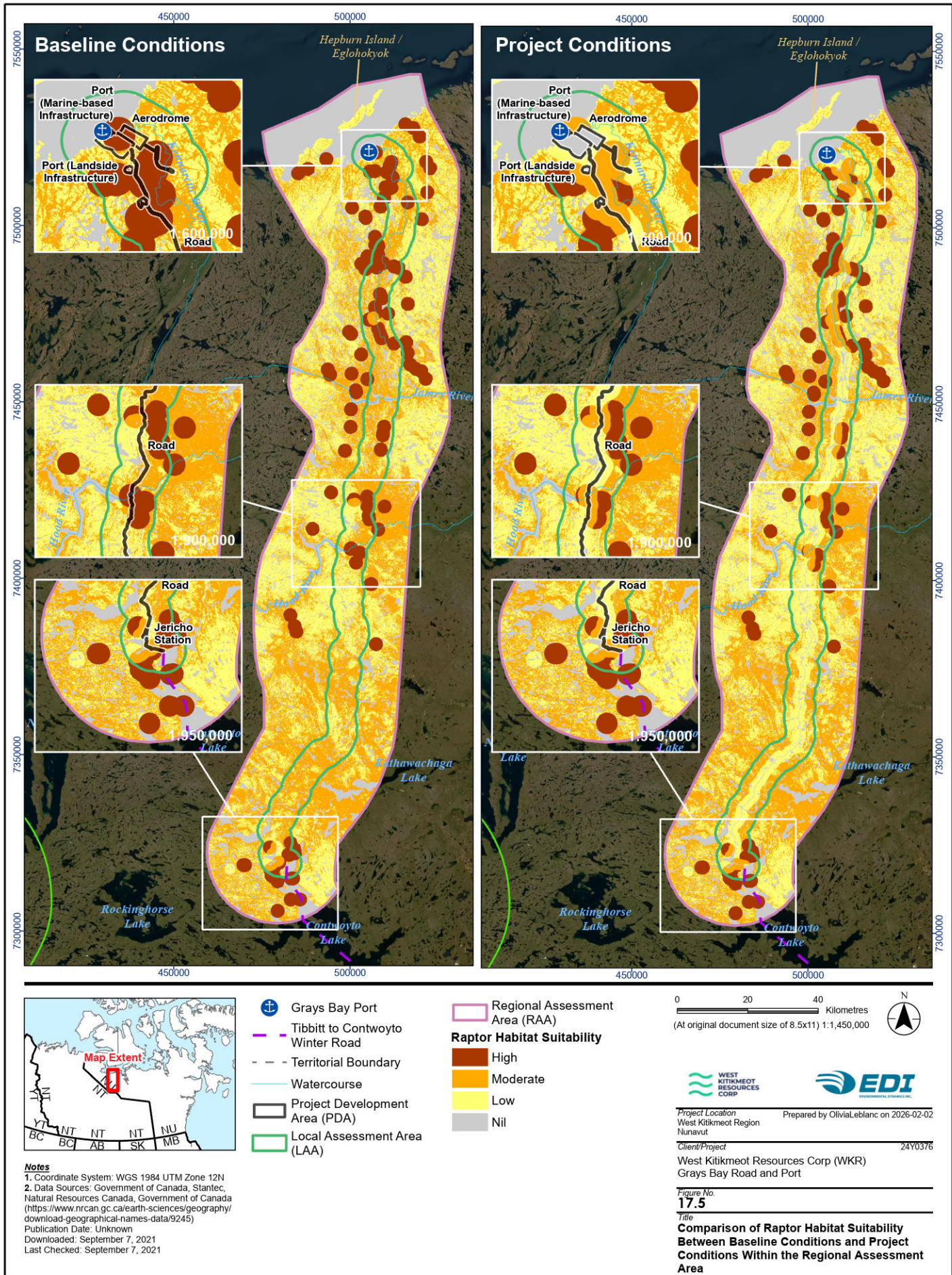
As with the other bird guilds, the Project's residual effects on the change in habitat for cliff-nesting raptors will be most apparent during the breeding and migration seasons. The majority of cliff-nesting raptor nests were located in the northern half of the PDA and at the terminus of the Road PDA near Contwoyto Lake (see Figure 17.5). The Project is anticipated to cause a direct habitat loss of 0.9% to the existing raptor nesting and foraging habitat within the PDA (see Table 17.13).

Table 17.13 Direct and Indirect Raptor Habitat Loss Influenced by the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	4,207.2	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	37.6	0.9
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	295.6	7.0
Total Habitat Loss			333.2	7.9

Indirect habitat loss was considerably higher, with a calculated estimate of 7.0% within the raptor ZOI (see Table 17.13). Indirect habitat alteration was higher than direct habitat loss but lower than indirect habitat loss, with a calculated estimate of 4.12% loss within the raptor ZOI. The project ZOI overlaps with 28 peregrine falcon nest buffers (see Figure 17.5). A further 154.5 km² of habitat was predicted to experience indirect habitat alteration due to the Project (i.e., a reduction in rating from High to Moderate) but remains suitable for birds; this represents 3.7% of the RAA.

The PDA overlaps with two peregrine falcon nests identified during baseline studies. One nest is located on a large rock outcropping located east of the Aerodrome PDA. This rock outcropping is part of the Obstacle Limitation Surfaces for a Non-Precision approach, necessary for safe air traffic landing and takeoff (Transport Canada 2013). Subsequently, this rock outcropping will be reduced in size to meet safety requirements. The nest on this rock outcropping was active when it was initially identified in 2008, but was not active during baseline studies in 2025. The second raptor nest is located on a canyon wall within the Road PDA where it crosses the Hood River. This nest was not active when it was initially identified in 2008. Construction of the Hood River bridge could potentially influence this nest. Occupancy of known cliff-nest sites may fluctuate locally. Species like the peregrine falcon will nest in different locations on the same cliff face or in adjacent suitable areas in different years (White et al. 2024).



Studies on human development and activity effects on cliff-nesting raptors suggest that overall effects are minimal. A monitoring study at a NT mine found that local spatial and temporal factors, such as prey abundance and climatic conditions, were the primary determinants of reproductive success and occupancy for peregrine falcons and rough-legged hawks, with distance from the open-cut mine showing no discernible influence (Franke et al. 2024). Similarly, peregrine falcon and gyrfalcon nests located as close as 0.8 km from an active mine showed no effect on hatch success or occupancy rates due to distance from the PDA (Coulton et al. 2013). These studies suggest that indirect effects in the ZOI is negligible. Overall, the total amount of raptor habitat influenced by the Project (either directly or indirectly) is predicted to be 7.9% of the RAA (see Table 17.13), which is considered a low-magnitude residual effect (see Table 17.4).

17.4.2 Change in Mortality Risk

17.4.2.1 Analytical Assessment Techniques

A qualitative assessment involved literature reviews and the evaluation of project-related activities that can influence mortality risk (e.g., timing of construction activities, land clearing and site preparation, speed limits, traffic). This also includes activities that can influence indirect mortality risk, such as bird and egg harvesting practices resulting from new access to areas where bird breeding activity is concentrated, and potential nest abandonment by breeding birds due to sensory disturbances.

17.4.2.2 Project Effects Pathways

Inuit, Indigenous, and Community Knowledge identified that birds are valued for sustenance, harvested for meat and down for insulation, and for eggs. Information acquired from these knowledge sources identified the following influences on bird mortality. NTKP consultants harvest all geese species in their area, including Canada goose, greater white-fronted goose, snow goose, Ross's goose and brants. They reported that birds were an important food source for ocean and coastal Inuit, because of the large concentrations of nesting waterfowl on the ocean coast, especially during spring migration. They further explained that sandhill cranes are harvested when they first arrive as they are fatty. Eider ducks and loons were hunted while they were resting on the open water in the cracks of the ocean ice. Ducks that were not eaten were cached in rocks for later use. NTKP consultants also reported that they often would harvest eggs (from waterfowl) in June. While raptors are not commonly hunted, consultants will use the feathers, meat, and eggs. (Banci and Spicker 2024).

During engagement on a previous project, Inuvialuit have identified harvesting ducks, geese, brant swans, Canada geese, and ptarmigan (Nagy 1999).

The period when most birds are present in the LAA is the breeding period, which generally spans from mid May to late August (Rousseu and Drolet 2015; Richards and Gaston 2018a, 2018b; see Table 17.14). Some raptor species are known to initiate nests in the Arctic as early as early April (e.g., golden eagle), but most species initiate nests in mid-May to early June (Rousseu and Drolet 2015; Richards and Gaston 2018a, 2018b).

Table 17.14 Breeding Period for Bird Guilds in the Local Assessment Area

Bird Guild	General Breeding Period
Passerines	early June to mid-August
Waterbirds	mid-May to mid-August
Raptors	mid-May to late August

Most birds that breed in the Arctic establish nests on the ground. Passerines in Arctic regions typically nest in sedge marshes, wetlands, areas with rock formations, or low shrub vegetation. Shorebirds primarily nest in tundra habitats, sand, gravels, or tussock sedges that have little to no overhead cover. Some raptor species are ground nesters (e.g., short-eared owl), whereas other species establish nests on cliffs and rock outcroppings (e.g., peregrine falcon).

Project activities during Construction, such as vegetation clearing, grading, or blasting, can interact with birds in ways that increase their mortality risk. Construction activities during the bird nesting period may result in incidental take due to interaction with avian species or their active nests. Incidental take is defined as the inadvertent killing/harming of birds or destruction/disturbance of nests and eggs (Canadian Wildlife Service and Environment Canada 2014). Construction activities that cause ground disturbances (e.g., blasting and moving rock materials, topsoil stripping, grading) have the potential to increase mortality risk to birds through incidental take.

The Project has the potential to increase bird mortality risk through collisions with marine vessels, vehicles, construction equipment, aircraft, and structures. Marine vessels will primarily be barges and tugs to shuttle construction equipment to the port site, two cargo ships per year to shuttle construction materials, and one fuel tanker ship. The Project's Construction phase will have considerably more vehicles, equipment, and aircraft than the Operations and Maintenance phase (see Volume 2), thereby increasing bird mortality risk from collisions. Approximately 1,000 trucks will be required to transport construction materials, fuel, and equipment to Jericho Station during each Tibbitt to Contowyto Winter Road season, beginning in the first winter. Barges transporting equipment and supplies from the marine vessel to the mainland of the port site may collide with waterbirds. Seabirds and waterfowl, especially diving ducks, that forage for fish and invertebrates in the intertidal zone are potentially at risk of a collision with the barges. Artificial lights can attract birds to the light source, or disorient them while they are flying (U.S. Fish and Wildlife Service 2024).

Collisions occur when birds fly across a roadway that intersects a vehicle, when birds are attracted to roads as locations of concentrated resources, or when birds are attracted to puddles as water sources (Hodson 1962; Rytwinski and Fahrig 2012). For example, some raptors being attracted to roads to forage on roadkill could increase their mortality risk.

Bird strikes from aircraft will become a concern with the temporary airstrip and, later, with the aerodrome becoming operational. Seventy-five percent of all bird strikes occur when aircraft are at or below 500 feet above ground level (Transport Canada 2007), which usually occurs during aircraft take-offs and landings. However, the number of birds influenced by this mortality risk is relatively small compared to other anthropogenic-related risks (Calvert et al. 2013). The proposed road and aerodrome will be elevated

linear features on the landscape that could serve as vantage points for predators during hunting. Additionally, nest predation has been found to increase adjacent to roads, especially low-traffic roads (Pescador and Peris 2007). The road may open new areas for Inuit people to collect bird eggs which could improve food security and maintain Inuit cultural identity, continuity and well-being, but it could also negatively impact bird populations if not managed sustainably (Dominique et al. 2020).

17.4.2.3 Mitigation, Management, and Enhancement Measures

Mitigation measures, best management practices, and regulatory requirements are expected to prevent or reduce the likelihood that project-related activities will directly or indirectly influence mortality risk to birds. The mitigation strategies will overlap with other interrelated VCs where the effects pathways are similar (e.g., other wildlife, caribou, marine mammals). Key mitigation measures to prevent or reduce the change in mortality risk for birds due to ground disturbance or collision/strikes with project vehicles, aircraft, vessels, equipment and/or infrastructure are listed below. With respect to potential increases in mortality due to improved access, hunter and trapper access to the port and road will be controlled by WKR during the Operations and Maintenance Phase. For safety reasons, no access to the port and road will be allowed during the Construction Phase.

Ground Disturbance

- The WMMP will outline general bird nesting activity timing windows, as well as recommended setback distances from active nests for various species.
- Vegetation clearing and ground disturbance will be completed, where practicable, outside the migratory bird nesting period of May 15 to August 18 (Zone N9; ECCC 2018).
- Wildlife sweeps will be completed to identify wildlife sensitivities (i.e., active nests, dens, other wildlife features) ahead of construction activities. No-disturbance buffers will be established around any sensitivities identified. If disturbance within a no-disturbance buffer is unavoidable, site-specific protection measures will be developed by a Qualified Professional.
- Construction and quarry development activities will adhere to the recommended setbacks and timing restrictions outlined in the WMMP.

Collisions and Strikes

- Aircraft will maintain a minimum cruising altitude of 610 m above ground level except during landing and take-off at the aerodrome, for safety reasons due to inclement weather, or when operationally required.
- Speed limits shall be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 kilometres per hour on project road surfaces or decreased in certain areas, depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road-crossing locations).
- All-terrain vehicle, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.

- All permanent outdoor light fixtures at the port site will be pointed downwards, where practicable, to reduce light disorientating flying birds, except where required for safety reasons.
- Turn off or dim deck and exterior lights on vessels except those used for navigation during low visibility periods (e.g., fog, rain, nighttime periods) (U.S. Fish and Wildlife Service 2024).

17.4.2.4 *Project Residual Effect*

The implementation of the mitigation measures identified in Section 17.4.2.3, combined with avoidance (e.g., timing restrictions, reduced footprint), reduction (e.g., reduced disturbance, approved areas), and direct protection (e.g., surveys, no-disturbance buffers), provides a comprehensive approach to managing project-related effects. The efficacy of the proposed mitigations is high when implemented throughout the project life.

The Project presents adverse effects to birds, but the predicted residual effects are low in magnitude, as only a small number of birds in the project area may be at increased mortality risk. The geographic extent of the mortality risk residual effect will be within the LAA based on aircraft taking off and landing at the aerodrome. Potential residual effects may overlap with sensitive bird breeding and migration periods, making their timing highly sensitive. The Project's residual effects on bird mortality risk are considered long-term and will occur at irregular intervals. The residual effects on mortality risk will be irreversible. Based on the evaluation provided herein, none of the potential effect pathways are expected to substantially influence local bird populations. Further details on how the residual effects will influence the different bird guilds are provided below.

Passerines

Project residual effects on passerine mortality risk will be limited to the breeding and migration periods when passerines are in the RAA. As construction progresses, the potential for passerine bird collisions with vehicles and equipment will likely increase as vehicle and equipment movement increases incrementally. Mortality risk during the Operations and Maintenance phase will likely be reduced based on the predicted traffic volumes during that time. Due to the low density of passerines in the RAA, mortality events will likely be sporadic and affect only a limited number of individuals. Therefore, the overall residual effect of bird collisions with the Project's vehicles and equipment is likely low.

Site preparation for the port site, road, and aerodrome could also cause incidental take of passerine nests during the breeding season. Although mitigation measures reduce the risk of incidental take, some passerine nests may be missed during wildlife sweeps conducted before site preparation activities. Despite this, the overall residual effect on passerine birds of incidental take occurring during construction activities is predicted to be low. Once the aerodrome is built and operational, passerines will face increased mortality risk from aircraft taking off and landing. The risk of aircraft-bird collisions is elevated at dawn and dusk and during specific seasons, such as spring and fall migration periods (Transport Canada 2007). Despite the potential for aerodrome operations to influence bird mortality, the overall mortality risk is low due to the combination of low air traffic volume and a relatively small passerine bird population identified within the aerodrome area from baseline surveys.

The influence of artificial lighting at the Project during low-visibility periods when migratory birds are present increases their mortality risk. The number of individuals this potential effect may influence is predicted to be low, as the interaction will likely occur only in discrete instances when artificial lighting is needed during low-visibility periods (e.g., foggy conditions).

Overall, the predicted residual effect of mortality risk on passerine birds is considered to be low.

Waterbirds

Project residual effects on waterbird mortality risk will primarily occur during the breeding and migration seasons. In the marine environment adjacent to the port site PDA, while most waterbirds (namely sea birds) will avoid marine vessels and barges, some individuals may interact with them, potentially resulting in mortality. These mortality events will be isolated incidents that are likely to affect a small number of individuals who may interact with marine vessels. The overall residual effect of marine vessel-barge interactions on waterbirds' mortality risk is likely low.

Similarly, the residual effects from lighting used on marine vessels and barges to influence waterbird mortality risk are also likely low. The marine vessels and barges will primarily be operating at the port site during periods of 24-hour sunlight during construction activities. The use of lighting by marine vessels and barges will be limited to periods of low visibility (e.g., foggy conditions and/or during dusk or dark) or as daylight hours decrease later in the marine vessel use season (i.e., when light use is required for human safety). The number of waterbirds that may interact with marine vessels or barges when lighting is being used is likely low, and the number of birds that may be disoriented and/or attracted to the lights is likely even less. Once constructed, the port site will accept vessels from early June until November, but will be open year-round. Increased use of lighting by marine vessels and/or barges is anticipated from August to November, when daylight hours are shorter. However, many waterbirds will have started their fall migration during this time, and subsequently, the potential for waterbirds to interact with the Project during the fall is reduced. Therefore, the number of waterbirds that may be influenced by lighting from marine vessels and barges during port site operations is likely low. The overall residual effect on waterbird mortality risk is low.

Site preparation and earthworks for the port site, road, and aerodrome could cause incidental take of waterbird nests that were not identified during wildlife sweeps completed ahead of construction activities during the breeding season. While the risk of incidental take is low following the implementation of mitigation measures, a waterbird nest may not be identified during a wildlife sweep due to the cryptic nature of some individuals, or a nest may be initiated in the time between the wildlife sweep and earthworks. The overall residual effect on waterbirds of incidental take occurring during construction activities is predicted to be low. Waterbirds may use parts of the port site or ancillary infrastructure during the Operations and Maintenance phase for nesting; however, these nesting locations on the infrastructure will likely be sheltered and away from human activity, thereby avoiding increased mortality risk from project-related activities. Once the aerodrome is built and operational, aircraft using it may collide with waterbirds (most notably during take-offs and landings), resulting in mortality. While aerodrome operations could influence mortality risk, the residual effect is considered low given the combination of low air traffic volume and relatively low waterbird occurrence within the Aerodrome PDA identified during baseline studies.

Raptors

Project residual effects on raptor mortality risk are apparent during the raptor breeding and migration periods. Vehicle and aircraft collisions with raptors are the most likely residual effect from the Project. Low-flying raptors are usually more susceptible to collisions than raptors that typically fly at higher altitudes (Rytwinski and Fahrig 2015). The low traffic volumes associated with the Project coupled with the mitigations identified, will reduce the overall mortality risk to raptors. Consequently, the overall residual effect of collisions influencing raptor mortality risk is low.

Ground-nesting raptors may be at risk of incidental take during construction activities. Mitigation measures, such as wildlife sweeps completed ahead of construction activities, should help prevent this mortality risk to raptors; however, any raptors flushed from a nest during a wildlife sweep may crush or puncture eggs or trample newly hatched young (Fyfe and Olendorff 1976). The instances of this occurring will be limited. The overall risk of this residual effect to the raptor population is negligible.

17.4.3 Summary of Project Residual Effects on Birds

The Project's residual effects on change in habitat and mortality risk for birds and bird habitat are expected to be low in magnitude, with the effects occurring within a local geographical extent. The residual effects will occur during the breeding season which is the most sensitive time period for birds. The duration of the residual effects will be long-term, and, given that the Project will be permanent, they will be irreversible. The residual effects of habitat change will be continuous, with sensory disturbances from the Project occurring throughout the Project's lifespan. The frequency of the Project's residual effects on mortality risk will be irregular when birds experience increased mortality risk from the Project. Table 17.15 summarizes the Project's residual effects on birds and bird habitat.

Table 17.15 Project Interactions with Birds

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C, O	A	L	LAA	HS	LT	C	I
Change in Mortality Risk	C, O	A	L	LAA	HS	LT	IR	I
Key: See Table 17.4 for detailed definitions Project Phase: C: Construction O: Operations and Maintenance Direction: P: Positive A: Adverse N: Neutral Magnitude: NMC: No Measurable Change L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable								

17.4.4 Effects of Climate Change on Birds

Inuit, Indigenous, and Community Knowledge provided information and concerns on how the climate is changing in the Arctic. Some information acquired about climate change in relation to birds included the following:

NTKP consultants have observed changes in the distribution and abundance of birds, including new species arriving in the north. They explained that the population of local birds, once abundant, are declining, including passerines, Lapland longspurs, snow buntings, larks, sandpipers, songbirds, and shorebirds. However, redpolls (who stay all year in willows), robins, speckled eider, red crested warblers, yellow warblers, mountain bluebirds, tree swallows, house finches (red and blue species), white winged scoters, northern shovelers, long billed curlews, and a white bird with a large bill are more recent birds in the region. Consultants attribute this change to changes in the weather. (Banci and Spicker 2024)

IAG members expressed concern for potential effects on migratory birds. They reported seeing raptors, such as bald eagles and golden eagles migrating north, and attributed this to the effects of climate change. About 15 years ago (c. 2010), IAG members observed eagles moving into the Contwoyto Lake area. The eagles frighten wolves, and they are attacking caribou. Wildfires seem to be exacerbating warming conditions and the presence of eagles. (IAG 2025a)

The future influence of climate change on various bird populations remains uncertain. Projected climatic changes for the RAA are consistent with much of the Canadian Arctic, with temperatures projected to increase by 4 degrees Celsius (°C) to 8°C (depending on emission scenario) by 2080 (see Volume 5, Appendix 12A). Accordingly, the region is expected to experience greater growing degree days during this time frame, while precipitation is also projected to increase. Altogether, these changes are likely to increase vegetation productivity in the region. This is consistent with current trends such as a northward shift in the treeline and increased range and abundance of many shrub species (Holtmeier and Broll 2005; Myers-Smith et al. 2015). This increase in net primary productivity will benefit bird species that breed and nest in these habitat types; those species will likely exhibit range expansion.

A study that reviewed bird responses to climate change in the Canadian Arctic tundra found little evidence of changes in the phenology of nesting birds with changing climate conditions over a 24-year period (the climate conditions during the study period showed a warming trend) (Gauthier et al. 2013). However, other studies suggest that herbivorous and insectivorous Arctic-breeding birds may have reduced chick growth rates due to a mismatch between food abundance and nest-hatching periods, resulting in reduced growth rates of young (McKinnon et al. 2012). The timing mismatch between vegetation green-up and snow geese hatching has also resulted in lower gosling body condition (Aubry et al. 2013).

The potential increase in extreme precipitation events and total precipitation received (see Volume 5, Section 12) attributed to climate change can influence bird productivity. Severe spring rain events during the raptor egg laying period can influence the number of eggs laid by raptors (Robinson et al. 2017). Sustained precipitation events during the nesting season can directly influence raptor nestling mortality (Ancil et al. 2014). Weather changes may also influence the hatching period of blood-feeding ornithophilic black flies, which can prey on nestlings, causing mortality events (Franke et al. 2016).

Climate change is also influencing predator-prey relationships in the Arctic, thereby affecting nest predation. When lemming populations experience a crash in the Arctic, predators that primarily prey on lemmings will apply pressure on alternate prey species, including shorebirds (Kubelka et al. 2018). The warmer climate may also facilitate the range expansion or increased densities of nest predators like foxes (*Vulpes* spp.) or cause changes in their behaviour that make them prey on more avian nests. An alteration in the Arctic food web linked to a changing climate could change predator-prey dynamics.

The projected effects of climate change on birds and bird habitat in the RAA does not affect the conclusion of the Project effects assessment. With planned mitigation and environmental management measures, climate-related changes are not expected to interact with project residual effects in a way that alters the characterization of project effects. Given the high degree of uncertainty, both in climate projections and in the ecological effects of climate change on birds and bird habitat within the RAA, long term monitoring of climate-driven changes to bird habitat or mortality risk will be important.

17.5 Assessment of Cumulative Effects

17.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 9A-1 in Appendix 9A (Volume 4, Section 9) presents the project inclusion list which identifies other projects and physical activities that might act cumulatively with the Project. Potential interactions may occur with past, present, reasonably foreseeable, and reasonably foreseeable induced (RFI) projects, as well as with physical activities. Interactions with past and present physical activities in the RAA were already considered in the assessment of Project effects. Thus, the CEA builds on the Project effects assessment by considering reasonably foreseeable and RFI conditions (see Table 17.16). No reasonably foreseeable physical activities in the PIL occur within the RAA, but some applicable physical activities may be induced (RFIs) by the Project.

Table 17.16 Interactions with the Potential to Contribute to Cumulative Effects

Physical Activities	Cumulative Effects	
	Change in Habitat	Change in Mortality Risk
Past		
Bathurst Inlet	–	–
Omingmaktok	–	–
Snap Lake Mine	–	–
Present		
Arcadia Bay Project	–	–
B2Gold George Property	–	–
B2Gold Marine Laydown Area	–	–
Bulk Carriers	–	–
Cambridge Bay	–	–
Chuk and Fire Shear Blocks	–	–
Commercial Cargo	–	–
Commercial and Domestic Harvesting	–	✓
Coppermine Project	–	–
Coppermine River Project	–	–
Diavik Diamond Mine	–	–
Ekati Diamond Mine	–	–
Epworth Project	–	–
Fishing Vessels	–	–
Gahcho Kué Diamond Mine	–	–
Goose Mine	–	–
Hackett River Project	–	–
High Lake (Izok Corridor Project)	✓	✓
High Lake East	–	–

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Physical Activities	Cumulative Effects	
	Change in Habitat	Change in Mortality Risk
Hood River Gold Project	–	–
Hope Bay Project	–	–
Hydroelectric	–	–
Icebreakers	–	–
Itchen Lake Property	–	–
Izok Lake (Izok Corridor Project)	–	–
Jericho Mine	✓	✓
Kennady North - Exploration	–	–
Lupin Mine	–	–
Kugluktuk	–	–
Muskox Nickel Property	–	–
NU Community Infrastructure	–	–
NT Community Infrastructure	–	–
Overflights	✓	✓
Passenger Ships and Pleasure Craft	✓	✓
Pistol Lake Project	–	–
Rae Copper Exploration Project	–	–
Rockinghorse (Koamaogaktok) Project	–	–
Roma Project	–	–
Scientific Research	✓	✓
South Kitikmeot Gold Project	–	–
Tanker Ships	–	–
Tibbitt to Contwoyto Winter Road	–	–
Tourism	✓	✓
Tree River Lodge	–	–
TTMG Project	–	–
Tugs/Barges	–	–
Ulu Gold Project	✓	✓
Wolf/Mistake Lake Property	–	–
Yellowknife City Gold Project	–	–
Past and Reasonably Foreseeable		
Indin Lake Gold Project	–	–
Mon Mine	–	–
Yellowknife Gold Project	–	–

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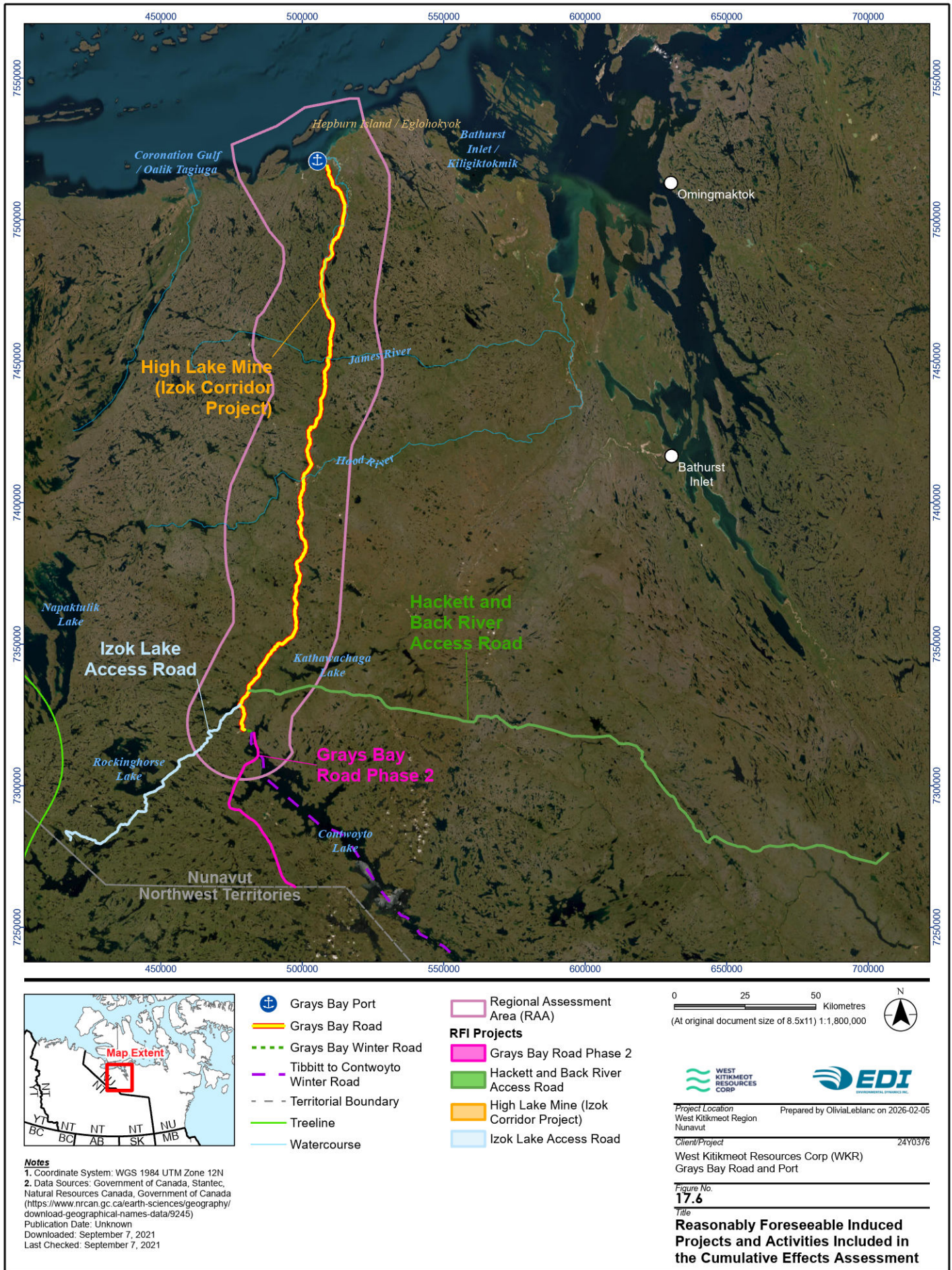
Physical Activities	Cumulative Effects	
	Change in Habitat	Change in Mortality Risk
Project-Related Physical Activities		
Reasonably Foreseeable		
Arctic Economic and Security Corridor	–	–
Courageous Lake Mine	–	–
NICO	–	–
Reasonably Foreseeable Induced		
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port	✓	✓
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho	✓	✓
Grays Bay Road and Port: Airstrip Expansion	✓	✓
Grays Bay Road and Port: Road Traffic	✓	✓
Grays Bay Road and Port: Port Traffic	✓	✓
Grays Bay Road and Port: Air Traffic	✓	✓
Grays Bay Road and Port Phase 2 –Jericho Mine to NT Border	✓	✓
Hackett River Project	–	–
Hackett and Back River Access Road	✓	✓
High Lake Mine (Izok Corridor Project)	✓	✓
Izok Lake Mine (Izok Corridor Project)	–	–
Izok Lake Access Road	✓	✓

Notes:

✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual effects.

– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

RFI physical activities are conditional on advancing only if the Project is first approved and then operational (see Volume 4, Section 9, Appendix 9A). RFI physical activities that may interact with Project residual effects within the RAA include the High Lake Mine (assumed footprint size of 0.78 km²) and induced access roads to other RFIs located outside the RAA. The induced access road portions within the RAA include 19.56 km of the Grays Bay Road Phase 2, 24.15 km of the Hackett and Back River access road, 27.33 km of the Izok Lake access road, and the High Lake Mine (see Figure 17.6). RFI physical activities related to the Project other than Grays Bay Road and Port Phase 2 occur within the proposed PDA (e.g., bulk fuel storage expansions, airstrip expansion, and traffic) and, therefore, do not add to surface disturbances in the RAA. Where residual effects from the Project cumulatively interact with those from other projects and physical activities, particularly under RFI conditions (see Table 17.16), a cumulative effects assessment is carried out.



The RFI conditions comprise all physical activities present during baseline conditions and Project conditions (baseline plus Project), as well as the additional RFI projects and physical activities identified in Table 17.16.

Physical activities that are not likely to interact cumulatively with residual effects of other projects and physical activities (i.e., no check mark) are located outside of the RAA. The assessment of the cumulative effects likely to result from the Project, in combination with other projects and physical activities, is discussed in subsequent sections.

The same ZOIs for each bird guild used in the Project effects assessment were applied to the RFIs to evaluate cumulative effects. While some of the physical activities identified in Table 17.16 are not located within the RAA, the RFI roads used to access the other physical activities do occur; therefore, any traffic associated with the RFI located outside the RAA was considered for cumulative effects.

17.5.2 Change in Habitat

17.5.2.1 Cumulative Effect Pathways

The RFI projects and activities (see Table 17.16) have the potential to act cumulatively with the Project to influence bird habitat. Direct habitat loss will occur from the combination of the Project's effects with all RFI activities identified within the RAA. Direct habitat loss includes vegetation removal and ground disturbance activities during both the Project and RFI projects' construction phases. Indirect habitat loss and alteration due to sensory disturbances (i.e., noise, dust, human activity) is also likely to occur. The Project's residual effects will cumulatively contribute to the residual effects from the RFI projects listed in combination with other projects and physical activities that have occurred in the present, and past and reasonably foreseeable activities to changes in bird habitat.

17.1.1.1 Mitigation, Management, and Enhancement Measures for Cumulative Effects

The mitigation, management, and enhancement measures identified in Section 17.4.1.3 are expected to apply to the RFI projects. No additional measures are anticipated. It is assumed that vegetation clearing and ground disturbance activities associated with the RFI projects will require the GN approval. It is expected that all future disturbances will remain within management guidelines at all times.

17.5.2.2 Cumulative Effects

A quantitative CEA was conducted based on the proportions of each RFI activity within the RAA. The CEA evaluated both direct and indirect habitat loss across the different bird guilds, focusing on how the Project's effects, combined with the RFI projects and activities, would contribute to habitat loss. The same LAA boundary was applied to the RFI activities for comparative analysis amongst all activities. The CEA followed the methods described in Section 17.4.1.1.

The cumulative effects from the Project and the RFI activities varied in the amount of habitat influenced on each bird guild. Cumulatively, the percentage of suitable bird habitat influenced by the Project and the RFIs was estimated to be 3.2% for passerines (see Table 17.17), 2.7% for waterbirds (represented by

shorebirds; see Table 17.18), and 10.1% for raptors (see Table 17.19). The magnitude of the cumulative residual effects on the change in bird habitat is low. The Project's residual effect of habitat loss, which is expected to be limited to the LAA, is anticipated to interact with the residual effects of RFI activities that extend into the RAA; therefore, the cumulative effect of habitat loss is predicted to have a regional geographic extent. The timing of the RFI activities is unknown, but some activities will likely occur during sensitive periods for birds (e.g., the breeding season), resulting in high sensitivity to timing. The duration of the cumulative residual effects will be long-term as the Project and RFI roads will be permanent. The frequency of these residual effects is expected to remain continuous throughout the Project, and they are irreversible. Overall, the Project's residual effects, combined with the RFI residual effects, will not substantially influence the amount or quality of bird habitat within the RAA. Further details on the Project's residual effects on habitat change for each bird guild are provided below.

Passerines

The RFI activities contribute an additional 20% of the overall change in habitat predicted within the RAA, in combination with the Project's residual effects. The majority of the cumulative residual effects on passerine habitat is from indirect habitat loss, with the RFI's contributing an increase of 23.3 km² (see Table 17.17). The RFI activities contributed a low amount of additional direct habitat loss, with an increase of 1.3 km². A further 3.2 km² of habitat, including 22.1 km² from the Project, is predicted to be altered but will remain suitable passerine habitat. Some RFI activities are already captured within the Project PDA (i.e., all the Grays Bay Road And Port expansions listed in Table 17.16), or the habitat was considered already influenced by existing disturbances and human activity at the RFI location (e.g., the High Lake Exploration Camp occurs within the High Lake Mine RFI footprint). The overall amount of suitable passerine habitat influenced by the cumulative residual effects from the Project and the RFI activities is low within the RAA.

Table 17.17 Cumulative Effects on Passerine Habitat Loss

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1	30.0	64.1	94.1	2.6
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NWT Border	0.2	2.8	3.0	0.1
Hackett and Back River Access Road	0.6	9.8	10.4	0.3
High Lake Mine (Izok Corridor Project)	0.1	0.3	0.4	0.0
Izok Lake Access Road	0.5	9.0	9.5	0.3
Total	31.3	86.1	117.4	3.3

Note:

* = activity occurs within Grays Bay Road and Port Phase 1 PDA

Waterbirds

Similar to passerines, the overall increase in habitat loss for waterbirds (i.e., using shorebirds as the focal group for habitat analysis) contributed by the RFI activities to the Project residual effects was a 25% increase within the RAA. The majority of the change in habitat from the RFI activities was due to indirect habitat loss, with an increase of 10 km² within the RAA (see Table 17.18). Interestingly, no additional indirect habitat loss was identified for the High Lake Mine RFI, as any suitable habitat within the RFI activities ZOI was already influenced by existing disturbances and human activity, which had already downgraded the amount of suitable waterbird habitat. Direct habitat loss from the RFI activities was low, with a predicted increase of 0.7 km². An additional 1 km² of habitat, including 5.6 km² from the Project, is predicted to be altered but will remain suitable waterbird habitat. Similar to the passerine's evaluation, some of the habitat changes are captured within the Project PDAs (e.g., all the Grays Bay Road and Port expansions listed in Table 17.16). The overall amount of suitable waterbird habitat influenced by the cumulative residual effects from the Project and the RFI activities is low within the RAA.

Table 17.18 Cumulative Effects on Shorebird Habitat

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1	10.1	21.8	31.9	2.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NWT Border	0.1	1.2	1.3	0.1
Hackett and Back River Access Road	0.4	6.1	6.5	0.4
High Lake Mine (Izok Corridor Project)	0.1	0.0 [†]	0.1	0.0
Izok Lake Access Road	0.2	2.6	2.8	0.2
Total	10.8	31.8	42.6	2.7

Notes:

* = activity occurs within Grays Bay Road and Port Phase 1 PDA;

[†] = habitat downgrading at High Lake Exploration Camp were captured in Baseline Conditions. No additional indirect habitat loss was identified within the ZOI for the High Lake Mine.

Raptors

The overall increase in habitat loss for raptors is considerably more than for waterbirds or passerines due to the larger ZOI for raptors (see Table 17.10 for details). The change in habitat contributed by the RFI activities to the Project residual effects was a 22.5% increase within the RAA. Similar to the other bird guilds, the majority of the change in habitat from the RFI activities came from indirect habitat loss, with an increase of 89.2 km² within the RAA (see Table 17.19). An additional 44.6 km² of habitat, including 154.4 km² from the Project, is predicted to be altered but will remain suitable raptor habitat. Similar to waterbirds, no additional indirect habitat loss was identified for the High Lake Mine RFI due to the existing disturbances and human activity at the High Lake Exploration Camp that already downgraded the amount of suitable raptor habitat in Baseline Conditions. Direct habitat loss from the RFI activities was 2.1 km². Some of the RFI activities identified occur within the Project PDA (i.e., Grays Bay Road and Port expansions); therefore, no additional habitat loss is predicted in the CEA. The overall amount of suitable waterbird habitat influenced by the cumulative residual effects from the Project and the RFI activities is low within the RAA.

Table 17.19 Magnitude of the Cumulative Effects on Raptor Habitat

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1	37.6	295.6	333.2	7.9
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NWT Border	0.4	6.6	7.0	0.2
Hackett and Back River Access Road	0.6	55.3	55.8	1.3
High Lake Mine (Izok Corridor Project)	0.7	0.0 [†]	0.7	0.0
Izok Lake Access Road	0.4	27.3	27.8	0.7
Total	39.7	384.8	424.4	10.1

Notes:

* = activity occurs within Grays Bay Road and Port Phase 1 PDA;

[†] = habitat downgrading at High Lake Exploration Camp were captured in Baseline Conditions. No additional indirect habitat loss was identified within the ZOI for the High Lake Mine.

17.5.3 Change in Mortality Risk

17.5.3.1 Cumulative Effect Pathways

As described in Section 17.4.2.2, project activities can influence bird mortality risk. The RFI projects, combined with the Project and all other present projects and physical activities, can potentially increase the risk of bird mortality. Construction activities for the RFI activities during the bird breeding season can increase the risk of mortality from incidental take, similar to the effects pathways described in Section 17.4.2.2.

The Project, combined with the RFI projects, can increase the risk of bird mortality through collisions with marine vessels, vehicles and equipment, aircraft, and infrastructure. The Project will facilitate additional marine vessel traffic to transport supplies, equipment, and materials to support the construction and operations of the RFI projects (most notably the proposed MMG – High Lake Mine). The increase in marine vessel traffic at the port will increase the risk of collisions with sea ducks and waterfowl. Artificial lighting used by marine traffic during low-visibility periods can either attract birds or disorient them, leading them to hit a vessel or land in the water, which may result in a mortality event (U.S. Fish and Wildlife Service 2024).

Increased marine vessel activity will also result in more vehicle traffic using the Project's road, with materials and supplies being transported from the port to the RFI projects. This increase in traffic, combined with the expansion of RFI roads (and the subsequent increase in traffic within the RAA), will increase the risk of bird mortality from vehicle collisions. The additional roads identified within the RAA may also facilitate new bird hunting and egg harvesting in the area, thereby indirectly increasing the risk of bird mortality. The RFI activities will also increase air traffic at the aerodrome PDA during each activities' construction phases, increasing potential bird strikes.

17.5.3.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

The mitigation and management measures identified in Section 17.4.2.3 are anticipated to be the same for the RFI activities identified in the RAA for this CEA. No additional measures are anticipated. It is assumed that vegetation clearing and ground disturbance activities associated with the RFI projects will require NIRB approval through the Impact Assessment process. It is expected that all future disturbances will remain within management guidelines at all times. The federal government and the GN regulate bird hunting, and Inuit harvest activities are protected under the Nunavut Agreement.

17.5.3.3 Cumulative Effects

The CEA evaluated both direct and indirect mortality based on potential interactions between the Project's residual effects summarized in Section 17.4.2.4 and the predicted RFI activities' residual effects within the RAA.

The Project's residual effects on bird mortality risk are expected to act cumulatively with the increased mortality risks from the past, present, and RFI projects and physical activities. There will be increased residual effects from the RFI activities on incidental take. The RFI projects will rely on the Project to

facilitate their development, which will result in an increase in bird strikes involving vessels, aircraft, and vehicles. Due to the low density of birds in the RAA (see Appendix 17A for details), mortality events will likely be sporadic and affect only a limited number of individuals. The overall effects will not reach a level anticipated to put bird populations at risk; therefore, the cumulative residual effects are predicted to be low in magnitude. The cumulative residual effects will be limited to the RFI activities within the Project's RAA; therefore, their extent will have a regional geographic context. The cumulative residual effect will occur year-round, including during the bird breeding season, which is the high-sensitivity period for birds. The cumulative residual effect is predicted to be a multiple-irregular event, with mortality events likely to be discrete occurrences. The duration of the cumulative bird mortality risk residual effects will be long-term, occurring throughout the life of the Project and the RFI activities.

17.5.4 Summary of Cumulative Effects

The Project's residual effects, combined with RFI activities, will cumulatively affect birds and their habitat. These cumulative effects are assessed as low in magnitude, regional in geographic extent, high sensitivity timing due to interactions during the bird breeding season, long-term in duration. They will occur either continuously (for cumulative effects on habitat) or as multiple, irregular events (for cumulative effects on mortality risk). Table 17.20 summarizes cumulative effects on birds and bird habitat.

For habitat loss, the Project accounts for 2.0 to 7.9% of suitable habitat loss for birds (depending on the bird guild) within the RAA. The RFI activities cumulatively add an additional 0.7 to 2.2% of habitat loss within the RAA. This cumulative effect is considered irreversible due to the permanent nature of the Project and most of the RFI activities in the RAA.

Regarding bird mortality risk, both the Project and the RFI activities will influence mortality; however, the mortality is predicted to be low in magnitude. The primary contributor to bird mortality risk will be collisions with vessels, aircraft, and vehicles. The influence of incidental take by the Project and RFI activities can be reduced through the mitigation and management measures identified. The cumulative residual effect will be irreversible due to the permanent nature of the effect. Future road infrastructure projects will provide additional routes of human access. Given that some future road infrastructure is likely to be permanent, the effects are predicted to be irreversible.

Table 17.20 Residual Cumulative Effects on Birds

Residual Cumulative Effect	Residual Cumulative Effects Characterization					
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	L	LAA	HS	LT	C	I
Contribution from the Project to Change in Habitat	The Project will contribute anywhere from 2.6 – 7.9% of bird habitat loss within the RAA, depending on the bird guild. The RFI will contribute an additional 0.7 – 2.2% of bird habitat loss, depending on the bird guild.					
Change in Mortality Risk	L	PDA	HS	LT	IR	I
Contribution from the Project to Change in Mortality Risk	The Project's contribution to the cumulative effect on bird mortality risk is low, with only a small proportion of individuals that interact with the Project and/or the RFI activities are at risk of a mortality event within the RAA. The potential for incidental take by the Project and the RFIs is also substantially reduced with the mitigation and management measures being implemented.					
Key: See Table 17.4 for detailed definitions						
Magnitude: NMC: No Measurable Change L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area		Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term		Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable		

17.6 Transboundary Effects

An assessment of the potential for transboundary effects on birds is provided in Volume 10, Section 33 Transboundary Effects Assessment.

17.7 Significance of Effects

17.7.1 Significance of Project Residual Effects

The Project's residual effects on change in habitat have been estimated based on habitat suitability ratings for different bird guilds. For the models evaluated, The Project's direct and indirect effects on suitable bird habitat range from 2.7% to 10.1% of the RAA, depending on the bird guild. The mitigation and management measures identified will reduce the overall residual effects on changes in bird habitat. Overall, the Project's residual effects will not result in an adverse change in the viability and persistence of the bird populations that interact with the RAA beyond an acceptable level within the RAA.

The Project's residual effects on the change in bird mortality risk, in which a small number of birds experience a mortality event caused by the Project are not expected to substantially influence local bird populations; therefore, the Project's residual effects will not result in an adverse change in the viability or persistence of bird populations that interact with the RAA.

In conclusion, based on the predicted magnitude and spatial extent of the residual effects, the effectiveness of proposed mitigation and management measures, and the context of baseline conditions, the Project's residual effects on birds are determined to be not significant.

17.7.2 Significance of Cumulative Effects

The cumulative effects of the Project and RFI projects and activities are not expected to influence the viability or persistence of bird populations that interact with the RAA. The RFI activities are expected to have less influence on the change in habitat residual effects than the Project's residual effects within the RAA. The residual cumulative effects on change in bird mortality risk are anticipated to be similar from the Project and the RFI projects and activities combined. The residual cumulative effects can be addressed with comparable mitigation and management measures and informed by monitoring and adaptive management strategies. Assuming the RFI projects adhere to standard mitigation and management measures for birds, the cumulative effects on birds and their habitats are predicted to be not significant.

17.7.3 Summary of Mitigation, Management, and Enhancement Measures

Mitigation and management measures were established to mitigate the effects of habitat change, reduce the risk of mortality from marine vessels and vehicle traffic, and address incidental take of nests and young. Key measures to mitigate project-related effects include restricting clearing to approved areas, complete wildlife sweeps ahead of construction activities during the breeding season, establishing no-disturbance buffers around active nests identified, and implementing dust control measures to reduce dust generation. Although direct habitat loss is a one-time event, indirect sensory disturbances will occur year-round.

The Project's effects on increased bird mortality risk will be mitigated through wildlife sweeps to prevent incidental take, speed limits to reduce potential bird-vehicle collisions, aircraft operating requirements to reduce bird strikes, and the control of artificial lighting use.

17.8 Prediction Confidence and Uncertainty

Confidence in the conclusions of the Project residual effects for birds and bird habitat is high. The Project's residual effects will not result in changes to bird habitat or mortality risk that will influence the bird populations' viability or persistence in the RAA. The level of confidence in these predictions is based on the following:

- Assumptions: A key assumption is the continued effectiveness of standard mitigation and management measures used on past projects to prevent and reduce effects on birds and bird habitat within the specific context of this Project. The long-term accuracy of habitat ratings assumes a degree of stability in environmental conditions beyond the Project's direct influence.

- **Baseline Data:** A variety of field surveys were conducted over several years to establish an understanding of the bird community in the project area. There was considerable Inuit, Indigenous, and Community Knowledge on birds that harmonized with the baseline study's findings on bird occurrence. The findings from the baseline studies show bird densities similar to those in other regions of the Arctic. No bird breeding colonies were identified in proximity to the PDA; therefore, no concerns that the Project will influence any important bird breeding areas. There is some uncertainty with the raptor nest data. It is unlikely that all raptor cliff-nests located within the LAA and RAA were identified (e.g., new nest sites may have been established since baseline studies were completed), and ground-nesting raptors usually select a new nest site location each year; therefore, the effects assessment on change in habitat likely underestimated the potential high quality habitat present. However, conservative assumptions made in the habitat evaluation are likely to result in an overestimate of the overall habitat effect.
- **Analytical Techniques:** The effects assessment relies on well-established techniques to predict habitat loss/disturbance in the PDA/LAA and to understand potential changes in bird mortality risk related to infrastructure and activities, based on relevant scientific literature. Habitat suitability mapping inherently carries some uncertainty related to spatial information, the ecological complexities of habitat use, and the grouping of bird guilds, which assume that all birds within a guild use similar habitat.
- **Success of mitigation, management and enhancement measures:** There is high confidence in the success of the mitigation and management measures outlined, as well as in the monitoring practices, based on their proven effectiveness in other projects and on information from the literature.
- **Future Environmental Conditions:** Uncertainty exists regarding the long-term accuracy of habitat suitability predictions due to potential limitations in spatial information and the influence of future projects, climate change, and natural disturbances (e.g., insect outbreaks, fires), which are beyond the direct control of the Project.
- **Conservative Measures:** The conclusion of not significant effects is conservative. It acknowledges the potential for some level of effect while determining that it remains within acceptable limits based on current knowledge and the implementation of proposed mitigation, management and enhancement measures.

Confidence in the conclusion for the cumulative effects assessment is also considered moderate to high due to an informed understanding of RFIs will influence birds and bird habitat. However, there is some uncertainty in predicting which RFIs will actually be developed in the future, as well as long-term climate-driven changes that could influence habitat suitability and future mortality risk. The implementation of adaptive management, ongoing community engagement, and annual reporting increases confidence that emerging cumulative risks can be detected and addressed.

17.9 Follow-up and Monitoring

Project activities will result in habitat changes and increased mortality risk from incidental take, collisions with vessels, vehicles, and equipment, aircraft, and Project infrastructure. The predicted effects on birds can be verified through a monitoring program designed to:

- Monitor bird occurrence and distribution in relation to the Project during all phases.
- Document any bird mortalities directly caused by the Project.

Further details on the monitoring program and its objectives can be found in the WMMP. The mitigation and monitoring strategies identified in the WMMP will be updated to remain consistent with new best management practices introduced during the Project's lifecycle and input received during the review process. Updates will also consider management reviews, incident investigations, shared Inuit, Indigenous, and Community Knowledge, new or improved scientific methods, regulatory changes, or other changes related to the Project.

WKR will continue to respond to questions and concerns from Kitikmiut, other Indigenous groups, and other potentially affected communities through its ongoing engagement efforts. Information provided following submission of the IS will be reviewed in the context of the IS and for incorporation into Project planning, including adaptive management and monitoring, as appropriate.

17.10 Knowledge and Literature Cited

- Ancil, A., Franke, A., and Bêty, J. 2014. Heavy rainfall increases nestling mortality of an Arctic top predator: experimental evidence and long-term trend in peregrine falcons. *Oecologia* 174(3):1033–1043. DOI: 10.1007/s00442-013-2800-y
- Andrén, H. 1994. Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review. *Oikos* 71(3):355–366. Nordic Society Oikos, Wiley. DOI: 10.2307/3545823
- Aubry, L.M., Rockwell, R.F., Cooch, E.G., Brook, R.W., Mulder, C.P.H., and Koons, D.N. 2013. Climate change, phenology, and habitat degradation: drivers of gosling body condition and juvenile survival in lesser snow geese. *Global Change Biology* 19(1):149–160. DOI: 10.1111/gcb.12013
- Banci, V. and Spicker, R. 2024. Kitikmiut Knowledge of the Proposed Kogloktokyo (Grays Bay) Port and Road Project. Naonaiyaotit Inuit Knowledge Project (NTKP). Kitikmeot Inuit Association, Lands & Environment Department. West Kitikmeot Resources Corp., Kugluktuk, Nunavut. 150 pp.
- Barber, J.R., Crooks, K.R., and Fristrup, K.M. 2010. The costs of chronic noise exposure for terrestrial organisms. *Trends in Ecology & Evolution* 25(3):180–189. DOI: 10.1016/j.tree.2009.08.002
- Barton, M.G., Henderson, I., Border, J.A., and Siriwardena, G. 2023. A review of the impacts of air pollution on terrestrial birds. *Science of the total environment* 873:162136. Elsevier.

- Bayne, E.M., Habib, L., and Boutin, S. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. *Conservation Biology* 22(5):1186–1193.
- Bibby, C.J., Burgess, N.D., and Hill, D.A. 1992. *Bird Census Techniques*. Published for the British Trust for Ornithology and the Royal Society for the Protection of Birds by Academic Press, London, United Kingdom. 257 pp.
- Blickley, J. and Patricelli, G. 2010. Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. *Journal of International Wildlife Law & Policy* 13(4):274–292. DOI: 10.1080/13880292.2010.524564
- Borgmann, K. 2011. A Review of Human Disturbance Impacts on Waterbirds. Audubon California, Tiburon, California. Available at:
<http://www.audubon.org/sites/default/files/documents/humandisturbanceimpactsreportfinal.pdf>
- Bromley, R.G. 1988. Status of Peregrine Falcons in the Kitikmeot, Baffin, and Keewatin regions, Northwest Territories, 1982-1985. pp. 51–57. In T.J. Cade, J.H. Enderson, C.G. Thelander, C.M. White (eds.) *Peregrine Falcon populations: their management and recovery*. The Peregrine Fund, Boise, ID.
- Cade, T.J. and Bird, D.M. 1990. Peregrine falcons, *Falco peregrinus*, nesting in an urban environment: a review. *Canadian Field-Naturalist* 104(2):209–218.
- Cade, T.J., Martell, M., Redig, P., Septon, G., and Tordoff, H. 1996. Peregrine falcons in urban North America. pp. 3–13. In D.M. Bird, D.E. Varland, J.J. Negro (eds.) *Raptors in human landscapes: adaptation to built and cultivated environments*. Academic Press Limited, London, United Kingdom.
- Calvert, A., Bishop, C., Elliot, R., Krebs, E., Kydd, T., Machtans, C., and Robertson, G. 2013. A Synthesis of Human-related Avian Mortality in Canada. *Avian Conservation & Ecology* 8(2):34–247.
- Canadian Endangered Species Conservation Council. 2022. *Wild Species 2020: The General Status of Species in Canada*. Canadian Endangered Species Conservation Council National General Status Working Group. 172 pp. Available at: www.wildspecies.ca
- Canadian Wildlife Service and Environment Canada. 2014. *Incidental Take of Migratory Birds in Canada*.
- Coulton, D.W., Virgl, J.A., and English, C. 2013. Falcon nest occupancy and hatch success near two diamond mines in the southern Arctic, Northwest Territories. *Avian Conservation and Ecology* 8(2):15. DOI: 10.5751/ACE-00621-080214
- Dominique, H.A., Carter, N.A., SheltonNipisar, A., LennyEmiktaut, BobbieSaviakjuk, Salliq Project Management Committee, Arviat Project Management Committee, Ljubicic, G.J., Smith, P.A., and Johnston, V. 2020. Qanuq ukua kanguit sunialiqpitigu? (What should we do with all of these geese?) Collaborative research to support wildlife co-management and Inuit self-determination. *Arctic Science* 6(3):173–207. DOI: <https://doi.org/10.1139/as-2019-0015>

- ECCC (Environment and Climate Change Canada). 2018. Nesting periods. Available at: <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html>. Accessed July 21, 2025.
- ECCC. 2023. Guidance Regarding Information Needed to Support Assessment of Project Effects on Birds: Presentation to National Industry Associations. Environment and Climate Change Canada. February 1, 2023 presentation.
- ERM Consultants Canada Ltd. 2025. Bathurst Caribou Zone of Influence Literature Review. Prepared for the Government of Northwest Territories. 18 pp.
- Franke, A., Settingington, M., Court, G., and Birkholz, D. 2010. Long-term trends of persistent organochlorine pollutants, occupancy and reproductive success in peregrine falcons (*Falco peregrinus tundrius*) breeding near Rankin Inlet, Nunavut, Canada. *Arctic* 63(4):442–450.
- Franke, A., Lamarre, V., and Hedlin, E. 2016. Rapid Nestling Mortality in Arctic Peregrine Falcons Due to Biting Effects of Black Flies. *ARCTIC* 69(3):281–285.
- Franke, A., Bajina, K., and Settingington, M. 2024. Arctic raptor occupancy and reproductive success near a remote open-cut mine: North Baffin Island, Nunavut. *Polar Biology*. DOI: 10.1007/s00300-024-03292-3. Available at: <https://doi.org/10.1007/s00300-024-03292-3>
- Fyfe, R.W. and Olendorff, R.R. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. Canadian Wildlife Service Occasional Paper Number 23. Canadian Wildlife Service, Ottawa, Ontario.
- Gauthier, G., Bêty, J., Cadieux, M.-C., Legagneux, P., Doiron, M., Chevallier, C., Lai, S., Tarroux, A., and Berteaux, D. 2013. Long-term monitoring at multiple trophic levels suggests heterogeneity in responses to climate change in the Canadian Arctic tundra. *Philosophical Transactions of the Royal Society B* 368(1624):1–12. DOI: 10.1098/rstb.2012.0482
- GN (Government of Nunavut). 2003. *Wildlife Act*. S.Nu. 2003,c.26.
- GN. 2014. Environmental Guideline for Dust Suppression on Unpaved Roads. Department of Environment, Government of Nunavut.
- GNWT (Government of Northwest Territories). 2015. Northern Land Use Guidelines: Northwest Territories Seismic Operations.
- GOC (Government of Canada). 1994. *Migratory Birds Convention Act*. S.C. 1994, c. 22. Department of Environment and Climate Change Canada. Available at: <https://laws-lois.justice.gc.ca/eng/acts/m-7.01/>
- GOC. 2022. *Migratory Birds Convention Act (MBCA) and Regulations*. Available at: <https://www.canlii.org/en/ca/laws/regu/sor-2022-105/latest/sor-2022-105.html>. Accessed July 15, 2019.

- Goodship, N.M. and Furness, R.W. 2022. Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. NatureScot Research Report 1283. Available at: <https://www.nature.scot/doc/naturescot-research-report-1283-disturbance-distances-review-updated-literature-review-disturbance>
- Hodson, N.L. 1962. Some notes on the causes of bird road casualties. *Bird Study* 9:168–173.
- Holtmeier, F. and Broll, G. 2005. Sensitivity and response of northern hemisphere altitudinal and polar treelines to environmental change at landscape and local scales. *Global Ecology and Biogeography* 14(5):395–410. DOI: 10.1111/j.1466-822X.2005.00168.x
- IAG (Inuit Advisory Group). 2025a. Grays Bay Road and Port Project What We Heard Report - Inuit Advisory Group Workshop #2 Summary. Understanding and Protecting Caribou. Prepared by West Kitikmeot Resources Corp., Kugluktuk, Nunavut. 113 pp.
- IAG. 2025b. Grays Bay Road and Port Project What We Heard Report - Inuit Advisory Group Workshop #1 Summary. Inuit Knowledge Integration Methods and Mitigation Strategies. Prepared for West Kitikmeot Resources Corp. by Nunami Stantec Ltd., Kugluktuk, Nunavut. 85 pp.
- Johnson, G.D., Young Jr, D.P., Erickson, W.P., Derby, C.E., Strickland, M.D., Good, R.E., and Kern, J.W. 2000. Wildlife Monitoring Studies: SeaWest Windpower Project, Carbon County, Wyoming, 1995-1999. Prepared for SeaWest Energy Corporation, San Diego, California and Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming, Cheyenne, Wyoming. 207 pp.
- Koch, S.L. and Paton, P.W. 2014. Assessing anthropogenic disturbances to develop buffer zones for shorebirds using a stopover site. *The Journal of Wildlife Management* 78(1):58–67. Wiley Online Library.
- Kubelka, V., Salek, M., Tomkovich, P.S., Vegvari, Z., Freckleton, R., and Szekely, T. 2018. Global pattern of nest predation is disrupted by climate change in shorebirds. *Science* 362:680–683.
- McIntyre, C.L. and Adams, L.G. 1999. Reproductive Characteristics of Migratory Golden Eagles in Denali National Park, Alaska. *The Condor* 101:115–123.
- McKinnon, L., Picotin, M., Bolduc, E., Juillet, C., and Bety, J. 2012. Timing of breeding, peak food availability, and effects of mismatch on chick growth in birds nesting in the High Arctic. *Canadian Journal of Zoology* 90:961–971.
- Miller, S.G., Knight, R.L., and Miller, C.K. 1998. Influence of Recreational Trails on Breeding Bird Communities. *Ecological Applications* 8(1):162–169. Ecological Society of America. DOI: 10.2307/2641318

- Myers-Smith, I.H., Elmendorf, S.C., Beck, P.S.A., Wilmking, M., Hallinger, M., Blok, D., Tape, K.D., Rayback, S.A., Macias-Fauria, M., Forbes, B.C., Speed, J.D.M., Boulanger-Lapointe, N., Rixen, C., Lévesque, E., Schmidt, N.M., Baittinger, C., Trant, A.J., Hermanutz, L., Collier, L.S., Dawes, M.A., Lantz, T.C., Weijers, S., Jørgensen, R.H., Buchwal, A., Buras, A., Naito, A.T., Ravolainen, V., Schaepman-Strub, G., Wheeler, J.A., Wipf, S., Guay, K.C., Hik, D.S., and Vellend, M. 2015. Climate sensitivity of shrub growth across the tundra biome. *Nature Climate Change* 5(9):887–891. DOI: 10.1038/nclimate2697
- Nagy, M. 1999. Aulavik Oral History Project on Banks Island, NWT: Final Report.
- NIRB (Nunavut Impact Review Board). 2018. Draft Guidelines for the Preparation of an Environmental Impact Statement (EIS) for the Kitikmeot Inuit Association and the Government of Nunavut's Grays Bay Road and Port Project (NIRB File 17XN011): Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=315965&applicationid=125069&sessionid=hg8jet3ct65kgfsoirs82o5f43. Accessed November 2025.
- NIRB. 2024. Back River Energy Centre Project Proposal - Hearing, Volume 1. Cambridge Bay, Nunavut.
- NIRB. 2025. Public Scoping and Impact Statement Guidelines Meetings Summary Report, April 22 to May 05, 2025, and May 13 and 15, 2025, for the Nunavut Impact Review Board's Review of West Kitikmeot God "Gray's Bay Port and Road" Project proposal, NIRB File No.: 24XN038. Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=357317&applicationid=125987&sessionid=3q7m406ln2ogakjpub8j9udck0. Accessed January 2026.
- NIRB. 2026. Guidelines for the Preparation of an Impact Statement for West Kitikmeot Resources Corp's Grays Bay Road and Port Proposal (NIRB File No. 24XN038). Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=359293&applicationid=125987&sessionid=73ij15k8f2m2n5hsla0cdlsr07. Accessed January 2026.
- NSMA (North Slave Metis Alliance). 2001. North Slave Metis Alliance (NSMA). 2001. Can't Live Without Work. July 1999 First Printing. Available at: https://reviewboard.ca/upload/project_document/EA0809-004_NSMA_Can_t_Live_Without_Work_-_2001.PDF. Accessed January 2025.
- NTKP (Naonaiyaotit Traditional Knowledge Project). 2018. Naonaiyaotit Traditional Knowledge Project. Cartographic material, transcripts, quotes, placenames and photos. Proprietary ArcGIS 10.5 Geodatabase and associated textual and photographic databases. Kitikmeot Inuit Association, Kugluktuk NU. Available at: <https://www.ntkp.ca/>
- Obst, J. 2011. Breeding phenology, densities and population trends of tundra breeding birds at Daring Lake, Southern Arctic Ecozone, Northwest Territories, 1998-2010. Department of Environment and Natural Resources, Wildlife Division, and Protected Areas Strategy Secretariat, Government of the Northwest Territories; and Environment and Conservation, Indian and Northern Affairs Canada. 33 pp.

- Pescador, M. and Peris, S. 2007. Influence of roads on bird nest predation: An experimental study in the Iberian Peninsula. *Landscape and Urban Planning* 82(1–2):66–71. DOI: 10.1016/j.landurbplan.2007.01.017
- Polfus, J.L., Hebblewhite, M., and Heinemeyer, K. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. *Biological Conservation* 144(11):2637–2646. DOI: 10.1016/j.biocon.2011.07.023
- Poole, K.G. and Bromley, R.G. 1988. Interrelationships within a raptor guild in the central Canadian arctic. *Canadian Journal of Zoology* 66(10):2275–2282.
- Prichard, A.K., Lawhead, B.E., Lenart, E.A., and Welch, J.H. 2020. Caribou Distribution and Movements in a Northern Alaska Oilfield. *The Journal of Wildlife Management* 84(8):1483–1499. DOI: 10.1002/jwmg.21932
- Prichard, A.K., Welch, J.H., and Lawhead, B.E. 2022. The Effect of Traffic Levels on the Distribution and Behaviour of Calving Caribou in an Arctic Oilfield. *ARCTIC* 75(1):1–19. DOI: 10.14430/arctic74609
- Priest, H. and Usher, P.J. 2004. Nunavut Wildlife Harvest Study. Nunavut Wildlife Management Board, Iqaluit, Nunavut. 822 pp. Available at: <http://www.nwmb.com/inu/publications/harvest-study/1824-156-nwhs-report-2004-156-0003/file>
- Rausch, J. 2025. Insights for Grays Bay Port and Road Project. Email from Jennie Rausch, Environment and Climate Change Canada to Eve Fernandes, EDI Environmental Dynamics Inc. Email. April 14, 2025 email.
- Reijnen, R. and Foppen, R. 1994. The effects of car traffic on breeding bird populations in woodland. I. Evidence of reduced habitat quality for willow warblers (*Phylloscopus trochilus*) breeding close to a highway. *Journal of Applied Ecology* 31(85–94).
- Reijnen, R., Foppen, R., Braak, C.T., and Thissen, J. 1995. The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads. *The Journal of Applied Ecology* 32(1):187–202. DOI: 10.2307/2404428
- Richards, J.M. and Gaston, A. (eds.). 2018a. Birds of Nunavut, Volume 1 Nonpasserines. UBC Press, Vancouver, British Columbia, Canada. 499 pp.
- Richards, J.M. and Gaston, A. (eds.). 2018b. Birds of Nunavut, Volume 2 Passerines. UBC Press, Vancouver, British Columbia, Canada. 499 pp.
- Robinson, B.G., Franke, A., and Derocher, A.E. 2017. Weather-mediated decline in prey delivery rates causes food-limitation in a top avian predator. *Journal of Avian Biology* 48(5):748–758. DOI: 10.1111/jav.01130
- Rodgers Jr, J.A. and Schwikert, S.T. 2002. Buffer-zone distances to protect foraging and loafing waterbirds from disturbance by personal watercraft and outboard-powered boats. *Conservation Biology* 16(1):216–224. Wiley Online Library.

- Rodríguez, A., Orozco-Valor, P.M., and Sarasola, J.H. 2021. Artificial light at night as a driver of urban colonization by an avian predator. *Landscape Ecology* 36(1):17–27. Springer.
- Rousseu, F. and Drolet, B. 2015. Prediction of the nesting phenology of birds in Canada - James River Ecodistrict. Bird Nesting Calendar Query Tool. Bird Studies Canada / Études d'Oiseaux Canada. Available at: <https://naturecounts.ca/apps/rnest/index.jsp>
- Rytwinski, T. and Fahrig, L. 2012. Do species life history traits explain population responses to roads? A meta-analysis. *Biological Conservation* 147(1):87–98. Elsevier Ltd. DOI: 10.1016/j.biocon.2011.11.023
- Rytwinski, T. and Fahrig, L. 2015. The Impacts of Roads and Traffic on Terrestrial Animal Populations. pp. 237–246. In R. Van Der Ree, D.J. Smith, C. Grilo (eds.) *Handbook of Road Ecology*, 1 Edition. Wiley. DOI: 10.1002/9781118568170.ch28. Available at: <https://onlinelibrary.wiley.com/doi/10.1002/9781118568170.ch28>
- Septon, G.A., Bielfeldt, J., Ellestad, T., Marks, J.B., and Rosenfeld, R.N. 1996. Peregrine falcons: power plant nest structure and shoreline movements. pp. 145–154. In D.M. Bird, D.E. Varland, J.J. Negro (eds.) *Raptors in human landscapes: adaptation to built and cultivated environments*. Academic Press Limited, London, United Kingdom.
- Shank, C.C. and Poole, K.G. 1994. Status of gyrfalcon *Falco rusticolus* populations in the Northwest Territories, Canada. *Raptor conservation today* :421–435.
- Smith, A.C., Virgl, J.A., Panayi, D., and Armstrong, A.R. 2010. Effects of a Diamond Mine on Tundra-Breeding Birds. *ARCTIC* 58(3):295–304. DOI: 10.14430/arctic431
- Swem, T., McIntyre, C., Ritchie, R.J., Bente, P.J., and Roseneau, D.G. 1994. Distribution, abundance, and notes on the breeding biology of Gyrfalcons *Falco rusticolus* in Alaska. pp. 437–444. In B.-U. Meyburg, R.D. Chancellor (eds.) *Raptor Conservation Today: Proceedings of the IV World Conference on Birds of Prey and Owls*, Berlin, Germany, 10-17 May 1992. WWGBP, Berlin, London and Paris. Available at: http://www.raptors-international.org/book/book_raptor_conservation_today_1994.html
- Swift, T.L. and Hannon, S.J. 2010. Critical thresholds associated with habitat loss: a review of the concepts, evidence, and applications. *Biological Reviews* 85(1):35–53. DOI: 10.1111/j.1469-185X.2009.00093.x
- Thorpe, N., Hakongak, N., Eyegetok, S., and Elders, Q. 2001. The Tuktu and Nogak Project: a caribou chronicle. Final Report. West Kitikmeot/Slave Study Society, Yellowknife, NWT.
- TG(Tłıchq Government). 2014. K'agòò tlıl Deè: Traditional Knowledge Study for the Proposal All-Season Road to Whatı. Tłıcho Research and Training Institute, October. Available at: https://reviewboard.ca/upload/project_document/EA-1617-01_Traditional_Knowledge_Study_Report_-_May_16_16.PDF. Accessed January 2025.

Transport Canada. 2007. Airport Wildlife Management. Available at:
https://tc.canada.ca/sites/default/files/migrated/tp8240e_38.pdf

Transport Canada. 2013. Aviation: Land Use In The Vicinity of Aerodromes. TP1247E.

U.S. Fish and Wildlife Service (United States Fish and Wildlife Service). 2024. Migratory Bird Program - Reducing Bird Collisions with Vessels. Available at:
<https://www.fws.gov/sites/default/files/documents/2025-01/reducing-bird-collisions-with-vessels-final.pdf>

Wang, J.-S., Tuanmu, M.-N., and Hung, C.-M. 2021. Effects of artificial light at night on the nest-site selection, reproductive success and behavior of a synanthropic bird. *Environmental Pollution* 288:117805. Elsevier.

Weir, J.N., Mahoney, S.P., McLaren, B., and Ferguson, S.H. 2007. Effects of Mine Development on Woodland Caribou *Rangifer tarandus* Distribution. *Wildlife Biology* 13(1):66–74. DOI: 10.2981/0909-6396(2007)13[66:EOMDOW]2.0.CO;2

White, C.M., Clum, T.J.C., and Hunt, W.G. 2024. Peregrine Falcon *Falco peregrinus* Breeding. Available at: <https://birdsoftheworld.org/bow/species/perfal/cur/breeding> . Accessed July 23, 2025.

18 Assessment of Potential Effects on Other Terrestrial Wildlife

Inuit in Nunavut (NU) maintain a dynamic, contemporary relationship with wildlife that is important to cultural continuity, economic viability, and self-governance. Harvesting species like those discussed in this assessment is not only a traditional practice but a cornerstone of food security and an economic activity that provides nutrition and income in remote communities with high costs of living. This practice is fundamentally tied to the exercise of land claims and Inuit rights, where active participation in managing and using animal populations reinforces sovereignty and a distinct cultural identity. The relationship is practical, necessary, and resilient, centred on sustainability and the direct provision of well-being for families and the community in the present day.

The Nunavut Impact Review Board (NIRB) guidelines (NIRB 2026) for the Grays Bay Road and Port Project (the Project) identified representative terrestrial mammals to consider for an effects assessment. This included caribou (*tuktuik*; *Rangifer tarandus*), muskox (*omingmak*; *Ovibos moschatus*), wolverine (*kalvik*; *Gulo gulo*), polar bear, wolves, foxes, and hares. A review was completed of Inuit, Indigenous, and Community Knowledge, western science, and the findings from the baseline studies to identify representative species to include in the effects assessment. This included consideration of the broad-scale potential effects pathways and mitigation measures that would apply to a wide range of Arctic terrestrial wildlife species. Caribou is the most important wildlife species for Inuit social, cultural, and economic values, and, as a result, this species has its own chapter in the effects assessment (see Volume 6, Section 16). The four indicator species selected to represent the Other Terrestrial Wildlife Valued Component (VC) for this effects assessment included muskox, moose (*tuktukvak*; *Alces alces*), grizzly bear (*akhak*; *Ursus arctos horribilis*), and wolverine. The Arctic wolf (*amagok*; *Canis lupus arctos*) is included in the caribou chapter regarding their influence on mortality risk. Inuit value terrestrial wildlife species for food, materials (e.g., hides for making clothing and blankets), cultural importance, and economic benefits from product sales, guided hunting, or ecotourism.

The Other Terrestrial Wildlife VC assessment is linked to the following VCs:

- Air Quality (see Volume 5, Section 11): Dust deposition can potentially influence forage suitability for muskox, moose, and grizzly bear.
- Climate (see Volume 5, Section 12): Other Terrestrial Wildlife VCs may be affected by climate change.
- Noise and Vibration (see Volume 5, Section 13): Noise can disturb Other Terrestrial Wildlife VCs and affect their use of habitat.
- Vegetation (see Volume 6, Section 15): Vegetation provides forage, as well as thermal or escape cover for Other Terrestrial Wildlife VCs.
- Wildlife — Caribou (see Volume 6, Section 16): Caribou are an important source of food for grizzly bear and wolverine.

- Wildlife — Birds (see Volume 6, Section 17): Birds and their eggs are a source of food for grizzly bear and wolverine.
- Water Resources (see Volume 7, Section 19): Water quality and quantity are important to the health and well-being of Other Terrestrial Wildlife VCs.
- Freshwater Fish and Fish Habitat (see Volume 7, Section 20): Fish can be a food source for grizzly bear and wolverine, and riparian areas provide suitable habitat for Other Terrestrial Wildlife VCs.
- Non-traditional Land, Marine, and Resource Use (see Volume 9, Section 29): Land and resource use, including hunting and trapping, can affect the Other Terrestrial Wildlife VCs.
- Freshwater Fish and Fish Habitat (see Volume 7, Section 20): Fish can be a food source for grizzly bear and wolverine, and riparian areas provide suitable habitat for Other Terrestrial Wildlife VCs.

The Other Terrestrial Wildlife VC assessment supports the following VCs:

- Traditional Land, Marine, and Resource Use (see Volume 9, Section 24): Inuit traditional and contemporary land use is intrinsically connected to the Other Terrestrial Wildlife VCs.
- Food Security and Food Sovereignty (see Volume 9, Section 25): The harvest of moose and muskox supports food security in NU.
- Community Health and Well-being (see Volume 9, Section 26): The Other Terrestrial Wildlife VCs are intrinsically valued by Inuit for providing sustenance, materials for clothing and blankets, and are an important component of their culture.
- Employment and Economy (see Volume 9, Section 27): The Other Wildlife Terrestrial VCs can contribute to the economy through the sale of meat, materials, guided hunting opportunities, or the sale of harvested pelts.

18.1 Scope of Assessment

This section defines and describes the scope of the assessment of potential effects on other terrestrial wildlife, using muskox, moose, grizzly bear, and wolverine as indicator or representative species. The scope of the assessment is based on the NIRB guidelines for the Project (NIRB 2025a) and considers a variety of information sources. The assessment builds on a compilation of regional Inuit, Indigenous, and Community Knowledge and scientific information to define the baseline conditions for the species. Project effects are evaluated for their potential to interact with facets of species ecology in the region, informed by Inuit, Indigenous, and Community Knowledge and scientific accounts. The assessment occurs within defined local and regional spatial boundaries for wolverine to evaluate potential project interactions and effects.

18.1.1 Influence of Engagement and Inuit, Indigenous, and Community Knowledge on the Assessment

West Kitikmeot Resources Corp. (WKR) continues to engage with Inuit of the Kitikmeot Region (hereafter referred to as Kitikmiut), other Indigenous groups, and other potentially affected communities about the Project. A summary of engagement activities conducted between 2016 and 2025 is presented in Volume 3, Section 6 (Public Engagement). In addition to these activities, WKR conducted community-based primary research with residents and organizations of the Kitikmeot communities of Cambridge Bay (*Ekaluktutiak*), Gjoa Haven (*Ursuqtuq*), Kugaaruk, Kugluktuk, and Taloyoak, along with organizations in Yellowknife. Additionally, an Inuit Advisory Group (IAG) was established to advise WKR on potential environmental and socio-economic effects or concerns related to the Project, planned mitigation approaches, and aspects of the environmental assessment, including, but not limited to, baseline conditions, significance determination and consideration, and integration of Inuit and Community Knowledge. Members were selected by the Kitikmeot Inuit Association and WKR based on their knowledge of many aspects of the natural and human environment, including but not limited to wildlife, fish, climate, land use and access, archaeology, and water in the Project area. During the IAG workshop held in March 2025 (IAG 2025a), a key focus of discussion was muskox.

To further inform the project design, a project-specific Inuit Knowledge report titled *Kitikmeot Knowledge of the Proposed Kogloktokyo (Grays Bay) Port and Road Project Final* (Banci and Spicker 2024) was commissioned by WKR. This report, compiled from Inuit Knowledge contained in the *Naonaiyaotit Traditional Knowledge Project* (NTKP) database, was made available to WKR through a licensing agreement with the Kitikmeot Inuit Association.

In addition, publicly available sources of Inuit and Indigenous Knowledge were reviewed to provide further context about baseline conditions and how conditions are changing, as well as potential mitigation measures recommended on previous projects that could be considered for the Project. Results from monitoring studies and other community-based research were also reviewed.

Through the Project-specific engagement program, Inuit, Indigenous groups, and other potentially affected communities shared comments, perspectives, concerns, and recommendations related to the selected indicator species. WKR commits to continued engagement with Kitikmiut, other Indigenous groups, and potentially affected communities throughout the life of the Project as project design, planning, and monitoring advance.

18.1.1.1 Influence of Inuit, Indigenous, and Community Knowledge on Assessment Boundaries

Information obtained through Inuit, Indigenous, and Community Knowledge was reviewed, considering the proposed spatial boundaries. The Project-specific Inuit Knowledge report, compiled from the NTKP database, provided spatial information about terrestrial wildlife, including grizzly bear, wolverine, muskox, and moose in the context of the Project, and this assessment includes those habitats where effects from the Project (both direct and indirect) are expected to occur (see Section 18.1.4.1).

Inuit Knowledge informed the spatial area for the Project assessment, covering culturally and ecologically important regions where Inuit traditionally lived, travelled, and harvested.

Inuit Knowledge established the geographical scope and extent of the study area considered in the Project-specific Inuit Knowledge report by identifying locations of traditional use and ecological importance, making certain the assessment included all potentially affected regions. Specific to Other Terrestrial Wildlife, Inuit Knowledge provided locations of places important to wildlife, including the distribution and denning areas of wolves and grizzly bears, which are correlated mainly with caribou habitat and eskers. It also provided seasonal hunting camp locations, wildlife migration corridors, and areas where Inuit travel to access harvesting areas (Banci and Spicker 2024). See Section 18.2.2 for a series of figures that represent the distribution of habitats identified through the Project-specific Inuit Knowledge report and the resulting assessment boundaries used in this assessment.

18.1.1.2 *Influence of Inuit, Indigenous, and Community Knowledge on Baseline Conditions*

WKR collected baseline conditions information by combining Inuit-led and collaborative knowledge gathering (including the Project-specific NTKP and IAG workshops), publicly available information from Indigenous groups considered in the context of the Project, and engagement feedback shared by Inuit, other Indigenous groups, and other potentially affected communities with technical studies based on Western scientific methods. Inuit and Community Knowledge played a substantial role in evaluating wildlife for the Project. This role went beyond mere data collection by shaping understanding of baseline conditions and potential effect severity, and by identifying subsequent mitigation and management strategies.

Inuit Knowledge provided essential historical context, behavioural insights, and spatial data that either complemented or went beyond the scope of Western scientific studies. For example,

- **Predator Distribution:** Inuit Knowledge informed that grizzly bears and wolves are increasing in number and expanding their range further north, even onto Victoria Island (*Keetlinik*) and near communities (Banci and Spicker 2024).
- **Muskox Behaviour and Ecology:** Inuit Knowledge details the muskox's preference for high country and consuming lichen and dwarf birch in the summer (IAG 2025a). Consultants noted specific behaviours, such as muskox walking continuously across ice until reaching land to assess ice thickness.
- **Habitat Changes:** Observations from Inuit Knowledge informed the assessment of localized ecological changes, including a 40-mile northern shift of the treeline and the recent presence of pines and red squirrels at Contwoyto Lake (IAG 2025a).

Baseline information from the sources cited above were considered and summarized in the assessment in Section 18.2.3, Table 18.10 and considered in the effects assessment that follows. The information obtained included terrestrial wildlife species of cultural importance, important habitats for terrestrial wildlife, and seasonal patterns (see Section 18.2.3). For example, through the Project-specific Inuit Knowledge report, compiled from the NTKP database, it was shared that Inuit trapped and traded the pelts of many animals including caribou, white and red fox, arctic hares, ground squirrels, grizzly bears, wolverine, wolves, and muskrat with the primary furbearer being Arctic fox. It was also shared that wolves and wolverine were not important pelts for the fur market until snowmachines were introduced (Banci and Spicker 2024).

18.1.1.3 *Influence of Inuit, Indigenous, and Community Knowledge on the Assessment of Project Effects*

Inuit, Indigenous, and Community Knowledge has been actively used throughout the assessment, going beyond simple description to directly support risk identification, define acceptable changes, and recommend practical, culturally informed mitigation measures. WKR discussed with Kitikmiut, other Indigenous groups, and other potentially affected communities how project activities (e.g., clearing, blasting, etc.) and project infrastructure could affect socio-economic conditions and culturally important interests, including terrestrial wildlife and wildlife habitat, within the Local Assessment Area (LAA) and Regional Assessment Area (RAA). Through community meetings, IAG workshops, and public engagement opportunities, Kitikmiut, other Indigenous groups, and other potentially affected communities provided perspectives and values which were considered and integrated into the potential effects. Inuit, Indigenous, and Community Knowledge helped to identify wildlife habitat of importance and project concerns, such as changes in the abundance of moose and other wildlife and concerns about sensorial effects on muskox (see the discussion starting in Section 18.4 and continuing through the assessment).

18.1.1.4 *Influence of Inuit, Indigenous, and Community Knowledge on the Assessment of Cumulative Effects*

Through workshops and regional discussions, Kitikmiut Knowledge Holders, other Indigenous groups, and other potentially affected communities assisted WKR in identifying culturally important areas, species and traditional food sources, and practices that may experience combined effects from the Project and other projects and activities in the Project's RAAs.

WKR wove Inuit, Indigenous, and Community perspectives with Western science to develop a holistic view of how multiple changes could affect land-based livelihoods, traditional land, marine, and resource use (TLMRU), and environmental integrity over time. The analysis recognizes the importance of long-term monitoring, where local, Inuit co-developed and co-implemented data collection will track combined effects to inform adaptive management plans. For example, monitoring will be used to verify the accuracy of predicted residual and cumulative effects, assess the effectiveness of measures, identify unanticipated constraints, and allow updates to mitigation and monitoring strategies, where necessary (see Section 18.22).

18.1.1.5 *Influence of Inuit, Indigenous and Community Knowledge on Assessing Significance of Effects*

Inuit, Indigenous, and Community values shaped the determination of the significance of effects on wildlife by providing holistic, culturally based perspectives about acceptable versus unacceptable (or significant) impacts from an Inuit or other Indigenous groups' perspective. Significance criteria were informed with consideration of the priorities and values identified through Inuit, Indigenous, and Community Knowledge (see Volume 3).

The concept of significance in the assessment was guided by Inuit, Indigenous, and Community values and detailed ecological observations about resource health, along with understanding of socio-economic conditions and TLMRU. Members of the IAG provided criteria to consider when identifying whether a

project is likely to have significant, or unacceptable, effects (see Sections 18.1.6, 18.7, 18.11, 18.15, and 18.19). IAG members advised that a significant adverse effect extends beyond simple Western scientific population models to encompass threats to sustenance, culture, and the ability to continue traditional harvesting practices (IAG 2025b). To be considered "non-significant" or acceptable, IAG members advised WKR to implement comprehensive measures and commitments that align with Inuit, Indigenous, and Community priorities and values.

- **Proactive Protection Measures:** WKR's commitment to avoiding or strictly mitigating known high-risk activities is crucial. This includes actions like avoiding roads through calving grounds and migration routes, instituting mobile protection zone, and implementing traffic restrictions/closures during sensitive seasons (IAG 2025a, 2025b).
- **Incorporation of Inuit, Indigenous, and Community Knowledge into Management:** The commitment to incorporate Inuit, Indigenous, and Community Knowledge and Western Science in all assessment sections, as appropriate, from baseline to monitoring, fostered dialogue and an inclusive Project. The request for Inuit monitors to enforce mitigation measures in real-time shows that inclusion requires active Inuit participation in the Project's management (IAG 2025a, 2025b).
- **Adaptive Management:** The use of adaptive management plans that can be revised based on ongoing monitoring and the ongoing sharing of Inuit, Indigenous, and Community Knowledge is seen as essential for success and acceptability, given the unpredictable nature of climate (IAG 2025a, 2025b).
- **Holistic Approach to Benefits:** The Project's success is tied to its broader social and economic benefits, such as contributing to more resilient supply chains and providing job/training opportunities for Inuit and other Indigenous groups. The protection of all wildlife and water resources, beyond just caribou, was also a key part of the holistic equation for acceptability (IAG 2025b).

18.1.1.6 *Influence of Inuit, Indigenous, and Community Knowledge on the Development of Mitigation, Management, and Enhancement Measures*

Through engagement activities, community-based primary research, IAG workshops, and the review of publicly available literature, measures to reduce adverse effects from the Project and enhance its benefits were identified. For example, during IAG workshops, participants stated that WKR should implement mitigation measures that have proven successful on other projects in Nunavut rather than inventing new measures (IAG 2025b). Feedback also helped focus the Project's design on sensitive timing and locations for monitoring and mitigation.

Proposed mitigation, management, and enhancement measures were discussed and reviewed with Inuit community representatives during IAG workshops and community meetings with the intent of developing and implementing measures that consider both the biophysical and human environment. Adjustments were made as appropriate, based on advice from IAG members and the Kitikmeot Inuit Association, as well as from Indigenous groups and other potentially affected communities through engagement. The mitigation measures listed within each indicator species assessment below are designed to avoid and reduce effects on terrestrial wildlife and wildlife habitat, recognizing their importance for ecosystem health, TLMRU, and food security.

Inuit, Indigenous, and Community Knowledge directly informed the development of practical, culturally responsive mitigation and monitoring measures:

- **Road Design for Wildlife Passage:** Inuit Knowledge influenced the design by recommending gradual, shallow embankment slopes (e.g., 3:1 slope) with finer, small-grained material to facilitate easy and frequent caribou and other terrestrial wildlife crossings. The warning about caribou injuring their legs on sharp mine rock highlighted the need for appropriate material to be used (Thorpe Consulting Services Ltd. 2014a; IAG 2025b).
- **Traffic Management:** Inuit, Indigenous, and Community perspectives expressed the need for active management, including:
 - **Speed Reduction:** Implementing mandatory speed reductions and stoppages when caribou or other terrestrial wildlife are present, giving wildlife the right-of-way (Thorpe Consulting Services Ltd. 2014a; IAG 2025b).

A summary of the mitigation ideas generated within the Inuit Advisory Group meetings is provided in Table 18.1.

Table 18.1 Inuit Knowledge-Informed Mitigations/Recommendations

Area of Concern	Inuit Knowledge-Informed Risk/Concern	Inuit Knowledge-Informed Mitigation/Recommendation
Road Design and Traffic	Steep road slopes and crushed rock surfaces are difficult or undesirable for wildlife to cross.	Use gradual road slopes and low road heights with fine gravel/sand to facilitate safe wildlife crossing.
	Noise (helicopters, blasting) and light disturbance deter wildlife, especially during critical seasons.	Minimize sensory disturbance (noise, dust, lights). Implement timing restrictions on blasting and traffic during sensitive periods.
Habitat/Land	Disturbance/contamination of lush, green areas critical for muskox foraging. Dust from the airstrip/road impacting vegetation.	Protect the land, avoid lush areas for road placement. Implement dust suppression using water and non-toxic chemicals.

18.1.1.7 Influence of Inuit, Indigenous, and Community Knowledge on Transboundary Effects

WKR engaged with and received feedback from Indigenous groups and other potentially affected communities, governments, and organizations in regions outside of the Kitikmeot Region to understand if project activities could affect socio-economic conditions, resources, wildlife, or culturally important areas shared between regions. This feedback has been integrated into the transboundary effects assessment (Volume 10, Section 33) and is not discussed further in this section.

18.1.2 Regulatory and Policy Setting

This assessment considered applicable federal and territorial legislation, regulations, strategies, guidelines, plans and best management practices relevant to the indicator species, and includes information provided by Inuit (see Table 18.2). Applicable recommendations in land use plans and designations were also considered.

Table 18.2 Summary of Key Legislation, Policy, and Regulatory Guidance Documents for Other Terrestrial Wildlife

Name	Description
<i>Species at Risk Act</i> , S.C. 2002, c. 29 (SARA)	The federal <i>Species at Risk Act</i> (SARA) constitutes the legal framework for protecting wildlife species at risk, their critical habitats, and their recovery in Canada. Grizzly bear and wolverine are both listed as a species of Special Concern under the SARA. While this designation does not prohibit killing or harm, it requires the development of a management plan to prevent the species from becoming threatened or endangered. The SARA applies to federal lands and to federal activities, complementing territorial regulations. Implementation involves cooperation with the territorial government and wildlife co-management boards.
<i>2024-2029 Nunavut Wildlife Management Board (NWMB) Strategic Plan</i> (NWMB 2024)	The <i>2024-2029 Nunavut Wildlife Management Board (NWMB) Strategic Plan</i> outlines NWMB's mission to manage wildlife in Nunavut (NU), balancing conservation with Inuit harvesting for the well-being of current and future generations. It aims to guide NU's move towards implementing the <i>Nunavut Lands and Resources Devolution Agreement</i> in 2027 (Government of Nunavut [GN] pending). The plan focuses on strengthening Inuit <i>Qaujimaqatuqangit</i> and Inuktitut in their work, collaborating with other Inuit organizations, and enhancing awareness of the NWMB's role.
<i>Wildlife Act</i> , S.Nu. 2003, c. 26	The NU <i>Wildlife Act</i> outlines the management and conservation of wildlife in NU. The Act provides guidelines on wildlife harvesting, habitat protection, respectful conduct toward wildlife, and the designation and protection of species at risk and their habitat. The Act translates the NWMB's decisions into enforceable regulations. Associated regulations include the Wildlife General Regulations, NWT Reg (Nu) 026-92, and Wildlife Licenses and Permits Regulations, NWT Reg (Nu) 027-92.
<i>Nunavut Land Claims Agreement Act</i> , S.C. 1993, c.29	The <i>Nunavut Land Claims Agreement</i> is an "Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada". The Agreement provides "Inuit with wildlife harvesting rights and rights to participate in decision-making concerning wildlife harvesting".
<i>Non-Inuit Grizzly Bear Sport Hunt Quota</i> (NWMB and GN-DOE 2019)	The <i>Non-Inuit Grizzly Bear Sport Hunt Quota</i> documents an agreement between the NWMB and the NU Minister of Environment to increase the annual level of grizzly bear harvesting in the Kitikmeot Region by non-Inuit sport hunters from 10 to 15 tags. Accepted on July 2, 2019.
<i>Nunavut Grizzly Bear Co-Management Plan</i> (GN-DOE 2017)	The <i>Nunavut Grizzly Bear Co-Management Plan</i> provides a collaborative framework for conserving and managing grizzly bear across NU. It was developed by the NWMB and the GN's Department of Environment and integrates scientific research and Inuit <i>Qaujimaqatuqangit</i> . The plan recommends research, monitoring, and co-management to maintain healthy populations, but does not prescribe numeric total allowable harvest, sex ratios, or percentage-based limits. It aims to maintain viable bear populations while supporting sustainable harvest for cultural and subsistence use.

In addition, the assessment of effects on terrestrial wildlife is guided by Inuit, Indigenous, and Community Knowledge (as outlined in Section 18.1.1). Inuit Knowledge may also be referred to as Inuit *Qaujimaningit*, which encompasses “Inuit traditional knowledge (and variations thereof or Inuit *Qaujimajatuqangit*), local and community-based knowledge, as well as Inuit epistemology as it relates to Inuit Societal Values and Inuit Knowledge (both traditional and contemporary)”. Inuit Societal Values, including traditional values, beliefs, and principles, are referred to as Inuit *Qaujimajatuqangit* principles. For more details, see Volume 3. The Kitikmeot Inuit Association recommended using the term Inuit Knowledge in the Impact Statement (IS). WKR has adopted this terminology and understands that Inuit Knowledge encompasses the principles of Inuit *Qaujimajatuqangit*, which have been incorporated into the assessment of effects on terrestrial wildlife.

The Government of Nunavut (GN) regulates the harvest of wildlife species by non-Inuit (GN 2024). Muskox has a total allowable harvest (TAH) for MX-11, within which the Project is located, which represents the maximum harvest rate set to achieve management goals. TAHs are established for each management unit and allocated among communities. The TAH for MX-11 is currently 350 individuals. The GN also regulates moose harvest (GN 2024). Moose populations are not actively managed for conservation in the territory, but harvest is regulated for residents and non-residents, with a limit of one, but no closed season. (GN 2024). Grizzly bear is managed by the *Nunavut Grizzly Bear Co-Management Plan* (GN-DOE 2017) and the *Non-Inuit Grizzly Bear Sport Hunt Quota* (NWMB and GN-DOE 2019) as identified in Table 18.2. The annual level of grizzly bear harvesting in the Kitikmeot Region by non-Inuit sport hunters is 15 tags (GN-DOE 2019). The spatial assessment boundaries (see Section 18.1.4.1) for grizzly bear coincide with Game Management Subzones 509-511, 522-524, and 526. Wolverine is classified as a furbearer in Nunavut, with both hunting regulations (GN 2024) and trapping regulations (GN 1999).

In accordance with the guidance provided by the IAG to WKR, best management practices to avoid or reduce project-related effects on the land, water, and the animals that use it were adapted from previously approved major development projects in the Arctic. The projects considered by WKR to be relevant sources of best management practices for other terrestrial wildlife included the Mackenzie Valley Highway, the Sabina Gold and Silver Corporation’s Back River Project, the Agnico Eagle Mines Limited – Meadowbank Complex and associated access roads, and the Baffinland Mary River Project. Developed with Inuit, Indigenous, and Community Knowledge, the best management practices from these projects, along with information shared with WKR in workshops with the IAG and engagement with communities, form the basis of the mitigation, management, and enhancement measures presented in this IS to avoid or reduce adverse effects on other terrestrial wildlife.

18.1.3 Potential Effects, Pathways, and Measurable Parameters

The Project has the potential to affect other terrestrial wildlife from populations that interact with the Project through the activities and infrastructure associated with the Construction and Operations and Maintenance phases of the Project (see Table 18.3).

Table 18.3 Potential Effects, Effects Pathways and Measurable Parameters for Other Terrestrial Wildlife

Potential Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement
Change in Habitat	- Direct habitat loss due to vegetation clearing and ground disturbance during construction - Indirect habitat loss due to dust deposition and sensory disturbances (i.e., noise, presence of people) causes wildlife to avoid or reduce habitat use adjacent to the Project	- Area (km²) of direct habitat loss within the PDA boundaries (quantitative) - Area (km²) of indirect habitat loss within a Zone of Influence around the PDA (quantitative)
Change in Movement	- Direct physical filter to wildlife movement because of project activities and components (e.g., vegetation clearing, infrastructure, roads) - Indirect perceptual filter to movement resulting from project activities and components (e.g., sensory disturbances)	Assessment of wildlife movement based on Inuit, Indigenous, and Community Knowledge, baseline conditions, literature, and professional judgment (qualitative)
Change in Mortality Risk	- Direct wildlife mortalities from project-related activities (e.g., vegetation clearing and earthworks, collisions with project vehicles and equipment) - Indirect risk from increased hunting and trapping due to increased access during construction - Increased risk of mortality due to human-wildlife conflicts (defence of life and property)	Predicted changes to mortality based on Inuit, Indigenous, and Community Knowledge, regional knowledge, baseline monitoring studies, harvest rates, and review of literature (qualitative)

Construction of the Project will cause direct habitat loss where infrastructure is proposed. Indirect habitat loss may occur during Construction and Operations and Maintenance due to project-related activities that displace other terrestrial wildlife from an area through sensory disturbances, thereby reducing the effectiveness of the adjacent habitat.

Project infrastructure and associated activities will influence the movement of terrestrial wildlife individuals that interact with it during the Construction and Operations and Maintenance phases. The Project can act as either a physical or perceptual filter, altering wildlife travel routes and movement patterns.

The Project will influence direct and indirect effects on mortality risk to other terrestrial wildlife. Direct effects are from project-related activities (e.g., vegetation clearing and earthworks, collisions with project vehicles and equipment) that may result in a mortality event. Indirect effects arise from increased hunting and trapping resulting from greater access to the area by harvesters. As well, there is a potential increased risk of mortality due to human-bear conflicts (defence of life and property [DLP]).

The Project is not expected to introduce contaminants into the environment at levels that would adversely affect the health of other terrestrial wildlife. An ecological risk assessment was completed as part of the Human Health and Ecological Risk Assessment Technical Data Report (Appendix 26A). The assessment reviewed Project-related emissions and considered how wildlife might be exposed to these emissions in the air, soil, water, and food. While some emissions are expected during Project construction and operation, these emissions are limited in magnitude and managed through standard controls and mitigation measures. Importantly, the assessment did not identify Project-related chemical contamination

to the air, soil, and water. As a result, there are no exposure pathways by which wildlife would come into contact with Project-related emissions at concentrations that would constitute an ecological risk. The assessment concludes that Project-related emissions are likely to result in a negligible ecological risk to terrestrial wildlife (e.g., caribou, birds, other terrestrial animals) and aquatic wildlife (e.g., freshwater and marine fish, marine mammals, and other aquatic wildlife), and vegetation. Accidental spills, which could pose a risk to the health of other terrestrial wildlife, are addressed in Accidents, Malfunctions, and Upset Events (see Volume 10, Section 32). The potential for the Project to facilitate increased predation was examined in the caribou assessment and was found to be negligible (see Volume 6, Section 16), so is not revisited here.

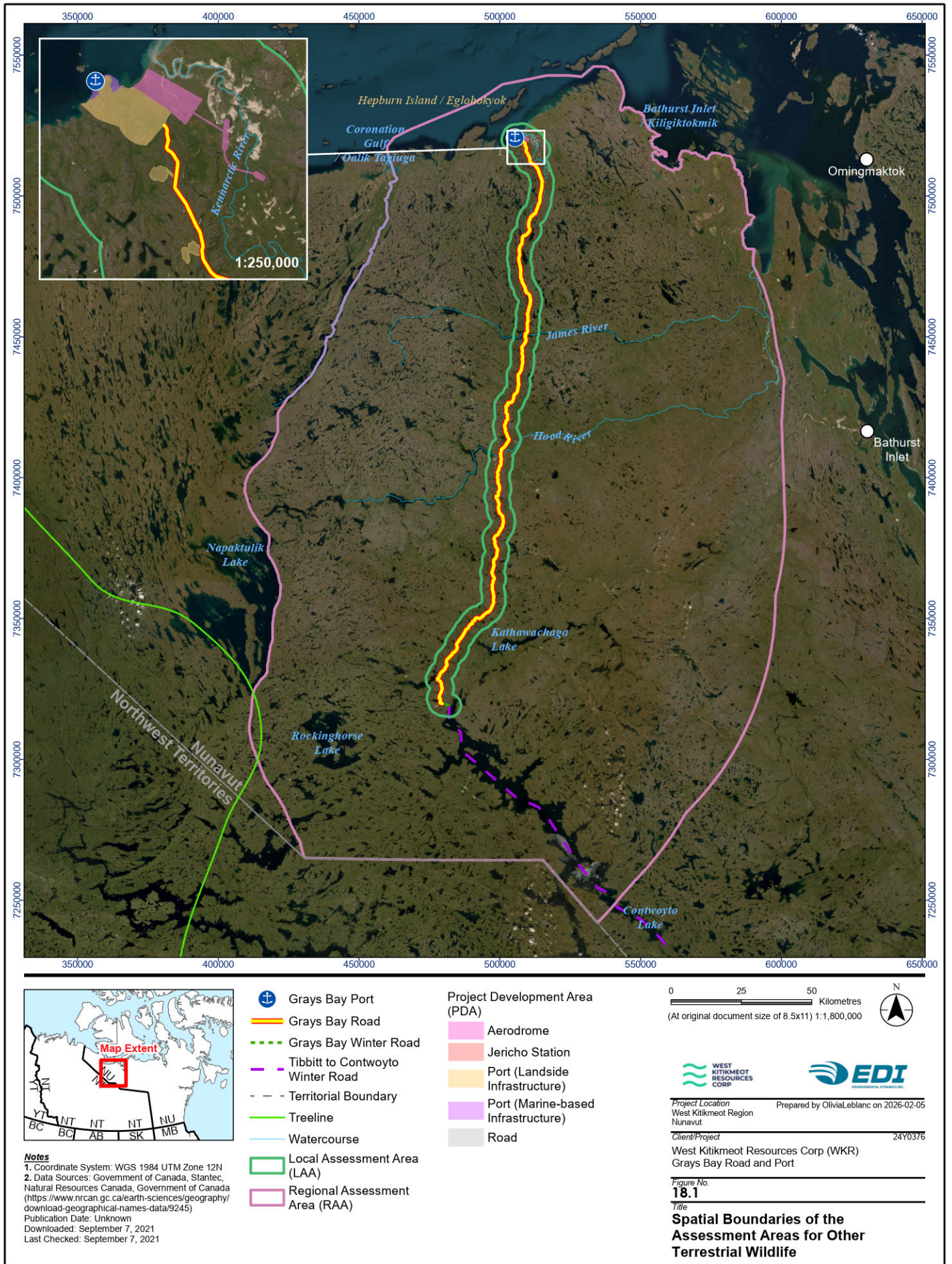
18.1.4 Boundaries

18.1.4.1 *Spatial Boundaries*

The spatial boundaries encompass the areas where the Project is expected to interact with other terrestrial wildlife and are relevant to culturally and ecologically important regions where Inuit camp, travel, and harvest (described in Section 18.1.1.1). Each spatial boundary represents the anticipated extent of different interactions with the Project. The assessment includes the Project Development Area (PDA), LAA, and RAA (see Figure 18.1).

Project Development Area

The PDA encompasses the physical footprint of all Project components, including both permanent and temporary disturbances (e.g., extent of Project infrastructure, planned clearing, and laydown areas). The PDA includes six sub-areas based on the types of components to be developed: the Port (which is further divided into marine and landside infrastructure), Road, Aerodrome, Jericho Station, and Winter Road PDAs. The boundary of the PDAs were created by applying buffers around where the Project components will be sited, and varies by each of the sub-areas depending on necessary flexibility for final siting of certain Project components based on conditions on the ground. For the Road PDA and Winter Road PDA, a 75 metre (m) buffer was applied to the roads centreline, for the Port PDA and the Aerodrome PDA, the areas were subdivided based on the conceptual Project component locations and then buffered approximately 1,000 m for the landside Port PDA, approximately 300 m for the marine Port PDA, and 500 m for the Aerodrome PDA. The Jericho Station PDA was buffered based on the existing development from the old Jericho Mine site that will be used for the Project and the need for additional space to accommodate the Project components that will be developed as part of the Project for this location. The Winter Road PDA will only exist annually between the beginning of February and end of March, will be built on land where the existing Jericho Station road ends, at the southeastern portion of Jericho Station, to the shoreline of Contwoyto Lake where it will connect to the TCWR. For the purposes of the impact assessment, the PDA is the same as the Site Study Area identified in the IS Guidelines.



Local Assessment Area

The LAA encompasses the PDA and the maximum predicted extent of most project-related environmental effects, both direct and indirect, on other terrestrial wildlife that can be predicted or measured with a reasonable degree of accuracy and confidence. The predicted extent of direct and indirect effects is based on a 4-kilometre (km) buffer around the PDA, which is established from studies completed on wildlife and their responses to human activities (Weir et al. 2007; Polfus et al. 2011; GNWT 2015; Prichard et al. 2020, 2022; ECCC 2023; ERM Consultants Canada Ltd. 2025a). The total area of the LAA is 1,981.4 square kilometres (km²) (198,140 hectares (ha)).

Regional Assessment Area

The RAA encompasses the PDA and LAA. It provides a regional context for how project-related effects may influence other terrestrial wildlife (i.e., excluding caribou, which use a different RAA) at a regional scale and how these effects may cumulatively interact with those of other past, present, reasonably foreseeable, or reasonably foreseeable induced (RFI) projects in the RAA. Given the diversity of wildlife species the Project may interact with, the RAA extent is based on local, wide-ranging wildlife species that reside in the area to fulfil their life requisites, consideration of culturally and ecologically important regions to Inuit, as well as landscape features.

Inuit Knowledge provided locations of places important to wildlife, including the distribution of muskox, moose, grizzly bear, and wolverine and their habitats and denning areas of wolves and grizzly bears, which are correlated mainly with caribou habitat and eskers. It also provided seasonal hunting camp locations, wildlife migration corridors, and areas where Inuit travel to access harvesting areas (Banci and Spicker 2024).

A study west of Kugluktuk, NU, found that the average home range size of muskox, measured as the mean maximum straight-line distance between summer and winter ranges, was 75 to 85 km, with a maximum straight-line distance of 138.5 km between seasonal ranges (Gunn and Fournier 2000).

Moose occur in low densities in the north. A study in the Mackenzie valley found that home range sizes of radio-collared female moose ranged from 40 to 942 km², with an average of 174 ± 31 km² (Stenhouse et al. 1995). Home-range sizes showed wide variability among all collared individuals, influencing differences in seasonal home-range use.

A grizzly bear study in the central Arctic region found that the average home range sizes for female and male grizzly bears were approximately 2,100 km² and 7,200 km², respectively (McLoughlin et al. 2003a). Assuming a roughly circular home range, this equates to a home range diameter of approximately 52 km for female bears and 96 km for male bears.

A wolverine study in the central Arctic region documented average home range sizes of 125 km² and 400 km² for females and males, respectively, corresponding to approximate home range diameters of 12 km and 22 km, respectively; however, the sample size was low (Mulders 2000). Most wolverine home ranges from this study fit within a maximum 50 km movement area.

Based on this ecological understanding of home ranges and land use by these far-ranging wildlife species from both Inuit Knowledge and western science, the RAA boundary extends from the Coronation Gulf coastline (including Hepburn Island [*Eglohokyok*]) to the north. The west boundary follows the Tree River (*Kugluktoalok*) down towards the east shoreline of Napaktulik Lake (*Napaktolik*) and then continues south to a deflection point in the NU/Northwest Territories (NT) boundary, which is also the south boundary of the RAA. The east boundary of the RAA follows the west coast of Bathurst Inlet (*Kiligiktokmik*) to where the James River (*Hannigayok*) flows into it, from which it continues south until it reaches the NU/NT boundary. The RAA is 43,087.5 km² (4,308,750 ha) in area.

18.1.4.2 Temporal Boundaries

The temporal boundaries for the assessment are based on the timing and duration of project activities and the nature of the interactions with other terrestrial wildlife. The purpose of a temporal boundary is to identify when an environmental effect may occur in relation to specific project phases and activities. Temporal boundaries for the Project include the baseline reference point and the Construction and Operations and Maintenance phases. The NIRB guidelines (NIRB 2025a) also state that temporal boundaries should include “temporary closure (care and maintenance), final closure (decommission and reclamation) and post-closure periods”. The temporary closure period (or care and maintenance) covers the period of untimely closure of the Project and includes care and maintenance activities; the final closure period covers decommissioning, and reclamation activities; and the post-closure period covers the period after the Project has been decommissioned and abandoned, and the site has been reclaimed and returned as much as possible to its natural state.

The schedule for this assessment is conceptual and follows a phased approach, consisting of a Construction phase and an Operations and Maintenance phase. Onsite works for the Project are scheduled to begin in 2029, with major construction commencing in 2030. The major construction activities are anticipated to span approximately five years. Operations and maintenance are anticipated to begin in 2035 and continue indefinitely, as the Project components are considered permanent infrastructure with a design life of 75 years. As the Project facilities are designed to be permanent, there are no plans for closure and reclamation, except for areas used solely for pre-construction/construction activities that are not required for ongoing operations and maintenance. Closure and reclamation of temporary workspaces, borrow sources, and quarries used only for construction are included within the Construction phase.

18.1.5 Residual Effects Characterization

The characterization of residual effects on other terrestrial wildlife indicator species is based on a review of Inuit Knowledge (see Section 18.1.1) and baseline conditions (see Section 18.2), quantitative analysis, assessment of project-related effects and the extent to which they can be mitigated, other relevant scientific information, and professional judgment. The residual effects on other wildlife indicator species have been characterized in terms of direction, magnitude, geographic extent, timing, duration, frequency, and reversibility. The definitions used for the characterization of residual effects are described in Table 18.4. Some of the measures used to quantify or categorize the residual effect varied among the indicator species, notably in the characterization of magnitude and timing. The rationale for the measures used for each indicator species for these characterizations is provided below.

Table 18.4 Characterization of Residual Effects on Other Wildlife

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect.	Positive – a residual effect that moves measurable parameters in a direction beneficial to the species relative to baseline. Adverse – a residual effect that moves measurable parameters in a direction detrimental to the species relative to baseline. Neutral – no net change in measurable parameters for the species relative to baseline.
Magnitude	The extent of a change in measurable parameters or the indicator species from baseline conditions.	<i>Habitat (quantitative)</i> Muskox, Moose, Wolverine Negligible – <1% loss of habitat in RAA Low – 1% to 15% loss of habitat in RAA Moderate – >15% to 30% loss of habitat in RAA High – >30% loss of habitat in RAA Grizzly Negligible – <1% loss of habitat in RAA Low – 1% to 10% loss of habitat in RAA Moderate – 10% to 20% loss of habitat in RAA High – >20% loss of habitat in RAA <i>Movement and Mortality Risk (qualitative)</i> Negligible – minor change from baseline conditions. Low – a change from baseline conditions but within the range of natural variation and/or accepted standards Moderate – a detectable change to baseline conditions slightly outside the range of natural variation or accepted standards and may become a management concern High – a detectable change to baseline conditions well outside the range of natural variability or accepted protective standards and represents a management concern
Geographic Extent	The spatial area(s) in which an effect is predicted to be detectable.	PDA – residual effects are restricted to the PDA LAA – residual effects extend into the LAA RAA – residual effects extend into the RAA or interact with other projects in the RAA
Timing	Considers when an effect is predicted to occur, where relevant to the indicator species.	No sensitivity – effect does not occur during a critical life stage Moderate sensitivity – effect may occur during a sensitive time period. Muskox = calving (April to early-June); Moose = calving (May to June); Grizzly bear = non denning period (late-April to October); wolverine = none. High sensitivity – effect occurs during a critical life stage. Muskox and Moose = late winter (February to April); Grizzly bear = denning (October to late-April); wolverine = natal/maternal denning period (late-Feb to May)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The time required until the measurable parameter or the indicator species returns to its existing condition, or the residual effect can no longer be measured or otherwise perceived.	Short-term – the residual effect is restricted to the Construction phase Medium-term – the residual effect returns to baseline condition within two years of the end of the Construction phase Long-term – the residual effect persists for longer than two years after the end of construction
Frequency	How often an effect is predicted to occur.	Single event – occurs once Irregular event – occurs at no set schedule Regular event – occurs at regular intervals Continuous – occurs continuously
Reversibility	The degree to which an indicator species can be returned to baseline conditions or other established reference point after relevant activities have ceased.	Reversible – the residual effect is likely to be reversed Irreversible – the residual effect is unlikely to be reversed

Magnitude

The magnitude characterization for the change in habitat varies among the indicator species. There is no known threshold of tolerance for muskox, moose, or wolverine. Swift and Hannon (2010) provide a meta-analysis of simulation and large-scale empirical studies on habitat patterns and factors that lead to potential population-level effects in some mammals. Simulation studies identified that many species require between 10% and 50% of their original habitat to be retained to maintain the population. Empirical large-scale studies suggest that 10% to 30% of the habitat must remain to sustain the population. Another meta-analysis study (Andrén 1994) also concluded that suitable habitat should be maintained at 10% to 30%, or, for some species, at 60% to 70%. Characteristics such as patch size, fragmentation, total available area, and patch spacing contributed to these varying estimates (Andrén 1994). This range of reactions to environmental change among species in the same ecosystem is known as response diversity (Elmqvist et al. 2003). Considering the upper end of the habitat retention thresholds identified in this literature (i.e., 70% habitat retention) and professional judgment, conservative threshold values were identified for the magnitude of changes to muskox, moose, and wolverine habitat, as follows: negligible change is defined as less than 1%, low magnitude habitat change is 1% to 15%, moderate magnitude habitat change is between 15% to 30%, and high magnitude habitat change is greater than 30%.

For grizzly bears, the magnitude of the habitat change reflects the proportion of important land cover types altered relative to available habitat. Previous environmental assessments for northern projects have used effects thresholds ranging from 10% to 40% to assess the significance of habitat change (Cumberland Resources Ltd. 2005; Wolfden 2006; De Beers Canada Inc. 2010). Many jurisdictions have adopted a 20% threshold for the collective direct and indirect effects on habitat and localized habitat use for grizzly bears, above which grizzly bear use of an area is expected to decline (AXYS Environmental Consulting Ltd. 2001). Because barren-ground grizzly bears occupy vast home ranges at low densities,

localized habitat disturbance below 10% of available high-value areas (e.g., riparian corridors, eskers) is unlikely to measurably influence habitat use or population viability (Gibeau et al. 2002; McLoughlin et al. 2003a). Disturbances exceeding 10 to 20% of preferred foraging or denning habitat can begin to fragment use patterns or reduce connectivity within seasonal ranges, particularly in the slow-recovery tundra environment (Mace et al. 1996; Nielsen et al. 2004). Losses greater than approximately 20% are considered high magnitude, because they may affect long-term reproductive or denning habitat security, thereby influencing local population persistence (Boulanger and Stenhouse 2014).

Timing

The sensitivity of an indicator species to an effect varies throughout the year. For muskox and moose, the most sensitive time period for their survival is the late winter. This is due to a combination of stress factors that can lead to a negative energy balance for an individual. For muskox, late winter is a critical period when high-quality habitat is more restricted, and their body condition has deteriorated due to prolonged energy deficits. During this time, poor range conditions, severe weather, deep snow, an impenetrable crust, heavy parasite or disease infestation, or old age can result in starvation-related death (Gunn et al. 1984; Berger et al. 2018). The fat reserves that moose build up during the summer and fall are depleted, reducing their energy reserves and potentially leading to catabolism of muscle protein (Hundertmark et al. 1994). Moose are likely more susceptible to seasonal malnutrition and parasites during late winter, putting them at greater risk of predation and health-related mortality (Musante et al. 2010). Calving is also a sensitive time period for both muskox and moose. Muskox calving typically occurs during late winter and spring between mid-April and early June though some calves are born in late-June and early-July (Gunn and Adamczewski 2003). Muskox are capital breeders, relying on the female's fat reserves for fetal growth and early lactation during forage-restricted and unpredictable seasons (White et al. 1997; Gunn et al. 2024). Project effects that reduce habitat suitability or impede muskox access to high-quality forage during the calving season could affect calf survivorship more than at other times of year and are assigned a moderate sensitivity rating. Moose typically calve between mid-May and early June, with little variation in the timing of births across a latitudinal gradient in North America (Bowyer et al. 2003). Female moose avoid habitats that have a higher risk of predator interaction during the calving season (Francis et al. 2021). Predation of moose calf and cow during the post-calving period is a major source of mortality for moose in Alaska (Boertje et al. 1988; Ballard et al. 1991; Bertram and Vivion 2002).

Barren-ground grizzly bears exhibit clear seasonal sensitivities linked to denning, emergence, and hyperphagia. Denning typically occurs from October to April, when females give birth and bears are least tolerant of disturbance; therefore, effects during this period represent high sensitivity. The spring emergence period (May–June) and hyperphagia (July–September) are periods of moderate sensitivity, as bears rely on limited seasonal food sources to rebuild fat reserves and prepare for winter. These sensitivities are consistent with Inuit Knowledge and regional research indicating that disturbance during denning or hyperphagia has the greatest potential to affect grizzly bear survival and reproductive success.

Wolverine have naturally low reproductive rates, which contribute to the species' sensitivity to the effects of human development (ECCC 2024). Female wolverines typically mate during their third summer and give birth in February or March (Scrafford and Ray 2022). Wolverine denning season generally is from late February to May (Mulders et al. 2007; Inman et al. 2012; Scrafford and Ray 2022). Wolverines spend most of their time near natal dens from parturition through weaning, as kits (juvenile wolverines) have limited mobility at this time (Scrafford and Ray 2022; Aronsson et al. 2023). As such, wolverine are most sensitive to disturbance in denning habitat during this time.

18.1.6 Significance Definition

No prescribed ecological or social thresholds exist for evaluating whether project effects on available habitat, movement, or mortality risk of the indicator species are significant.

During the September 2025 IAG workshop, participants discussed effects that members consider acceptable or unacceptable. Through the discussion, a holistic suite of considerations emerged that must be integrated into the Project's social, environmental, and economic plans. With respect to terrestrial wildlife and bird habitat, feedback received from IAG members identified the following priorities when considering unacceptable changes as a result of the Project (IAG 2025b):

- That Inuit perspectives are considered and addressed in project design
- That the Project provides access to hunters and supplies for hunters at both Grays Bay and Jericho Station
- That the Project does not negatively affect people's ability to put food on the table
- That water and wildlife are protected

Furthermore, a significant adverse residual effect on other terrestrial wildlife is defined as one that is expected to alter the viability and persistence of populations of indicator species that interact with the RAA beyond an acceptable level (e.g., where it is not sustainable or is unavailable to contribute to biodiversity and ecosystem function or is not available for managed harvest).

18.2 Baseline Conditions

18.2.1 Methods

18.2.1.1 *Muskox*

The details of the methods used to determine muskox distribution and abundance are provided in the Wildlife Baseline Report (see Appendix 16A). Baseline conditions for muskox in the RAA were determined through a review of Inuit Knowledge and hunter harvest reports from the Kitikmeot region, Government of Nunavut Department of Environment (GN-DOE) muskox survey data, the results of project-specific ungulate surveys completed in the RAA, and habitat suitability modelling. Inuit knowledge of terrestrial wildlife, including muskox, in the West Kitikmeot region is integrated into this assessment.

To establish baseline information on muskox abundance and distribution, project-based surveys were conducted within a Regional Study Area (RSA), which encompassed a 30 km buffer around major project components and a 20 km buffer around the proposed road alignment, covering approximately 42% of the larger RAA. The methods included a combination of standardized fixed-wing aerial transect surveys conducted between 2004 and 2013 during various seasons (winter, calving, summer, and fall) to coincide with caribou migratory patterns and to capture key periods for muskox. Additional data were gathered through ground-based winter snow-track surveys along the proposed road alignment in late winter 2012 to assess seasonal ungulate use, and by deploying remote cameras in August/September 2024 to collect distribution and relative abundance data, specifically targeting caribou but also muskox.

Habitat suitability modelling for muskox was completed for summer and late winter, relying on landcover mapping, Inuit, Indigenous, and Community Knowledge, local experts, and published literature to characterize habitat use. The habitat ratings derived from the land cover data were adjusted for existing landscape disturbances, where present, and applied across the land cover dataset to map the current distribution of grizzly habitat suitability within the RAA. The baseline disturbances were informed by the Project Inclusion List (PIL), which considered a variety of information sources to identify physical activities and disturbances (e.g., mines, exploration, roads) (see Volume 4, Appendix 9A). In addition to the direct effects (footprints) from PIL physical activities, indirect effects on muskox habitat were considered by applying a Zone of Influence (ZOI) buffer, as discussed further in Section 18.4.1.1. Due to the limited human activity associated with these existing disturbances, the “low activity” ZOI buffer for muskox of 1.5 km was applied around the footprints of these past and present PIL activities, and habitat within the ZOI was downrated by one habitat suitability rating (HSR), as described in Section 18.4.1.1. After accounting for existing disturbances, areas rated as High or Moderate suitability were classified as Suitable habitat, while areas of Low or Nil habitat rating were classified as Not Suitable.

18.2.1.2 *Moose*

A combination of Inuit, Indigenous, and Community Knowledge, publicly available literature, and Project surveys was used to complete a baseline assessment of moose. Information from Inuit Knowledge sources relating to terrestrial wildlife was summarized and integrated into the Wildlife Baseline Report (see Appendix 16A).

A combination of aerial survey methods was used to characterize baseline conditions for moose in the baseline RSA. The RSA covered 19,408 km², approximately 43% of the RAA's extent. It included a 30 km buffer surrounding major proposed project components (i.e., the High Lake exploration camp to Grays Bay Port corridor), and a 20 km buffer around the proposed all-season controlled access road from Jericho Station, past Ulu, to just south of the High Lake area. Additional details on the survey methods are presented in the Wildlife Baseline Report (see Appendix 16A); only a summary is provided here.

Standardized aerial fixed-wing transect surveys were completed between 2004 and 2013 to collect information on ungulates and other large mammals in the RSA. The timing of these surveys was determined by known caribou migratory patterns, based in part on Inuit Knowledge of migratory behaviour and on satellite-collar information. Surveys were completed in February and March (winter), April (late winter), May (pre-calving season), early June (calving), late June/early July (post-calving), late July/August (summer), and September and October (fall). The aerial ungulate surveys involved flying in a

fixed-wing aircraft at approximately 125 m to 150 m above ground level at approximately 140 to 160 kilometres per hour (km/h) over the RSA on pre-determined systematic transects (1 km wide transects [500 m each side of the aircraft] spaced 8 km apart. Moose were classified to bulls, cows, or calves where possible. Other wildlife species observed were noted and locations recorded.

Winter snow-tracking surveys were completed by helicopter along the road alignment. Surveys were conducted on March 27 and April 7, 8, and 17, 2012. Winter snow-tracking surveys were conducted to provide additional information on ungulate seasonal use of the proposed road alignment. An aerial summer trail survey was completed via helicopter along the proposed road alignment in July 2012. The objective of the survey was to document the relative density and distribution of wildlife trails near or crossing the proposed road alignment. Trails were grouped into categories (few: 1–5 trails; some: 6–10 trails; or many: >10 or an indistinguishable number of trails), the predominant trail direction was recorded (east-west or north-south), and locations were recorded on a Global Positioning System (GPS).

18.2.1.3 Grizzly Bear

Initial work to understand the distribution and behaviour of grizzly bears in the RAA involved synthesizing Inuit Knowledge acquired through workshops, consultations, and literature reviews. This Inuit Knowledge was crucial for mapping where grizzly bears occur and how they use the habitat, and for informing the baseline assessment of movement and mortality. This was then complemented by field-based and desktop assessments. Field studies focused on carnivore distribution and ecology were conducted between 2004 and 2012 within a regional study area. Monitoring for population understanding involved collecting incidental sighting information since 2004 and conducting denning surveys via helicopter from 2005 to 2012, with a focus on areas along the proposed road alignment. More recently, to obtain density and abundance estimates, a broad DNA-hair-snagging program was conducted across the Kitikmeot Region from 2021 to 2023 (Awan et al. 2025). Lastly, to predict suitable habitat, HSRs were developed from Resource Selection Function (RSF) modelling, originally described by Johnson et al. (2005). These seasonal models were standardized and averaged to create four annual suitability classes (High, Moderate, Low, and Nil), which were then applied to land cover data and verified using collared grizzly bear information specific to the Project area. The full details of these methods are available in the Wildlife Baseline Report (see Appendix 16A). The habitat ratings derived from the land cover data were adjusted for existing landscape disturbances, where present, and applied across the land cover dataset to map the current distribution of grizzly habitat suitability within the RAA. The baseline disturbances were informed by the PIL, which considered a variety of information sources to identify past and present physical activities and disturbances (e.g., mines, exploration, roads) (see Volume 4, Appendix 9A). In addition to the direct effects (footprints) from PIL physical activities, indirect effects on grizzly habitat were considered by applying a ZOI buffer, as discussed further in Section 18.12.1.1. Due to the limited human activity associated with these existing disturbances, the “low activity” ZOI buffer for grizzly bear of 800 m was applied around the footprints of these past and present PIL activities, and habitat within the ZOI was downrated by one HSR, as described in Section 18.12.1.1. After accounting for existing disturbances, areas rated as High or Moderate suitability were classified as Suitable habitat, while areas of Low or Nil habitat rating were classified as Not Suitable.

18.2.1.4 *Wolverine*

Inuit Knowledge was reviewed to determine the distribution and behavioural patterns of wolverine in the RAA. This was supplemented by project-specific desktop and field-based assessments to determine the ecological characteristics of wolverine populations in the region and, more broadly, across the region. Findings from these efforts contributed to establishing baseline conditions of wolverine habitat, movement, and mortality. A summary of the methods used is provided below, and details are further described in the Wildlife Baseline Report (see Appendix 16A).

Through a series of workshops, consultations, and a review of relevant literature, Inuit Knowledge on wolverine was acquired and synthesized. Based on these findings, the spatial distribution of high wolverine utilization areas was mapped across the RAA (see Figure 18.12). Furthermore, Inuit Knowledge accounts describing wolverine habitat use, movement, and mortality were incorporated into the baseline assessment for wolverine in the region.

Desktop assessments included additional project-specific habitat mapping within the RAA, and a review of existing literature, databases, and historical studies completed in the region.

Baseline wolverine monitoring efforts in the Arctic have used several study designs in recent years, including various methods of snow track counts (e.g., Diavik Diamond Mines Inc. 2006) and genetic mark-recapture surveys. Monitoring of wolverine within the RAA has included collecting incidental observations since 2004 and a DNA-based population assessment at High Lake in 2008. Regionally, additional genetic mark-recapture population studies were undertaken in the Izok area in 2012 (25% to 30% of the study area was in the Project's RAA) and at Napaktulik Lake (partially in RAA) in 2018/2019 (Boulanger 2013; Awan et al. 2020). These mark-recapture study designs followed a methodology similar to that used in Mulders et al. (2007), involving microsatellite genotyping with seven markers (Paetkau 2012, pers. comm.), allowing identification of individuals and sex. Spatially explicit mark-recapture analysis was used to estimate the number and density of wolverines in each study area and to test the robustness of the study design (Boulanger 2013).

Habitat suitability mapping was completed for wolverine using HSRs based on previously established habitat associations for wolverine in the region (from Johnson et al. 2005), in combination with *Northern Land Cover* (Olthof et al. 2009, 2015) and *Earth Observation for Sustainable Development of Forests* (Wood et al. 2002; Natural Resources Canada 2013) land cover classification products. Based on wolverine RSF coefficients (indicating the magnitude and direction of selection for a particular habitat attribute) determined by Johnson et al. (2005), land cover types were characterized into the following HSRs: High, Moderate, Low, and Nil. Details on the attribution of suitability ratings to each of the land cover types are presented in the Wildlife Baseline Report (see Appendix 16A). These habitat ratings were then adjusted for existing landscape disturbances, where present, and applied across the landcover datasets to map the distribution of wolverine habitat suitability within the RAA. These baseline disturbances were informed by the PIL, which considered a variety of information sources to identify physical activities and disturbances (e.g., mines, exploration, roads) (see Volume 4, Appendix 9A). In addition to the direct effects (footprints) from PIL physical activities, indirect effects to wolverine habitat were considered by applying a ZOI buffer, as discussed further in Section 18.16.1.1. After accounting for existing disturbances, areas rated as High or Moderate suitability were classified as Suitable habitat, while areas of Low or Nil habitat rating were classified as Not Suitable.

18.2.2 Overview

18.2.2.1 Muskox

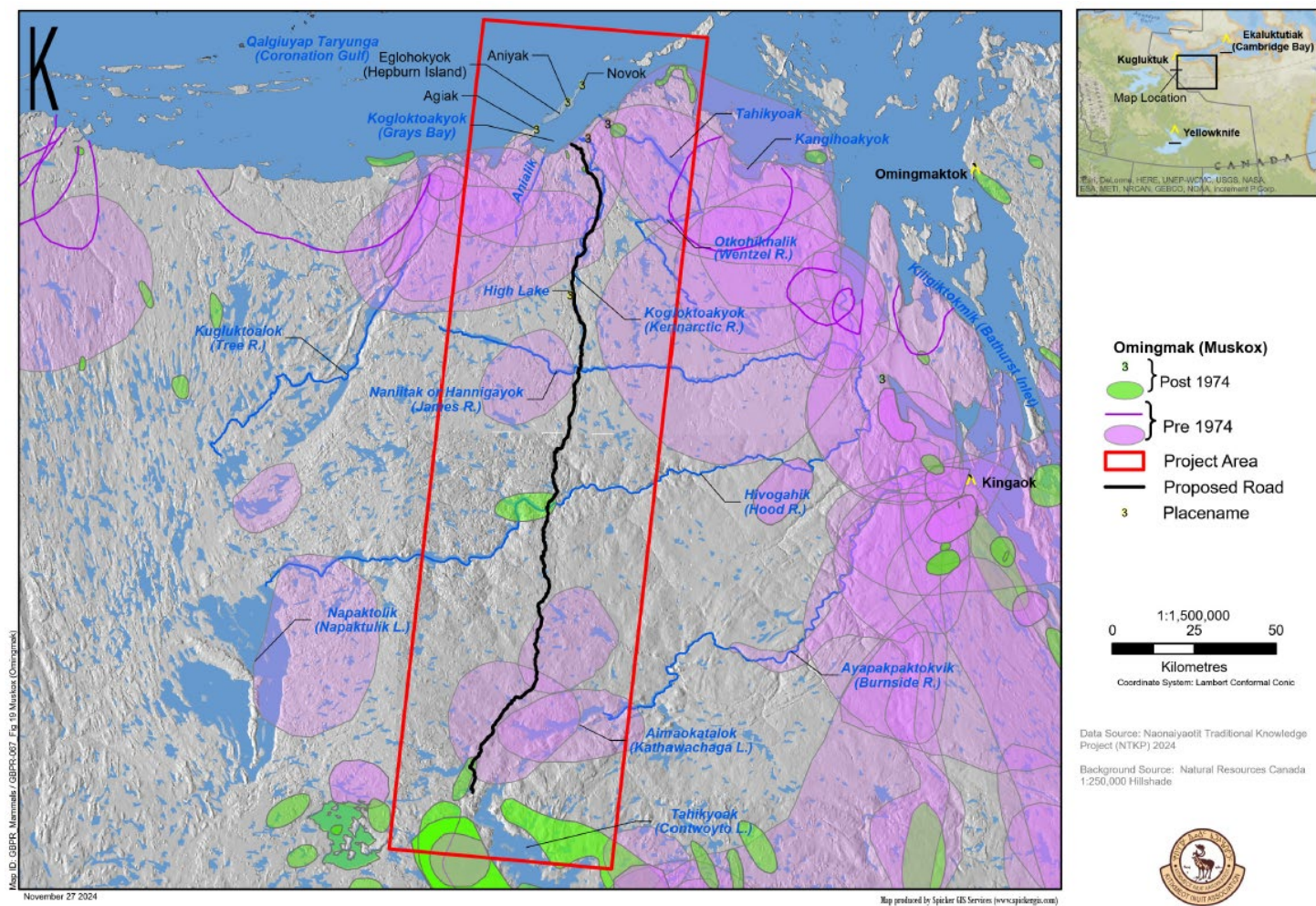
As detailed in the Wildlife Baseline Report (see Appendix 16A), muskox occurs throughout the RAA. It is an important species to Kitikmeot Inuit for food, clothing and other uses (NTKP 2018; Banci and Spicker 2024). Muskox represent an alternative source of meat when caribou and seal are not available and is important to the food security of communities in West Kitikmeot (see Volume 9, Section 25.2.2.3). Materials provided by muskox include hides, horns, and underwool (*qiviut*). Commercially, the meat is an important export for local communities and guided muskox sport hunting, as well as wildlife viewing, are increasingly common sources of local income.

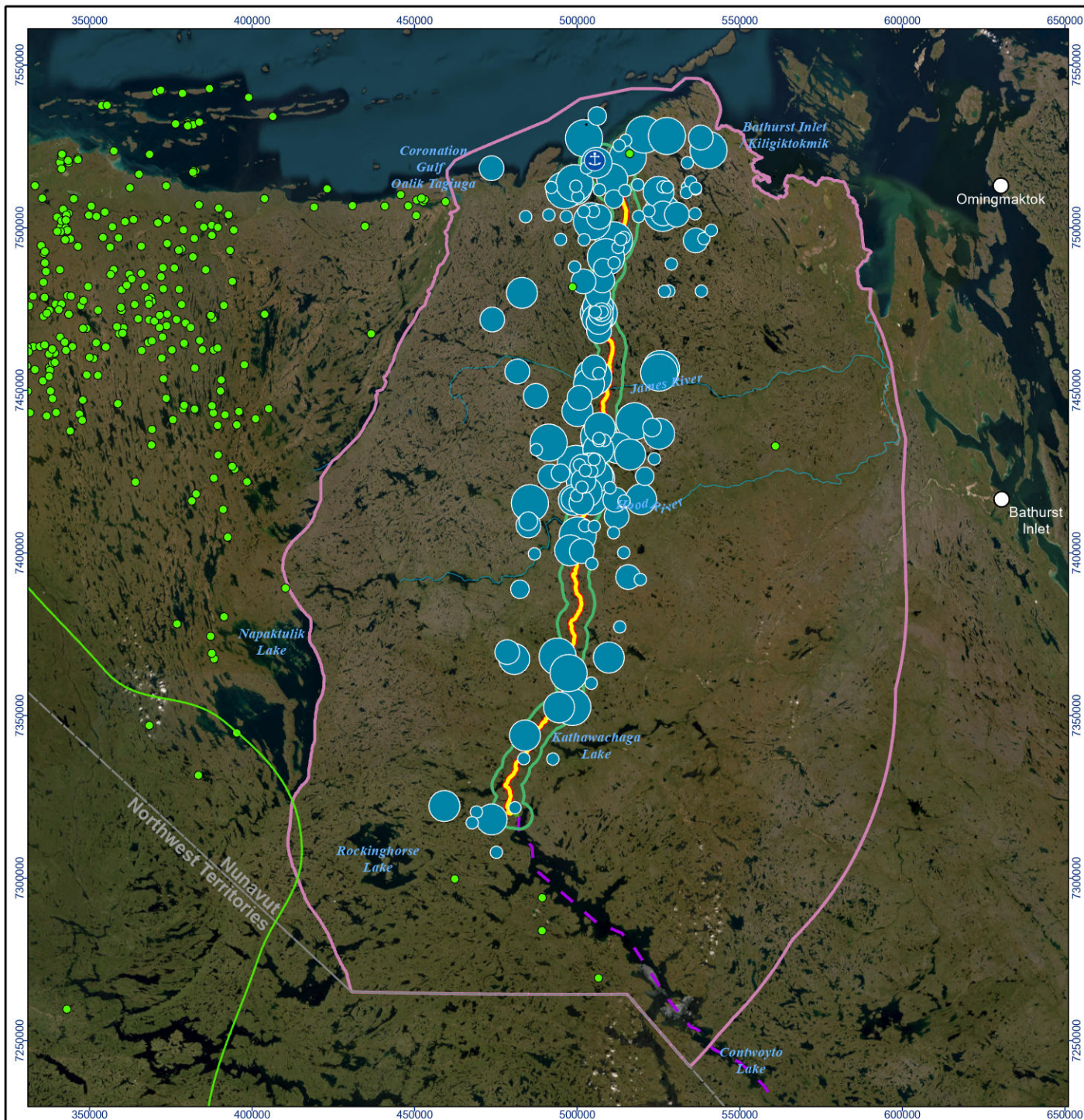
Muskox populations were reduced to near-extirpation levels across northern Canada in the late 19th and early 20th centuries, largely to supply whalers and the fur trade (Banci and Spicker 2024). A prohibition against the hunting of muskox was implemented in Canada in 1917 (Leclerc 2015). Since that time, muskox populations have been recovering, and in recent years the population in the West Kitikmeot region has shown increasing abundance (Leclerc et al. 2024; Banci and Spicker 2024). The current range of muskox extends across most of the Arctic islands and much of the mainland tundra of NU and NT (Gunn and Adamczewski 2003). The status of muskox in NU is considered Apparently Secure by the *Canadian Endangered Species Conservation Council* (Canadian Endangered Species Conservation Council 2022). Inuit Knowledge indicates that the muskox population is recovering, but there was an apparent decline in 2015 due to disease. Community members have been seeing muskox tracks all over the region (IAG 2025a) (see Figure 18.2).

The Project is in the Central Kitikmeot Group muskox management unit, MX-11, where population surveys since the 1970s have consistently aligned with Inuit local knowledge, indicating an uneven and variable distribution of muskox. Aerial surveys across the RAA showed fluctuating estimates: a 2005 survey found adult estimates ranging from 365 to 1,732 across RAA sections, while a 2013 systematic survey in the Kugluktuk subunit estimated a total of 6,746 muskox, with a much higher density in the northern stratum (24.66 muskox per 100 km² vs. 7.78 muskox per 100 km² in the south). The most recent and comprehensive 2022 survey estimated the total muskox abundance in MX-11 at 10,246 (with a density of 7.89 muskox per 100 km², confirming that distribution strongly favours the northern portions of the RAA toward bathurst Inlet. However, due to differences in methodology (as described in Gunn 1990). This best estimate cannot be directly compared with prior studies to establish a population trend.

Between 2004 and 2013, numerous Project-specific ungulate surveys were flown in the baseline RSA. Muskox density values, based on systematic observations made during the most recent of these surveys in 2012 and 2013, ranged from 0 to 8.8 muskox per 100 km² with an average of 3.9 muskox per 100 km² within the baseline RSA (see Volume 6, Appendix 16A). Muskox densities observed during the baseline surveys were highest in late summer and fall. Similar to other surveys completed in MX-11, muskox distribution was clumped, with the highest concentrations in the central and northern parts of the baseline RSA (see Figure 18.3), similar to the distribution indicated by Inuit Knowledge (see Figure 18.2).

Figure 18.2 Kitikmiut Knowledge of Omingmak (Muskox) in the Kogloktokayok (Grays Bay) Project Area (reproduced from Figure 19 Banci and Spicker (2024))





Notes
 1. Coordinate System: WGS 1984 UTM Zone 12N
 2. Data Sources: Government of Canada, Stantec, Natural Resources Canada, Government of Canada (<https://www.nrcan.gc.ca/earth-sciences/geography/download-geographical-names-data/9245>)
 Publication Date: Unknown
 Downloaded: September 7, 2021
 Last Checked: September 7, 2021

- Muskox Harvest Points
- ⚓ Grays Bay Port
- Grays Bay Road
- - - Grays Bay Winter Road
- - - Tibbitt to Contwoyto Winter Road
- - - Territorial Boundary
- Treeline
- Watercourse
- Local Assessment Area (LAA)

Regional Assessment Area (RAA)

Muskoxen Group Sizes

- 1 - 5 Muskoxen
- 6 - 10 Muskoxen
- 11 - 20 Muskoxen
- 21 - 30 Muskoxen
- > 30 Muskoxen

0 25 50 Kilometres
 (At original document size of 8.5x11) 1:1,800,000



Project Location
 West Kitikmeot Region
 Nunavut

Prepared by OliviaLeblanc on 2026-02-05

Client/Project

West Kitikmeot Resources Corp (WKR)
 Grays Bay Road and Port

24Y0376

Figure No.

18.3

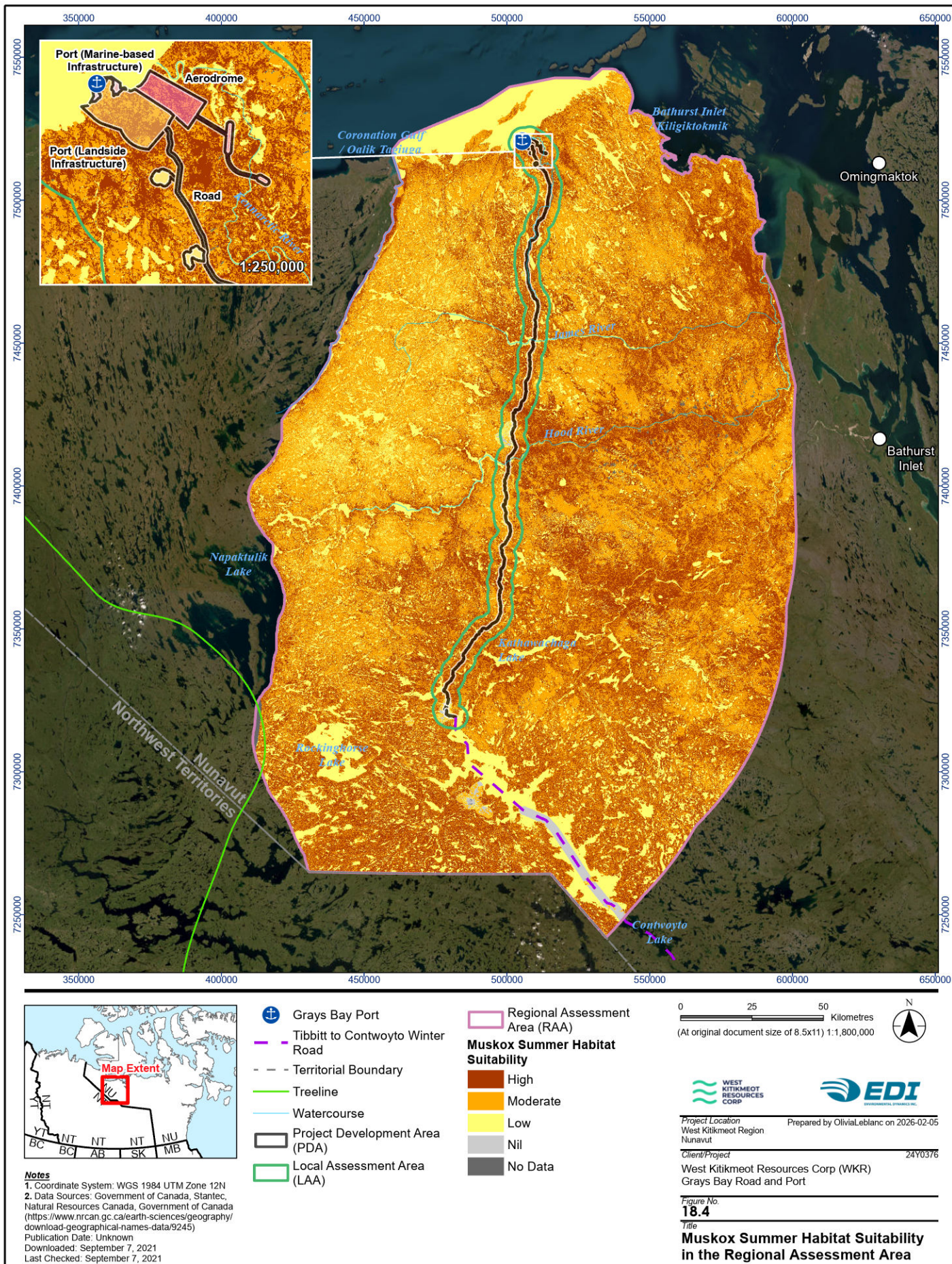
Baseline Study Muskox Observations and Regional Hunter Harvest Locations

Muskox are predominantly grazers adapted to foraging on graminoids but will also browse on shrubs and selectively forage for forbs and seeds. In most areas, their diet is dominated by sedges, grasses and willows, and the proportions of each likely reflect local availability and plant phenology (Ferguson 1991; Gunn and Sutherland 1997; Larter and Nagy 2004).

Inuit hunters in the Bathurst Inlet region report that muskox often concentrate in lowland habitats along drainages and on the coast in June and July to feed on greening vegetation but return to the uplands as the willow (*avalakiak*) leaves turn yellow (J. Tikhak in Gunn 1990). Inuit Knowledge holders also note that important muskox habitat includes eskers and islands (Golder Associates Ltd. 2003). In general, summer habitats consist of wetter, low-lying areas, including river valleys, lake shores, seepage meadows, and coastal plains (Klein et al. 1993; Danks and Klein 2002; Gunn and Adamczewski 2003). Muskox may remain in lowland habitats through the early winter, but by late winter, they often shift to windblown hilltops, slopes, and plateaus where snow has been blown away; winter snow depths of 20 to 50 centimetres (cm) may limit the ability of muskox to crater for food (Klein et al. 1993; Gunn and Adamczewski 2003).

Habitat suitability modelling for muskox within the RAA was completed for two seasons: summer (growing season) and late winter (see Figure 18.4 and Figure 18.5). During the summer season, high-quality habitats generally occur in wet-to-dry graminoid tundra and are most concentrated along major drainages and other low-lying areas. Modelled high-quality habitat was more common in the Ulu to Grays Bay area and across areas west of Contwoyto Lake. In both seasons, areas below the treeline were generally rated as low value. Table 18.5 and Table 18.6 show the amounts of each habitat rating for summer and late winter muskox habitat in each of the spatial boundaries for the assessment areas, respectively. These amounts account for a 71.6 km² reduction in suitable summer habitat and a 79.5 km² reduction in late winter habitat from those indicated by the land cover data, due to existing disturbance within the RAA.

Path: L:\PROJECTS\2024\W\H\4\Y0029_GBRP\24Y0376_EIS\mapping\aprx24Y0376_WildlifeEIS_Fig18.4_Muskox_SummerHSR_2026-02-05 By: OliviaLeblanc



Disclaimer: EDI Environmental Dynamics Inc. has made every effort to verify this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

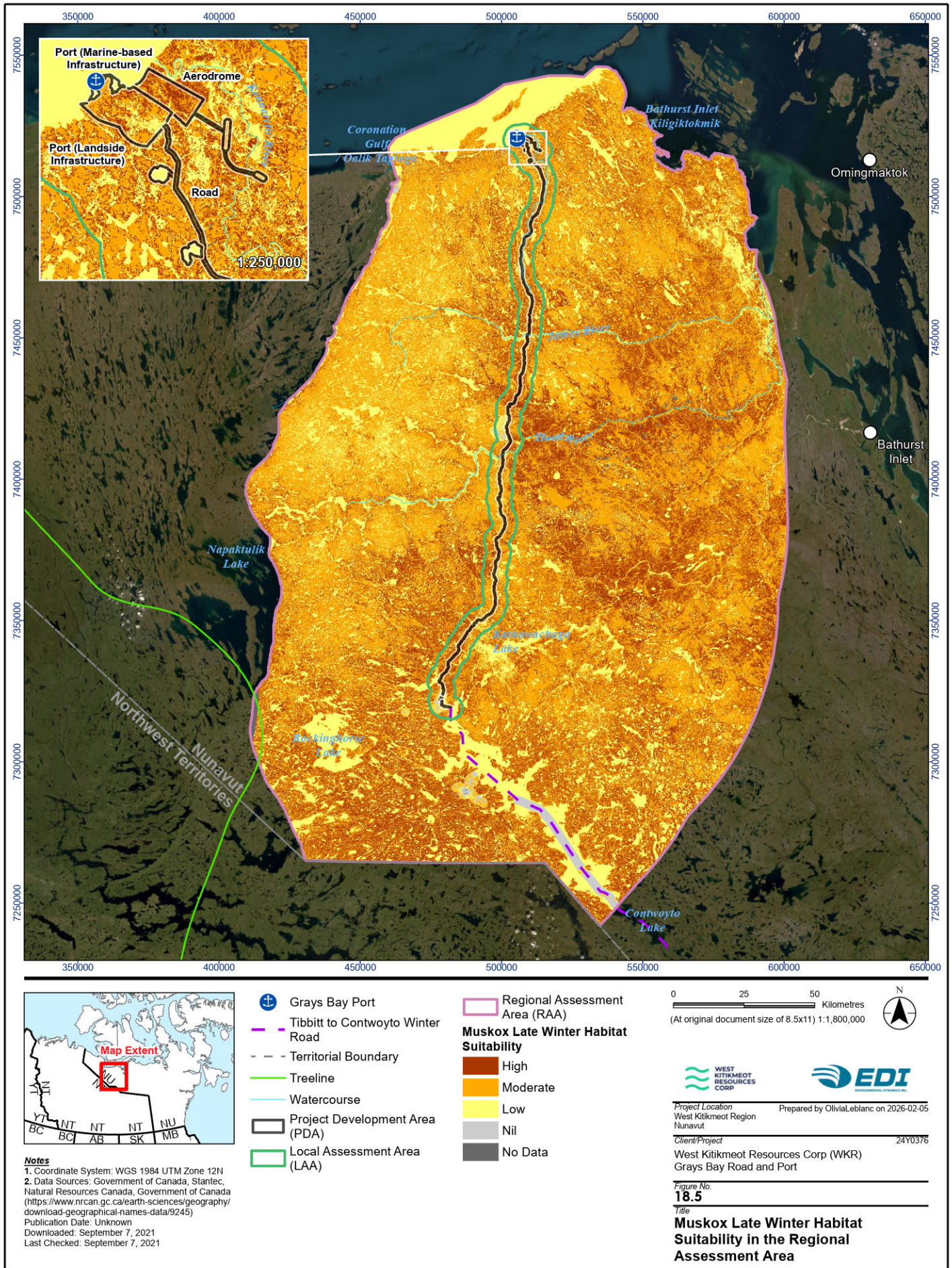


Table 18.5 Area and Percent of Suitable Muskox Summer Habitat within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	14,361.5	33.3	787.8	39.8	24.5	48.8
	Moderate	19,116.6	44.4	795.7	40.2	20.6	41.1
	Total	33,478.2	77.7	1,583.5	79.9	45.1	89.9
Non-Suitable Habitat	Low	9,229.9	21.4	373.2	18.8	4.0	8.0
	Nil	204.9	0.5	19.6	1.0	1.0	2.0
	Total	9,434.7	21.9	392.7	19.8	5.0	10.0
No Data		174.6	0.4	5.1	0.3	0.1	0.1
Grand Total		43,087.5	100.0	1,981.4	100.0	50.2	100.0

Table 18.6 Area and Percent of Suitable Muskox Late Winter Habitat within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	11,702.7	27.2	595.5	30.1	17.5	34.9
	Moderate	20,501.8	47.6	877.2	44.3	22.3	44.5
	Total	32,204.6	74.7	1,472.7	74.3	39.8	79.3
Non-Suitable Habitat	Low	10,494.4	24.4	482.6	24.4	9.2	18.3
	Nil	213.9	0.5	20.9	1.1	1.1	2.3
	Total	10,708.3	24.9	503.6	25.4	10.3	20.5
No Data		174.6	0.4	5.1	0.3	0.1	0.1
Grand Total		43,087.5	100.0	1,981.4	100.0	50.2	100.0

While muskox do not migrate to the extent of caribou, they do display some seasonal movements, as well as dispersion and changes in distribution, and will move between calving, rutting, and wintering areas (Reynolds 1998; Winbourne and Benson 2021; Banci and Spicker 2024). Inuit Knowledge from the project region describes muskox moving between calving areas and other seasonal ranges, as well as shifts in distribution from year to year (NTKP 2018; Banci and Spicker 2024). Fine-scale movements may be influenced by land cover, insect harassment, temperature, forage quality, topography, and photoperiod (Jingfors 1982; Schmidt et al. 2016; WMAC 2018). Muskox can travel between the mainland and islands over sea ice (Banci and Spicker 2024). During an advisory workshop with members of the IAG, members described how muskox will migrate between the mainland and the islands, walking continuously across sea ice (IAG 2025a).

Muskox home ranges are relatively small and tend to be larger in summer than winter or during calving season (Reynolds 1998). A study in the Sahtu region of NT found the mean range size of 10 collared cows to be much greater in summer (566.4 km²) than during winter (112.8 km²), spring (calving) (184.4 km²), or fall (257.7 km²) (B. Tacz, unpublished data in (Gunn et al. 2004)). Daily movements of muskox are greater in summer than other seasons, though they are still relatively sedentary. Reynolds et al. (2002) found mean daily muskox movements in summer (2.6 km/day) to be greater than in other seasons (1.1 to 1.4 km/day) and overall found muskox to move less than 5 km/day for 95% of all recorded moves. (Gunn and Fournier 2000) documented muskox moving seasonally 85 km from April to November from valleys to coastal uplands. A study in northeastern Greenland found that GPS-collared muskox travelled approximately 800 km per year, on average, with all collared cows staying within 40 km of the collaring location (Schmidt et al. 2016).

Inuit have hunted muskox in the West Kitikmeot for as long as they have occupied the region. Records of muskox harvest from the RAA near the Tree River, Contwoyto Lake, and Itchen Lake (*Tahikaffaloknahik*), date back to the 19th century (Freeman 1976). Long-term data from muskox harvest and population monitoring across northern Canada suggest that a harvest rate of 3% allows slow population growth, 5% results in population stability, and 7% leads to decline (Tener 1965). Following the establishment of the first muskox management unit in the region in the 1990s, the TAH has risen in response to muskox population growth. In 2015, the TAH for MX-11 was set at 225 individuals, corresponding to a harvest rate of approximately 3% of the population (Leclerc et al. 2024). This value was based on the 2013 survey estimate for the Kugluktuk subunit and the assumption that at least 750 muskox were in the eastern part of the MX-11 population (i.e., Bathurst Inlet). The 2022 GN-DOE survey for MX-11 resulted in a higher population estimate than previous surveys. The TAH for MX-11 in 2023 was raised to 350 individuals (NWMB 2023). Since 2015, reported muskox harvests in MX-11 have ranged from 78 to 124 individuals annually, averaging 94, for a harvest rate of approximately 1% (Leclerc et al. 2024).

Wolf and grizzly bear are the main predators of muskox in the region (Allen Kapolak [*Kingauk*], in Golder Associates Ltd. 2003; Thorpe Consulting Services Ltd. 2014b; NTKP 2018). During the 2013 GN-DOE muskox survey, a total of nine wolves and four grizzly bears were observed in the Kugluktuk subunit of MX-11 at a rate of 20 wolves per 100 hours and 13 grizzly bears per 100 hours (Leclerc 2015). In the 2022 GN-DOE survey, observers recorded nine wolves across MX-11, including five within the Project RAA.

18.2.2.2 Moose

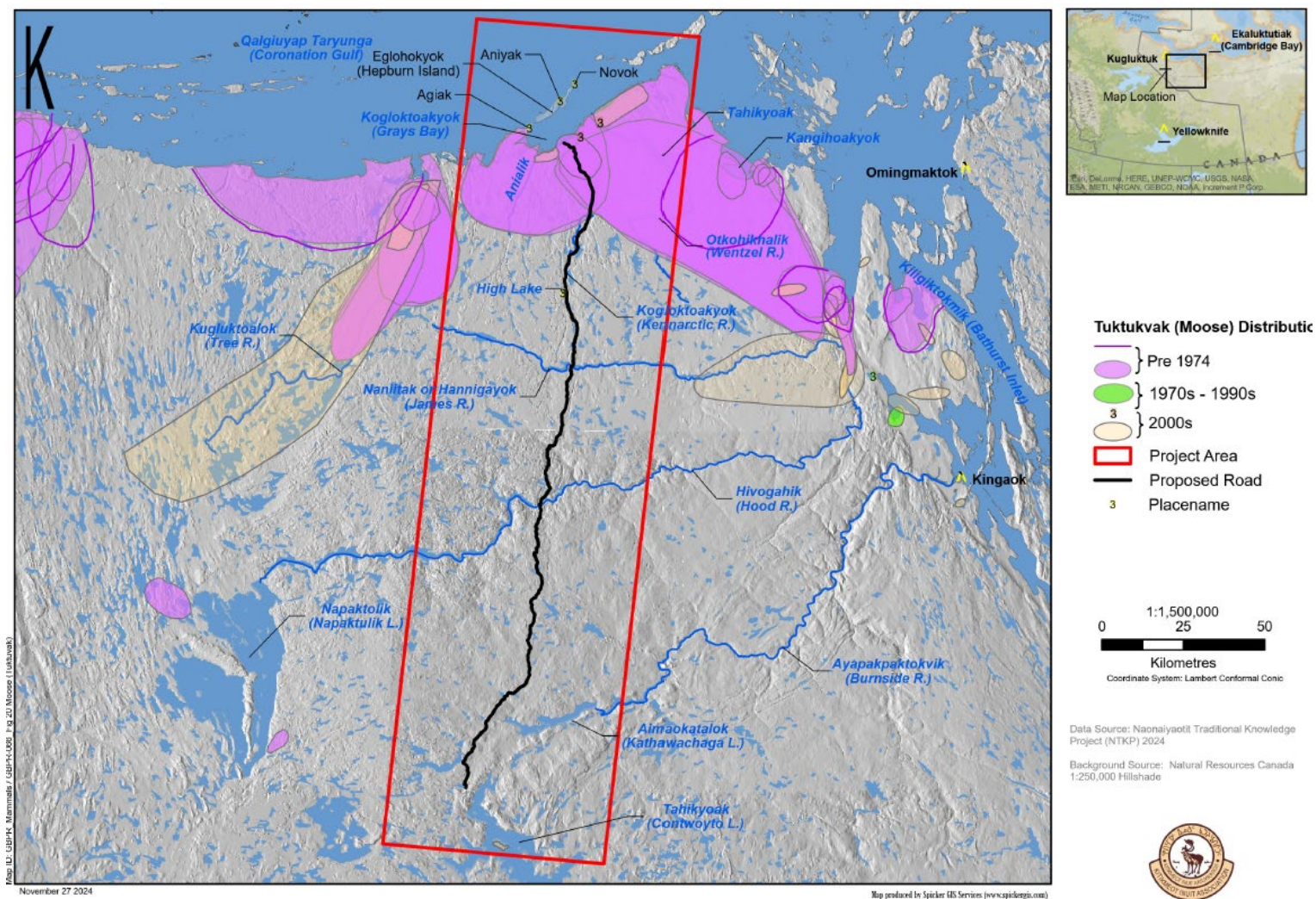
Within NU, moose only exist within the Kivalliq Region near treeline and within the Kitikmeot Region within treeline and along coastal tundra areas (Wildlife Research Section 2007; GN 2022). Moose are infrequently harvested in NU, with harvest mostly opportunistic rather than targeted. Inuit hunters in NU have free, unrestricted access to moose. Moose populations are not actively managed for conservation in NU, but harvest is regulated for residents and non-residents, with a limit of one, but no closed season. (GN 2024). Moose within the RAA are at the edge of their North American range in relatively poor habitat and are likely highly selective for areas with sufficient forage.

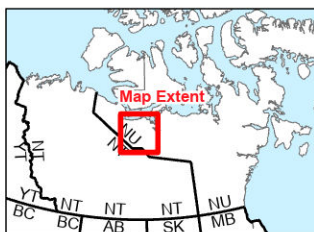
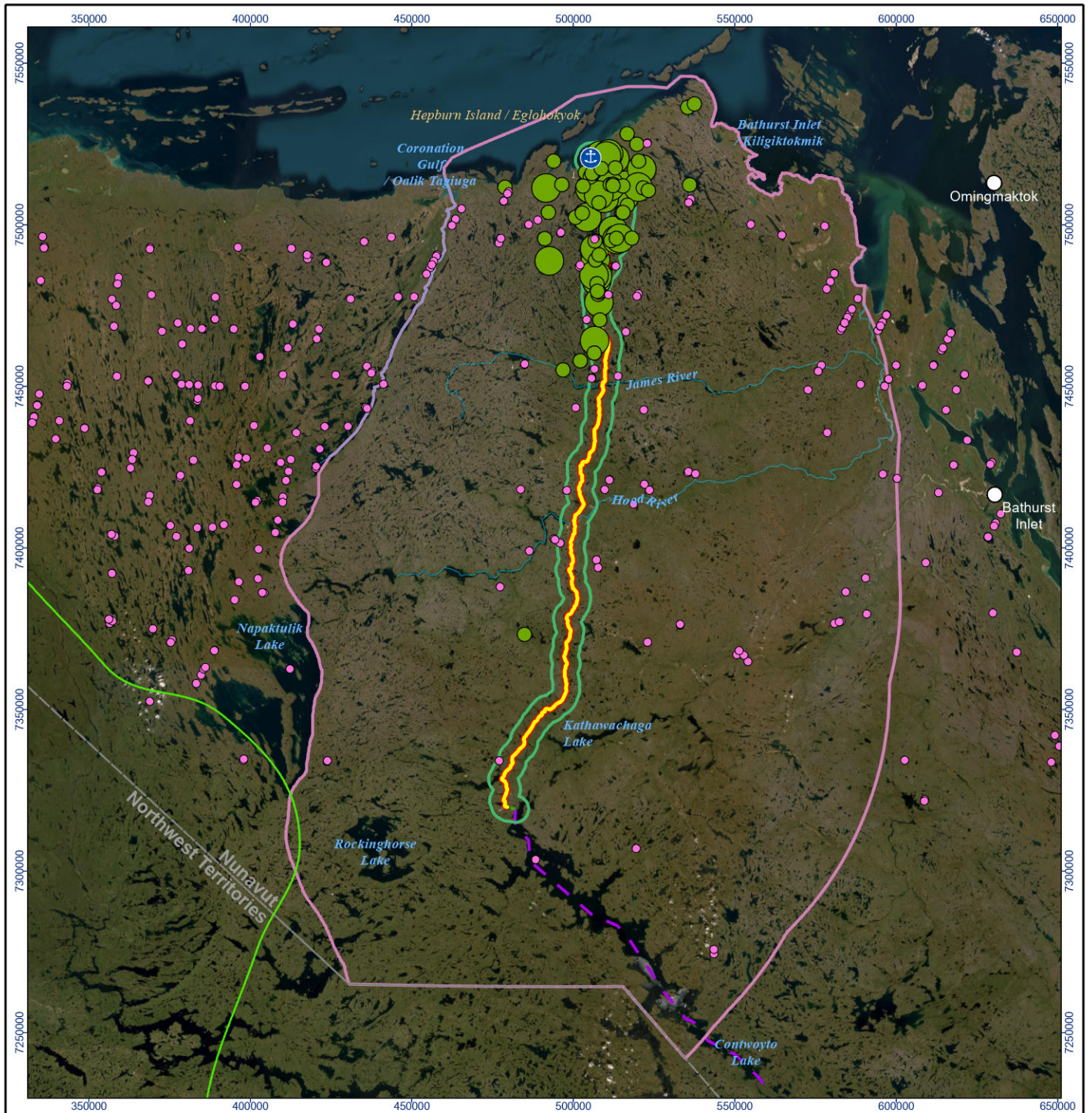
Based on 1990 estimates, approximately 224,000 moose inhabit Arctic North America, with the majority residing in Alaska (~155,000), and fewer in the Yukon (~60,000) and NT (9,000) (Karns 1997); NU populations are considered to make a negligible contribution to the overall arctic moose population, but no population estimates are provided in the literature. Currently, no population survey data or population estimates are available for moose in the RAA. Within the Taiga Shield Ecozone north of Great Slave Lake, moose density was estimated to be 2.0 to 3.5 moose/100 km² (Cluff 2005).

Within the western Kitikmeot Region, moose have been recorded in the Bathurst Inlet and Tree River areas since the early 1950s and 1960s, and in the Coppermine River area as early as 1872 (Kelsall 1972). Historical records show that very few moose were observed north of the Thelon River between the Coppermine River and Bathurst Inlet (Kelsall 1972). Banfield (1974) showed that moose distribution in western NU included the Coppermine River and a buffer along Coronation Gulf and the western side of Bathurst Inlet. Graf (1992) cited reports of moose inhabiting some river valleys on the tundra as far north as the Arctic coast. On the tundra of the Low Arctic Ecozone, moose were believed to occur in small concentrations in areas of thick willow growth (Treseder and Graf 1985).

In the RAA, moose habitat is primarily confined to river valleys and slopes with high shrub cover. The Grays Bay area is cited as having lots of willow that attract moose (Thorpe Consulting Services Ltd. 2014b). Inuit Knowledge shows that moose occur near the coastline of the Coronation Gulf from west of the Tree River to Bathurst Inlet. More recently, moose have been identified further south along the Tree River and in the east portion of the James River (Figure 18.6). Most observations of moose during baseline surveys occurred in valley bottoms or shrub habitats along river systems or coastal plains, corroborating Inuit Knowledge (NTKP 2018). These detections largely conform to the distribution provided by Kitikmiut (Figure 18.7) and that reported by Banfield (1974) described above, and may be related to higher shrub cover in these areas (Thorpe Consulting Services Ltd. 2014b).

Figure 18.6 Kitikmiut Knowledge of Tuktuvak (Moose) in the Kogloktokayok (Grays Bay) Project Area (reproduced from Figure 20 Banci and Spicker 2024)





Notes
 1. Coordinate System: WGS 1984 UTM Zone 12N
 2. Data Sources: Government of Canada, Stantec, Natural Resources Canada, Government of Canada (<https://www.nrcan.gc.ca/earth-sciences/geography/download-geographical-names-data/9245>)
 Publication Date: Unknown
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- Moose Harvest Points
- ⚓ Grays Bay Port
- Grays Bay Road
- Grays Bay Winter Road
- Tibbitt to Contwoyto Winter Road
- - - Territorial Boundary
- Treeline
- Watercourse
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)

Moose Observations (2004-2013)

- 1 Moose
- 2 - 4 Moose

0 25 50 Kilometres
 (At original document size of 8.5x11) 1:1,800,000



Project Location
 West Kitikmeot Region
 Nunavut

Prepared by OliviaLeblanc on 2026-02-05

Client/Project

West Kitikmeot Resources Corp (WKR)
 Grays Bay Road and Port

24Y0376

Figure No.

18.7

Title
Moose Observations from 2004-2013 in the Baseline RSA and Mortality Records from 2005-2022 in and around the RAA

Inuit Knowledge notes that moose numbers and distribution have increased (Banci and Spicker 2024). Inuit Knowledge indicates that moose are found near the James, Hood (*Hivogahik*) and Tree rivers, and also at Contwoyto Lake (NTKP 2018). Project survey data indicated that moose are only present in low numbers and are predominantly found in river valleys near Coronation Gulf, especially near Grays Bay, confirming the distribution information provided by the Inuit Knowledge (NTKP 2018). Baseline ungulate surveys within the RSA from 2004 to 2013 documented moose primarily in the High Lake to Grays Bay area, specifically from 10 to 15 km south of High Lake to the coast, along vegetated creek and river edges. A single incidental moose observation was made south of the James River; however, several mortality records are known from south of this river. Densities are thought to be relatively low in the northern RAA and very low in the southern RAA, with some dispersal of moose north from treeline into the southern RAA. Moose were observed in all seasons, from March to October, including all age and sex classes. During track surveys completed in March and April 2012, moose tracks were only observed between Ulu and Grays Bay. Many moose fecal pellets were found during borrow pit surveys in the High Lake area. In 2012 and 2013, four observations of cows with twins in the High Lake area were made; it is believed there were two sets of cows with twins in the area.

In 2022 during regional muskox surveys, moose were observed incidentally within the RAA (Leclerc et al. 2024). Incidentally, during bird surveys in 2025, a cow moose with twin calves was identified in the Aerodrome PDA in a small creek bottom containing willows. An adult female moose skull was also identified in upland, tall shrub habitat (i.e., dwarf birch) within the Port PDA. Moose pellets were regularly identified during wildlife surveys in 2025 near the Port PDA and aerodrome PDA.

Information on moose movement in NU is lacking. In general, moose can be migratory, resident, or somewhere in between, so movement patterns can vary from season to season or year to year (Sweanor and Sandegren 1989; White et al. 2014; Rolandsen et al. 2017; Berg et al. 2019; Hetta 2025). There was no indication from Inuit Knowledge that moose in the RAA are migratory. Inuit Knowledge notes that moose have used river corridors to move northwards (Banci and Spicker 2024). Moose have shown dispersal rates ranging from 2 km to 24 km per year (Rolley and Keith 1980; Hundertmark 1998). Seasonal movements for non-migratory moose in Alaska ranged from 2 km to 29 km, and in migratory moose ranged from 1 km to 57 km (Joly et al. 2015).

Inuit hunters in NU have free and unrestricted access to harvesting moose; however, annual harvest is limited to one moose per year for resident, non-resident, and non-resident foreigner, with no closed season (GN 2024). Between 1916 and 1959, people hunted moose in the willows along the Tree River (west of the Project area); however, moose were supplementary to other harvested species (Freeman 1976). Small numbers of moose continue to be regularly harvested in this area (Thorpe Consulting Services Ltd. 2014b). People in Kugluktuk have harvested moose for many years (Treseder and Graf 1985). Moose harvest within the RAA is likely minimal, as densities within the region are generally sparse and access for hunters is limited. The *Nunavut Wildlife Harvest Study* (Priest and Usher 2004) found that moose harvest within the western Kitikmeot Region was very low, with only two moose harvested in the Bathurst Inlet area and a reported five to seven moose harvested annually by Kugluktuk residents between 1996 and 2001 (Priest and Usher 2004). Moose have since become locally more abundant near Kugluktuk at the mouth of the Coppermine River and are now harvested more regularly for meat and skins (Kuliktana 2020). Recent records near Kugluktuk show a total of 98 moose harvested in March 2022 (Leclerc 2025). Within the RAA, wolves likely prey opportunistically upon moose, although the

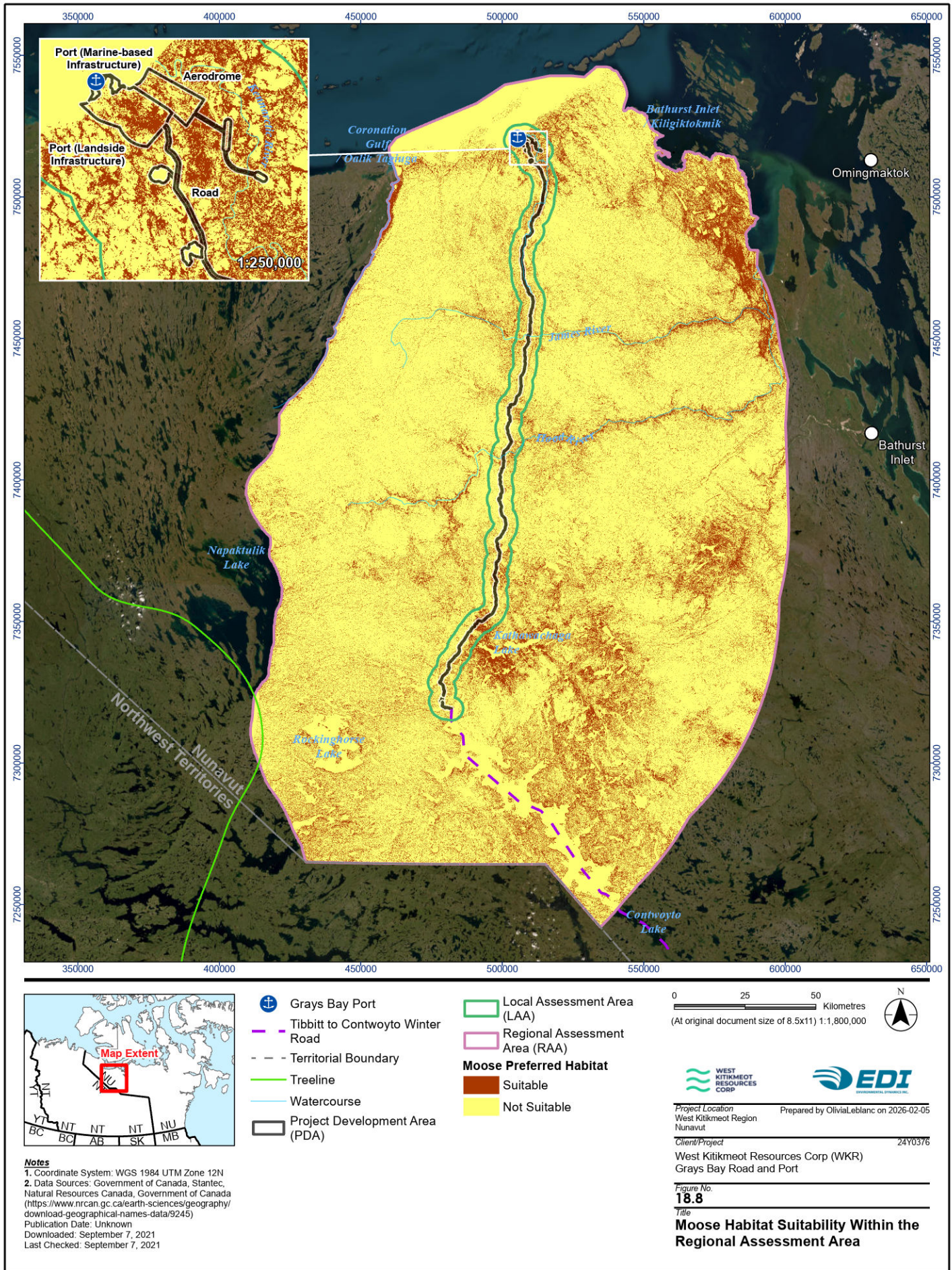
extent of predation is unknown. The ecology of wolves in the region is most closely associated with caribou, as wolves prey predominantly on caribou throughout most of the year (Kuyt 1972; Williams 1990; Heard and Williams 1992; Wiebe et al. 2009).

The habitat suitability rating identified limited areas where suitable habitat is present for moose within the RAA. Most of the suitable habitat is concentrated in the northern portion of the RAA near the port, along major streams and rivers, and a portion just north-northeast of Jericho Station (see Figure 18.8). Suitable habitat generally consists of tall shrubs in riparian areas adjacent to waterbodies and wetlands, as well as in some upland areas where tall shrubs dominate the landscape. Approximately 16.6% (7,158.7 km²) of the RAA contains suitable habitat (see Table 18.7). The PDA contains a higher proportion of suitable habitat (i.e., 31.9%) within its boundaries.

Table 18.7 Area and Percent of Suitable Moose Habitat within the Project Assessment Areas

Habitat Suitability	Project Assessment Area					
	RAA		LAA		PDA	
	Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable	7,158.7	16.6	424.5	21.4	16.0	31.9
Non-Suitable	35,928.7	83.4	1,556.9	78.6	34.2	68.1
Grand Total	43,087.5	100.0	1,981.4	100.0	50.2	100.0

Path: L:\PROJECTS\2024\W\H\4\Y0029_GBRP\24Y0376_EIS\mapping\aprx24Y0376_WildlifeEIS_Fig18.8_MooseHSR_20260205_Revise: 2026-02-05 By: Olivia Leblanc



Disclaimer: EDI Environmental Dynamics Inc. has made every effort to verify this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

18.2.2.3 Grizzly Bear

In Canada, grizzly bear is listed as Special Concern under Schedule 1 of the federal *Species at Risk Act*, S.C. 2002, c. 29 (SARA) due to global population declines, sensitivity to human disturbance, and high mortality risk in human-populated areas (COSEWIC 2012). The species' status as Special Concern indicates that the population is not at risk of immediate extinction but requires ongoing management to ensure its sustainability. NU does not have a status for the species; instead, the territory has a co-management plan that focuses on monitoring and sustainability.

Population and Distribution

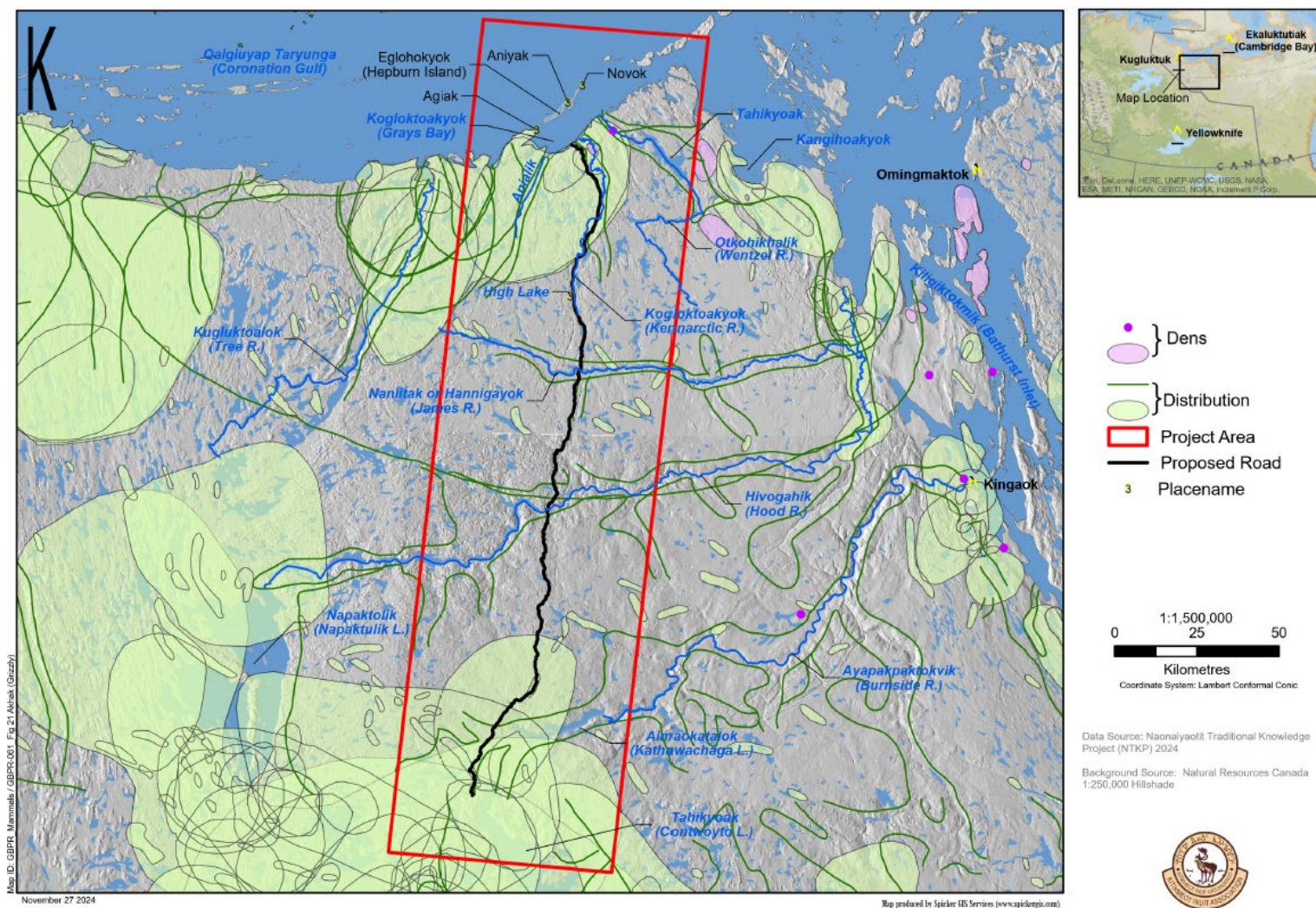
Inuit Knowledge indicates that grizzly bear are present throughout the RAA (Figure 18.9), occurring near the coastline within the Project area, as well as further south around Napaktulik Lake and Contwoyto Lake. Many of the areas identified for grizzly bears are associated with Inuit travel routes through the region, thereby accounting for more observations and/or hunting opportunities for grizzly bear. Inuit Knowledge also recognizes that grizzly bears occur near all major rivers within the RAA.

Although observations appear to be more numerous in the Ulu, High Lake, and Grays Bay areas, this reflects, in part, a greater presence of observers in those areas. Inuit Knowledge and recent studies indicate that densities differ between coastal and interior portions of the RAA (see Figure 18.9). Based on a study by Awan (Awan et al. 2025) the sub-grid sampled in the north had a lower density (2.4 grizzly bears/1,000 km²) than the sub-grid in the south (5.8 bears/1,000 km²). Inuit Knowledge observations (see Figure 18.9) confirm these metrics, indicating the greatest densities in the southern portion of the PDA.

Seasonal migrations to higher quality food sources likely occur; the calving Bathurst caribou herd along the Hood River likely attract a relatively high number of bears in June, and seasonal fish sources along the coast may draw in bears as well (Thorpe Consulting Services Ltd. 2014b; WMAC (North Slope), 2008).

Compared with other populations in North America, grizzly bears in the Central Arctic have very large home ranges and occur at low density in areas of relatively low productivity and habitat quality (McLoughlin et al. 2000). Recorded densities in tundra habitat are among the lowest on the continent (COSEWIC 2012). Rough population estimates for grizzly bears in NU, based on extrapolation of densities from local capture and collaring studies, ranged from 800 (minimum estimate) to 2,000 (typically 3.5 to 4 bears/1,000 km²), with most in the Kitikmeot Region (COSEWIC 2012). More recently, grizzly bear DNA studies across NU and adjacent regions show higher and broadly consistent population densities, typically ranging from 5.4 to 11 bears per 1,000 km², with variation among study areas and years. The most recent Kitikmeot-wide DNA surveys (2021–2023) found densities of 6.6 bears/1,000 km² in the west, 5.45 bears/1,000 km² in the central (the Project area), and 6.15 bears/1,000 km² in the east, for a regional estimate of 927 bears (Awan et al. 2025).

Figure 18.9 Kitikmiut Knowledge of Akhak (Grizzly Bear) in the Kogloктоаkyok (Grays Bay) Project Area (reproduced from Figure 21 Banci and Spicker (2024))



Barren-ground grizzly bears are expected to have lower reproductive rates than their southern counterparts because they occupy areas of low productivity and high seasonality (Gunn 1991; McLoughlin et al. 2000; Slavik 2010). In addition, barren-ground grizzly bears have later ages of maturity, smaller litter sizes, and lower birth rates than southern populations (McLoughlin et al. 2003a). The viability of the grizzly bear population depends on the high survival and productivity of adult females (McLellan 1989; Eberhardt et al. 1994; Garshelis et al. 2005; MacHutchon 2025). Annual grizzly bear mortality in NU is reported as relatively low compared to other jurisdictions.

Grizzly bear populations in the Arctic appear to have increased, and their range has expanded in recent years (Gunn 1991; Slavik 2010; Clark and Slocombe 2011; COSEWIC 2012; Dumond et al. 2015). Inuit, Indigenous, and Community Knowledge, combined with previous survey data and modelling, suggest the population of barren-ground grizzly bears in the Kugluktuk and West Kitikmeot/Slave Study (WKSS) study areas is stable to slightly increasing (Case and Buckland 1998; McLoughlin et al. 2003a; Inuvik Community Corporation et al. 2006; WMAC (North Slope) 2008; Thorpe Consulting Services Ltd. 2014b; Barrueto et al. 2023; Awan et al. 2025).

Habitat and Diet

Inuit Knowledge holders and western scientists have observed that, within home ranges, bears generally selected eskers and tall-shrub riparian habitats (De Beers Canada Inc. 2013), with tussock/hummock tundra favoured by males. Eskers harbour berry-producing shrubs and ground squirrels, and are used seasonally when those food sources are available (Gau et al. 2002). Riparian zones contain preferred horsetails and sedges and are often used by caribou for feeding. Studies by (McLoughlin et al. 2002a) indicated selection of esker, tussock/hummock tundra, lichen veneer (flat islands and low peninsulas with continuous mats of lichen), birch seep, and riparian tall shrub habitats at the landscape scale, with no major differences between sexes. Females with cubs differed from males and lone females in their habitat use, possibly to reduce interactions with other predatory bears (McLoughlin et al. 2002a).

Inuit Knowledge indicated that grizzly bears like rugged areas and/or sandy areas for denning, often along river banks (Wolfden 2006; NTKP 2018).

The bears' dens are found where the land is high, on a sandy ground or in rock caves. (NTKP 2018)

He mapped a grizzly den on the banks of Koglokoakyok and noted that they den in sandy banks. (NTKP 2018)

Western science supports these observations, with studies showing that barren-ground grizzlies prefer sandy substrates, tall shrub riparian habitats, and heath tundra for denning (Miller et al. 1982; McLoughlin et al. 2002b). Eskers were used to a lesser extent than previously documented (Miller et al. 1982; McLoughlin et al. 2002b), but they remained important year-round habitat for bears. The WKSS research examined 56 grizzly bear dens (McLoughlin et al. 2002b). The majority of grizzly bears entered dens in the last two weeks of October and emerged in early May. Although esker habitat was selected more than expected by chance, 60% of the dens were in heath tundra and heath-boulder habitats, with the remaining in riparian tall shrub and birch seep habitats, which likely help support the ceiling. Dens were generally north-, southeast-, and southwest-facing, constructed on well-drained, steep slopes, and

excavated in deep soil or under natural cover (Miller et al. 1982; Nagy 1990; McLoughlin et al. 2002b). A recent study in the NT showed preferences for rolling moraine, colluvial deposits, and alluvial plains for den construction (Smereka et al. 2017). The substrate was generally well drained. Most dens collapsed by mid-summer, thus most bears likely dig new dens each year (McLoughlin et al. 2002b).

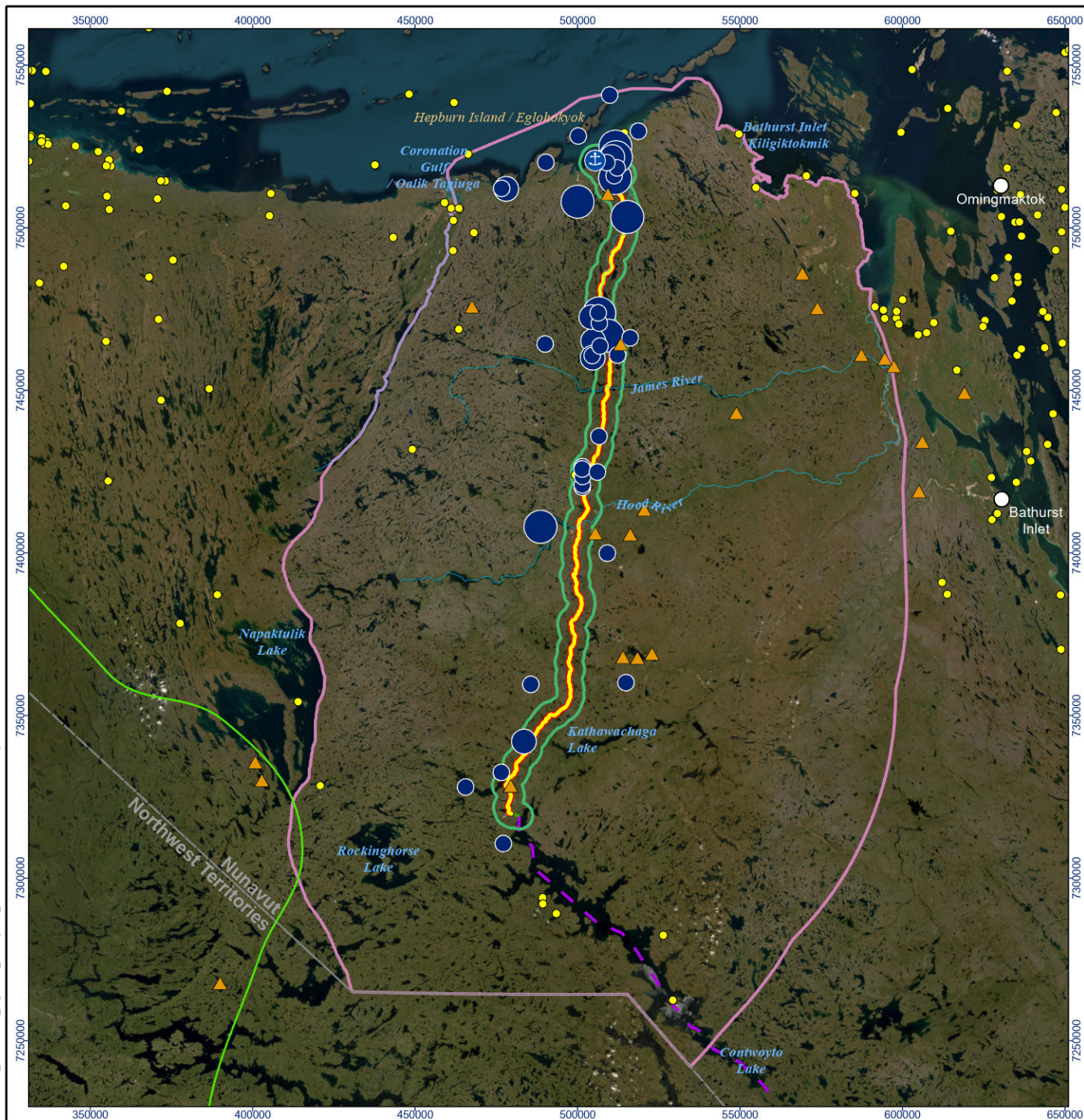
HSR for grizzly bear were applied within the RAA and adjusted for existing disturbances within the RAA (see Figure 18.11; see Table 18.8). High-quality habitat generally occurs in heath tundra and riparian shrub habitats, while lower-quality habitat occurs in the more bedrock- and boulder-covered classes west and southwest of High Lake and broadly within the treeline transition zone. Approximately 46% (19,847 km²) of the RAA contains high-quality grizzly bear habitat, 27% (11,452 km²) medium-quality habitat, 9% (4,094 km²) low-quality habitat, and 17% (7,520 km²) nil-quality habitat. Habitat quality was relatively evenly distributed throughout the modelled area, except for lower quality areas west and southwest of High Lake. Baseline conditions include a reduction of 40.4 km² of suitable (i.e., high- and moderate-rated) grizzly bear habitat due to existing disturbances within the RAA, as indicated by the landcover data.

Few grizzly dens were verified during project field work (see Figure 18.10), with suspected dens observed south of Grays Bay (mid-slope on a hill), and near Jericho Station (in glacio-fluvial material). Outside of the RAA (approximately 30 km southwest of the Izok area), one of the wolverine DNA posts was inadvertently placed about 10 m from a grizzly bear den.

Table 18.8 Area and Percent of Suitable Grizzly Bear Habitat within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	19,847.1	46.1	926.3	46.7	27.8	55.4
	Moderate	11,452.1	26.6	611.1	30.8	16.4	32.7
	Total	31,299.2	72.6	1,537.4	77.6	44.2	88.1
Non-Suitable Habitat	Low	4,093.6	9.5	144.6	7.3	2.9	5.8
	Nil	7,520.1	17.5	294.3	14.9	3.0	6.0
	Total	11,613.7	27.0	438.9	22.1	5.9	11.8
No Data		174.6	0.4	5.1	0.3	0.1	0.1
Grand Total		43,087.5	100.0	1,981.4	100.0	50.2	100.0

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Notes
1. Coordinate System: WGS 1984 UTM Zone 12N
2. Data Sources: Government of Canada, Stantec, Natural Resources Canada, Government of Canada (<https://www.nrcan.gc.ca/earth-sciences/geography/download-geographical-names-data/9245>)
Publication Date: Unknown
Downloaded: September 7, 2021
Last Checked: September 7, 2021

- ▲ Grizzly Bear Den Site
- Grizzly Harvest Points
- ⚓ Grays Bay Port
- Grays Bay Road
- - - Grays Bay Winter Road
- - - Tibbitt to Contwoyto Winter Road
- - - Territorial Boundary
- Treeline
- Watercourse
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)

Grizzly Bear Observations 2003-2013

- 1 Grizzly Bear
- 2 Grizzly Bears
- 3 - 5 Grizzly Bears

0 25 50 Kilometres
(At original document size of 8.5x11) 1:1,800,000



Project Location
West Kitikmeot Region
Nunavut

Prepared by OliviaLeblanc on 2026-02-05

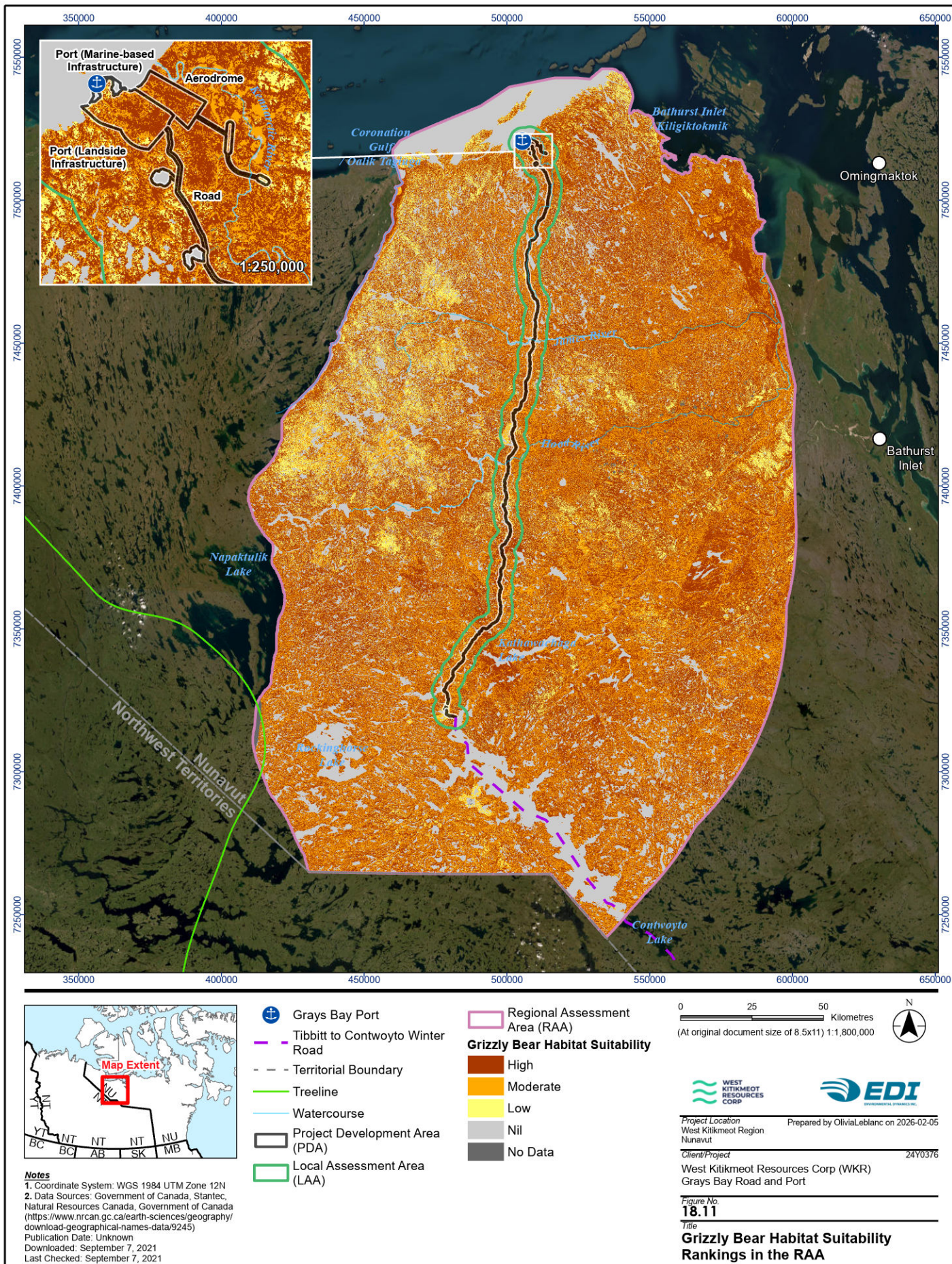
Client/Project
West Kitikmeot Resources Corp (WKR)
Grays Bay Road and Port

24Y0376

Figure No.
18.10

Title
Grizzly Bear Observations, Den Sites, and Mortality Locations in and around the RAA

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Both local Inuit Knowledge and scientific knowledge confirm that grizzly bears typically have a wide-ranging diet that is primarily herbivorous in most areas. However, Arctic grizzly bear populations demonstrate mixed diets and different foraging strategies (Edwards et al. 2011), with Inuit Knowledge and western studies showing that these populations have the highest terrestrial prey fractions among interior, non-salmon systems (Gau et al. 2002; Mowat and Heard 2006; WMAC (North Slope) 2008; NTKP 2018) due to the availability of caribou and, to a lesser extent, muskox.

Bears have the caribou calves for food, even the young muskox calves. They also have other young *wildlife* but mainly they eat the newborn caribou and muskox calves. (NTKP 2018)

Movement

The range of grizzly bears has been expanding northwards, with community members reporting that grizzly bears have crossed the Coronation Gulf to Victoria Island for the first time in living memory (Thorpe Consulting Services Ltd. 2014a, 2014b; NTKP 2018). Grizzly bears are also said to be coming closer to communities in search of food and becoming more of a nuisance (Golder Associates Ltd. 2010). In Kugluktuk, as in other communities in NU, community members are increasingly frustrated with nuisance grizzly bears coming closer to communities in recent years.

The bear population is growing in the Kugluktuk area. They are moving to Kugluktuk area from other areas. Gjoa Haven people say they have been seen on Victoria Island and on Holman Island. Some say the grizzlies are eating young polar bear cubs, as they've found dead cubs in an area with a big grizzly (NTKP 2018).

These days there are lots of bears. Long ago never used to be any bears on Victoria Island, but now lots of grizzly bears are coming. They are moving north (NTKP 2018).

There are more bears all over the coast and inland now (2013) whereas they were rarely seen many years ago. You were lucky to see them every once in a while. It's mostly a concern for camping, like staying in camps. People are more apprehensive if they have to go camping. Lots of bear sightings. (Banci and Spicker 2024)

Grizzly bears also exhibit seasonal movement that reflects the region's ecological constraints: in the spring, bears concentrate in snow-free areas, specifically along south-facing slopes and near den emergence sites, while summer use shifts to riparian areas (tall shrub habitat), sedge meadows, and coastal habitats with high marine and terrestrial prey availability. During the late summer and into autumn, bears focus on berry-rich tundra and coastal zones where carcass scavenging is possible before denning (McLoughlin et al. 2002a; WMAC (North Slope) 2008; Benson 2014).

Harvest and Mortality

In NU, Inuit have the right to hunt grizzly bears at any time of year, up to the full extent of their economic, social, and cultural needs. Currently, Inuit and Inuvialuit hunt grizzly bear for hides more than for subsistence (WMAC (North Slope) 2008). Non-beneficiaries (residents and non-residents) can only hunt adult bears not accompanied by a cub during August 15 to October 31 and April 15 to May 31 in designated grizzly bear management zones. The Nunavut Wildlife Management Board (NWMB) regulated

the non-resident/non-resident foreigner sport hunt of grizzly bears with an annual quota of 10 for the Kitikmeot Region; however, in June 2019, the NWMB increased the annual sport hunt quota to 15 tags for the Kitikmeot Region and 10 for the Kivalliq Region (Awan 2021). Non-residents are subject to a trophy fee and must report their harvest. Subsistence harvesting reports are voluntary, and therefore existing reporting data may be incomplete (Awan 2021).

While the NWMB has authority under the *Nunavut Land Claims Agreement Act, S.C. 1993, c.29* to establish a TAH that limits the total number of animals that may be harvested in a given year, no formal TAH has yet been set for grizzly bears (Wildlife Research Section 2007; GN-DOE 2017). In practice, management relies on community quotas for non-resident sport hunts and on voluntary reporting of Inuit harvest. The current quota system serves as an informal or partial expression of TAH principles, allocating opportunities to non-beneficiaries within sustainable limits, while Inuit harvesting remains governed by their inherent rights rather than numerical caps.

From 2013 to 2019, a total of 232 grizzly bears were reported harvested in NU, 93 in the Kitikmeot and 139 in the Kivalliq (Awan 2021). Grizzly bear harvest was concentrated in the western Kitikmeot, in the vicinity of Kugluktuk, Cambridge Bay, and along the traditional travel route from Cambridge Bay to the Bathurst Inlet area. The proportion of adults in the Kitikmeot harvest was 60%. Between 2009 and 2024, six grizzly bears were harvested in the Central Kitikmeot Region (the area where the Project lies) (Awan et al. 2025). The average harvest in the Kitikmeot from 2013 to 2019 appears to have been relatively stable (average of 13 bears harvested/year), with a slight increase in the last three hunting seasons (Awan 2021). NU-wide human-caused mortalities from 2001 to 2010 averaged 15 hunter kills and eight bears killed for defence and other causes annually (COSEWIC 2012). Mean rates of kill in response to conflicts with humans for that decade, as a proportion of total known kill, were therefore roughly 30% in NU.

18.2.2.4 *Wolverine*

Wolverine are solitary carnivores with low population densities and large home ranges distributed throughout most of northern and western Canada (COSEWIC 2014). They are both scavengers and predators, relying on a diversity of foods including birds, small mammals, and large prey such as ungulates to offset the uncertainty of food availability in the harsh northern environment (Banci 1987; Mulders 2000; Lofroth et al. 2007; van Dijk et al. 2008; Species at Risk Committee 2014). Caribou (62%) and muskox (11%) form the bulk of wolverine diet for animals in the Kitikmeot Region (Mulders 2000), and are most often consumed as carrion (Magoun 1987). Wolverine also consume a variety of other species, including Arctic ground squirrels (*hikhik*; *Spermophilus parryii*), voles, lemmings, ptarmigan, and seals (Mulders 2000). In preparation for the food-scarce winter season, wolverines will often store food in caches for future retrieval and consumption (Magoun 1987). In warmer months, wolverine will supplement their diet with berries, roots, and other vegetation. Wolverines are an important cultural and economic resource for the people of the NT and NU. By some accounts, Inuit speak highly of the wolverine for its intelligence and cunning (NTKP 2018; Glass et al. 2022). However, Inuit have also considered wolverine a pest due to their propensity to raid food caches (Laugrand 2019).

Regional Inuit Knowledge suggests that wolverine populations may be declining in the RAA due to a reported decrease in the number of sightings (Banci and Spicker 2024). However, field studies since 2003 suggest wolverines are more abundant in parts of NT and NU than previously thought, and the species appears to be expanding its range eastward and northward (COSEWIC 2014; Thorpe Consulting Services Ltd. 2014b; ECCC 2024). Overall, wolverine populations are thought to be increasing in the Arctic (Glass et al. 2022), and density in the Kitikmeot Region is considered to be increasing or stable (ECCC 2024).

Within proximity to the RAA, pooled wolverine population densities at High Lake and Izok between 2005 and 2012 were comparable with densities observed at Daring Lake, NT, and the two diamond mines in the Lac de Gras area of the NT (3.9–11.4 wolverines/1,000 km²) (Boulanger and Mulders 2013). These densities are similar to those estimated in 2018 (3.10 wolverines/1,000 km²) and 2019 (4.14 wolverines/1,000 km²) near Napaktulik Lake, in the Kitikmeot Region in NU (Awan et al. 2020). Density estimates in the Kitikmeot Region have ranged up to 4.80 wolverines/1,000 km² (Boulanger 2013). While these estimates indicate that wolverines in the Kitikmeot Region exist at relatively moderate densities (Awan et al. 2020), they are higher than those recorded in other parts of NU (ECCC 2024).

The home ranges of adult wolverines in the Slave Geological Province (NU and NT) were estimated to be 125 km² for females and 400 km² for males, while movements of yearlings (likely dispersal-related) resulted in much larger ranges (Mulders 2000). These home ranges are smaller than the mean home range size for adult wolverines in other areas of North America and Scandinavia, which can be up to three times larger (Species at Risk Committee 2014). The home ranges of male wolverine typically overlap those of several females, as the species follows a polygynous mating system (multiple females per male), but overlap of adult male-male and female-female home ranges is rare due to highly territorial behaviour (Persson et al. 2010). Research has found mixed results regarding sex differences in dispersal distance, and it is generally thought that males disperse in search of mates, while females disperse in search of resources (Vangen et al. 2001, Dalerum et al. 2007). Within the 3,000 km² High Lake and Izok DNA study areas, movements of individual wolverines ranged up to 130 km (High Lake) and 127 km (Izok) between survey posts. The two longest distances moved among posts within each study area were by males.

Project personnel have made 30 wolverine sightings since 2003, including three groups of three individuals. Most observations were clustered in the northern portion of the RAA, likely due to greater observer presence and higher wolverine habitat quality compared to more central parts of the area. Inuit Knowledge sources identify an abundance of wolverine in the Grays Bay area (Banci and Spicker 2024). Inuit have observed sea ice use by wolverine, consistent with observations made during project-related studies; for example, three wolverines were observed on sea ice in the northern portion of the Grays Bay region during marine mammal surveys in mid-June 2004, including two individuals 15 km north of Hepburn Island. In mid-July 2008, a wolverine was observed during seabird nest surveys on the ice near the westernmost of the Jameson Islands, 10 km off the mainland. Track counts along the proposed road route in March and April 2012 detected wolverine tracks between 10 km south of Ulu and Grays Bay ($n = 16$ sets of tracks), and none along the rest of the road alignment to the south.

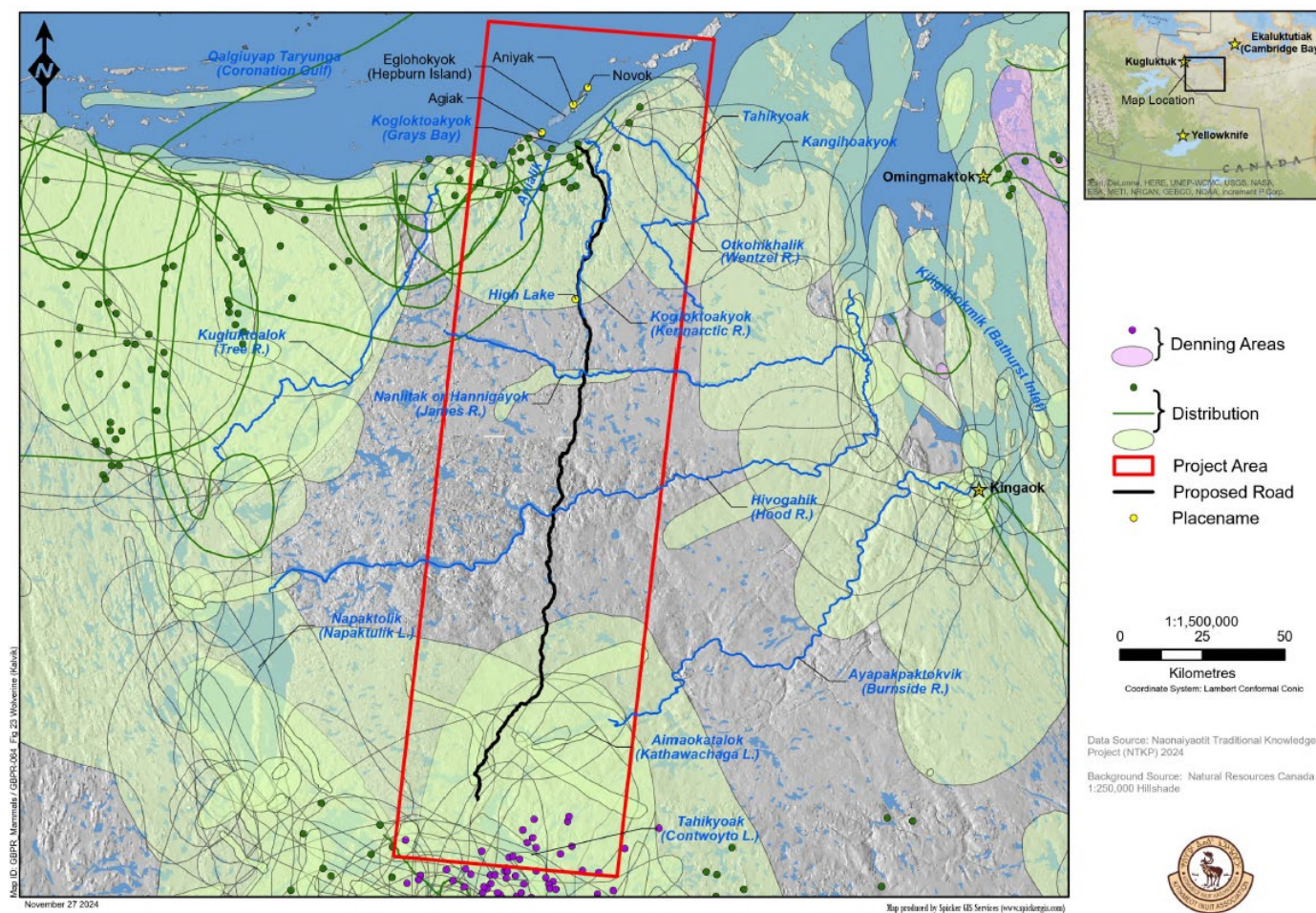
Inuit Knowledge descriptions of wolverine distribution in and around the RAA indicate wolverine use areas at the northern and southern portions of the RAA more frequently, with a thin horizontal strip of use in the central latitudes of the RAA along the James River, as shown in Figure 18.12 (Banci and Spicker 2024). Inuit Knowledge has identified numerous denning areas in the southern portion of the RAA, though none have been identified in areas further north (Banci and Spicker 2024). Inuit Knowledge states that the habitat most important for wolverine are rocky areas, crevices and cliffs. Rocky areas provided security and hiding cover to escape wolves, bears, and hunters, while cliffs were used for scavenging and caching food (Banci and Spicker 2024).

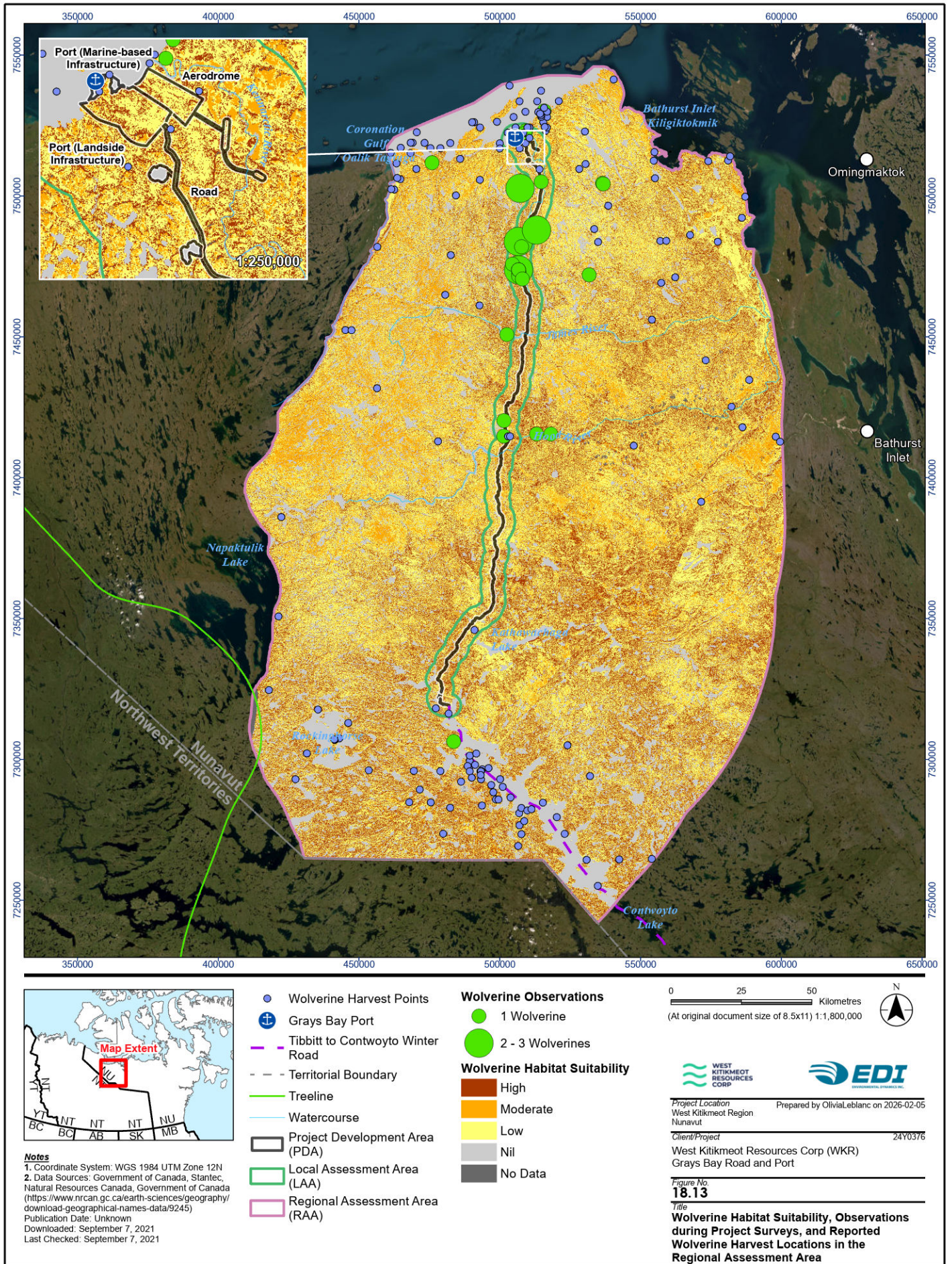
Habitat suitability rating suggests that almost two-thirds of the RAA is composed of low- and nil-quality wolverine habitats (see Table 18.9). On average, the northern portion of the RAA contained lower-quality habitat than the southern portion, though there was a relatively high concentration of Moderate-quality habitat in the northwestern portion of the RAA (see Figure 18.13). High-quality habitat generally occurs in sedge and tussock habitats and was found to be largely concentrated in a band approximately 10 to 20 km wide from Grays Bay to Ulu, as well as scattered throughout much of the southern portion of the RAA (see Figure 18.13). Approximately 25% (10,566 km²) of the RAA contains High-quality wolverine habitat, and 12% (4,937 km²) Moderate-quality habitat, resulting in 36% (19,845 km²) of the RAA constituting Suitable (High- and Moderate-quality) habitat for wolverine (see Table 18.9). Baseline conditions include a reduction of 14.9 km² of suitable wolverine habitat due to existing disturbances within the RAA from that indicated by the landcover data.

Table 18.9 Area and Percent of Suitable Wolverine Habitat within the Project Assessment Areas

Habitat Suitability Rating		Project Assessment Area					
		RAA		LAA		PDA	
		Area (km ²)	%	Area (km ²)	%	Area (km ²)	%
Suitable Habitat	High	10,565.6	24.5	570.5	28.8	15.4	30.6
	Moderate	4,936.8	11.5	165.6	8.4	3.1	6.2
	Total	15,502.4	36.0	736.1	37.2	18.5	36.9
Not Suitable Habitat	Low	19,844.5	46.1	925.4	46.7	27.9	55.5
	Nil	7,566.0	17.6	314.7	15.9	3.8	7.5
	Total	27,410.5	63.6	1,240.1	62.6	31.6	63.0
No Data		174.6	0.4	5.1	0.3	0.1	0.1
Grand Total		43,087.5	100.0	1,981.4	100.0	50.2	100.0

Figure 18.12 Kitikmiut Knowledge of Kalvik (Wolverine) in the Kogloктоayok (Grays Bay) Project Area (reproduced from Figure 23 Banci and Spicker 2024)





Inuit Knowledge identified many of the areas classified as Suitable by the HSR to be suitable wolverine habitat based on the provided descriptions of wolverine habitat preference and distribution (Banci and Spicker 2024) (see Figure 18.12 and Figure 18.13). This congruence shows agreement between HSRs based on western scientific approaches and those based on Inuit, Indigenous, and Community Knowledge. Academic research on the topic has also found a high degree of correspondence between wolverine distributions in NU, defined by both Inuit Knowledge and Western Science (Kowalchuk 2011). However, while the HSRs classified patchy areas of high-quality habitat across the RAA's latitudinal range, Inuit Knowledge mainly identified areas of high wolverine utilization in the northern and southern parts of the assessment area.

Inuit Knowledge states that wolverine natal dens tend to be found in rocky areas and/or areas with cliffs, and that wolverine do not den in eskers or dig holes in the ground for denning. Dens are thought to consist of snow tunnels within boulder fields that terminate in a crevice. This Inuit Knowledge is largely consistent with the academic literature, which has found that most wolverine natal den sites in Alaskan alpine tundra are associated with deep snow cover persisting into spring, providing protection from predators and cold temperatures (Magoun and Copeland 1998). Denning habitat on the tundra may require rocky outcrops and extensive snowdrifts, which likely are not limited in West Kitikmeot (Lee and Niptanatiak 1996; Wolfden 2006). As such, there is likely an abundance of wolverine denning habitat present in the RAA. Wolverines are particularly sensitive to disturbance during natal denning in late winter and early spring (February 15 to May 31), when females require secluded areas with persistent spring snow or insulating substrates such as peat moss (Magoun 1985; Copeland et al. 2010; Scrafford and Boyce 2015; Jokinen et al. 2019).

Wolverine are harvested throughout the North and used for domestic consumption, mainly for their frost-resistant fur, which is used as parka trim. Local harvesters often sell this fur to auction houses and, as a result, wolverine harvest contributes to the local economy of Northern communities. Under the *Nunavut Land Claims Agreement Act* furbearer harvest rights are held by Inuit, non-Inuit who legally harvested furbearers in the Nunavut Settlement Area before 1981, and non-Inuit whose application has been approved and recommended by local Hunters and Trappers Organizations (HTO; Awan 2025). Inuit in West Kitikmeot keenly hunt and/or trap wolverines wherever and whenever possible, resulting in moderate to high harvest near communities and along travel routes (Banci and Spicker 2024). The GN-DOE Wildlife Research Section (2007) considers wolverines in the mainland West Kitikmeot Region to be abundant as part of a core area (W/01), and in 2007 recommended a total annual harvest of 160 wolverines for the West Kitikmeot portion of the core area (W/01-KT). In NU, there were 691 recorded wolverine harvested from 2019 to 2024, with 397 from Kitikmeot, 290 from Kivalliq, and 4 from Qikiqtaaluk (Awan 2025). Hunting with rifles accounted for 84% of reported wolverine harvest in NU, while trapping accounted for only 16%, contrary to trends in most other Canadian jurisdictions (Awan 2025). No limit is set for wolverine harvest by Inuit in NU, and there is no requirement for hunters to report their harvest. Wolverine harvest in NU tends to be concentrated near communities (Awan 2025).

Wolverine carcass collections in the Kugluktuk and Bathurst Inlet areas have been conducted to varying degrees since the mid-1980s, with increased effort since 1995. On average, about 120 wolverines per year were harvested in West Kitikmeot in the second half of the 1990s (Mulders 2000). Based on harvest data obtained from the GN and covering 1999 to 2015 ($n = 1,293$), most wolverines were harvested in areas southwest, south, and southeast of Kugluktuk, and to a lesser extent along the coast of Coronation

Gulf and in the immediate vicinity of the Bathurst Inlet area (Mulders 2000; M. Awan, GN, unpublished data, December 2016). Limited harvest has occurred in the upland areas west of Bathurst Inlet, including the majority of the RAA (see Figure 18.13) (Mulders 2000; M. Awan, GN, unpublished data, December 2016). Annual harvests during this period have declined from an average of 104 annually (range = 84–129) from 1999 to 2006, to an average of 51 (range = 40–77) from 2007 to 2015 (M. Awan, GN, unpublished data, December 2016). However, it remains unclear whether this decrease is due to local declines in wolverine availability or reduced trapping effort. Wolverine harvest within a 100 km radius of the PDA has been primarily restricted to areas along or near the coast, and to a lesser extent in the southern portion of the PDA west of Contwoyto Lake (see Figure 18.12). Since 2008, only eight wolverine were recorded as harvested in the northern portion of the RAA (mainly along the coast), and only one in the southern portion of the RAA (Contwoyto Lake area; see Figure 18.13). Reporting of wolverine harvest in NU is voluntary, and the number of harvested animals is likely underreported (ECCC 2024).

Between 1998 and 2011, 27 wolverines were reported as either being killed or relocated from the Lac de Gras region in NT in connection with mine-related activities, usually following an extended period of habituation to the site and multiple deterrent attempts (Mulders, unpublished data 2013 in Species at Risk Committee 2014). A single wolverine was hit and killed by a vehicle on the Tibbitt Contwoyto Winter Road in 1996 (Banci, pers. comm. In EBA Engineering Consultants Ltd. 2001). At the Ekati Diamond Mine in NT, from 1997 to 2024 only one wolverine was killed from a vehicle collision in 2024, while 10 died from non-vehicle-related causes during the same time period (but none since 2005; ERM Consultants Canada Ltd. 2025). The frequency of wolverine incidents at mine sites has declined since the mid-2000s due to enhanced waste management and mitigation measures (e.g., building skirting). While wolverines in the Arctic are susceptible to high rates of parasitism (Watson et al. 2020; Sharma et al. 2021), only one case of wolverine mortality from disease has been documented in the Arctic (Woodford and Beckmen 2012; Glass et al. 2022), indicating that disease has a negligible direct effect on wolverine mortality.

18.2.3 Inuit, Indigenous, and Community Knowledge and Engagement Feedback

Through the Project-specific engagement program delivered between 2016 and 2025, including community meetings, workshops, community-based primary research, the Project-specific Inuit Knowledge report, compiled from the NTKP database, and through a review of publicly available information, Kitikmiut, other Indigenous groups, and other potentially affected communities shared information, expressed concerns, and provided recommendations related to other wildlife. This feedback has been considered and summarized in Table 18.10, and where applicable, has been integrated into the assessment of potential effects on other wildlife that follows.

Table 18.10 Summary of Inuit, Indigenous, and Community Knowledge and Engagement Feedback

Comment	Source	WKR Response	Where Addressed
NTKP consultants identified wildlife species of cultural importance, as well as important wildlife habitat and wildlife harvesting areas IAG members shared that all wildlife in general is of concern, including bear, muskox, and moose.	Banci and Spicker 2024; IAG 2025a	WKR recognizes the importance of all wildlife, including grizzly bear, muskox, and moose to Inuit. A summary of the information compiled on these species can be found in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A). These species are included as Indicator species in the Other Terrestrial Wildlife assessment.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Muskox – Sections 18.4 to 18.7; Moose – Sections 18.8 to 18.11; Grizzly bear – Sections 18.12 to 18.15.
NTKP consultants reported that prior to the arrival of Europeans, muskox (<i>omingmak</i>) was one important element in Inuit diet that by necessity was varied, in space and in time. Muskox were used when caribou and seals were not available. Inuit hunted them during all seasons except summer. Nunamiut hunted muskox during the winter, as they were a source of fresh meat when <i>tuktuik</i> were wintering in the boreal forest and not accessible. The larger bulls had tough meat, and Inuit preferred the smaller female cows and young animals. Less desirable meat would be fed to the dogs. Muskox provided a wealth of needed materials. Muskox meat and fat, if taken from a suitable animal and at a suitable time, was tasty and appreciated by Inuit. Muskox fat was not used for the <i>kudlik</i> (stone oil lamp) because muskox were not sufficiently numerous, compared to caribou. The hide was too thick and too stiff to be used for clothing but was used as bedding under caribou skins and for dog mats. Part of the hide might be used for trim. Wigs were made out of the thick muskox hair to protect the head from biting insects. Muskox horns were made into cups, bowls, carvings, fish spears, bow parts, and ulu handles.	Banci and Spicker 2024	WKR appreciates this information on how muskox is valued and used seasonally by Inuit. This is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A)

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Comment	Source	WKR Response	Where Addressed
(cont'd from above) Before rifles, Inuit hunted muskox using bows and arrows. The best season to kill muskox was in the fall after the animals grew new coats and were fat, and before the rutting season, while the meat was still good. Muskox coats were of good quality in the winter. In summer, muskox were skinny, the pelt quality was poor, and the meat was not good to eat.			
IAG members reported that muskox generally avoid noise, activity, and vehicle exhaust	IAG 2025a	Indirect effects from the Project include sensory disturbances like noise, human activity, and vehicles. These sensory disturbances are accounted for through the Zone of Influence, which is evaluated in potential effects on muskox change in habitat and change in movement. WKR has identified mitigation measures to reduce the influence of sensory disturbances from the Project on muskox. Mitigations are also identified in the <i>Wildlife Mitigation and Monitoring Plan</i> (Volume 11, Appendix 34B; WMMP). WKR commits to continued engagement with Kitikmiut, other Indigenous groups, and potentially affected communities throughout the life of the Project as project design, planning, and monitoring advance.	Section 18.4.1 Change in Habitat; Section 18.4.2 Change in Movement; <i>Wildlife Mitigation and Monitoring Plan</i> (Volume 11, Appendix 34B)
Through publicly available literature, changes in wildlife dynamics are commonly adapted to by changing the timing and location of harvesting activities, as well as the choice of species hunted. Kugluktuk residents are reported to have access to many traditional food species, including caribou, musk ox, moose, geese, ringed seal, Arctic char and lake trout	Prno et al. 2011	WKR recognizes that Kugluktuk residents value the variety of wildlife in the area. This is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A). Grizzly bear, muskox, and moose are included as Indicator species in the Other Terrestrial Wildlife assessment, and hunting is addressed in the Change in Mortality Risk sections for each of these wildlife species.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Muskox – Section 18.4.3; Moose – Section 18.8.3; Grizzly bear – Section 18.12.3.

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Comment	Source	WKR Response	Where Addressed
Through publicly available literature, Inuit shared that hunting and harvesting retain social, cultural and economic significance.	Prno et al. 2011	This information helps to inform how muskox and moose are valued by Inuit. This is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A), and why they are included as an Indicator species for this effects assessment. The Project will provide Inuit more access to the land for hunting, which is identified in the Change in Mortality Risk sections for both muskox and moose.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Muskox – Section 18.4.3; Moose – Section 18.8.3.
NTKP consultants reported that by the 1970s muskox had reoccupied much of their range in the Bathurst Inlet and <i>Kogloktokyo</i> (Kennarctic River) areas. Within the project area, habitat and harvesting areas were specifically mapped around the rivers. Muskox distribution changes regularly and that is why they can be seen one year and not the next.	Banci and Spicker 2024	Inuit Knowledge on the preferred habitats for muskox was incorporated into the habitat suitability models. Elder accounts of historical declines in muskox populations in the region, along with hunters' knowledge of the current distributional increase in the population, have been used to describe baseline conditions in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A) and to evaluate potential effects on muskox mortality and movement.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Section 18.4.2 Change in Movement; Section 18.4.3 Change in Mortality Risk.
NTKP consultants reported that moose (<i>tuktukvak</i>) were primarily known and used by Inuit living near the treeline. Only some consultants had experience with moose. Like muskox, moose were increasing in numbers and distribution. Occasionally <i>tuktukvak</i> were found at extensive distances from the boreal forest, predominantly when they had followed river corridors north. Moose were seen in winter, as well as in other seasons.	Banci and Spicker 2024	This information has been incorporated into the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A);

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Comment	Source	WKR Response	Where Addressed
During the original project application (B2 Gold), the mine application, there was an area identified close to the marine laydown area just west of southern Bathurst Inlet that traditionally was an area that was important for moose hunting. When we learned this, we redesigned the winter ice road to avoid that area. So, through traditional knowledge, it was shared with us that that was an important area for winter -- for moose hunting, so we redesigned our winter ice road to avoid that area. Additionally, when there is traffic along the winter ice road, we have mitigation measures, wildlife mitigation measures in place for that trucking. If they encounter wildlife, they are to stop, And that includes moose.	NIRB 2024a	The B2 Gold Project is outside of the RAA; however, similar mitigation measures are proposed for wildlife encounters along the Project's roadway, to reduce effects on moose movement and mortality.	Section 18.8.2 Change in Movement; Section 18.8.3 Change in Mortality Risk
IAG members shared that the numbers of moose are increasing. In the past, it was rare to catch a moose near Kugluktuk, but now, there are more being hunted. They shared that the women in the past didn't know how to prepare moose hides, but there was a training course on how to tan them and now people can.	IAG 2025a	WKR appreciates historic information on how moose populations have changed in the area, and how the Inuit have learned new ways to use the harvested animal. This information is incorporated in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A)

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Comment	Source	WKR Response	Where Addressed
NTKP consultants stated that grizzly bears (<i>akhak</i>) were important animals to Inuit and were hunted in the spring and fall, when they carried high levels of fat. Grizzly bears used to be rare, but numbers have increased in recent years (especially along the coast), which has led to a decline in ground squirrels (<i>hikhik</i>), a preferred food source for bears. Grizzly bears are extensively distributed throughout the west Kitikmeot, which is causing safety concerns for people in camps. <i>There are more bears all over the coast and inland now (2013) whereas they were rarely seen many years ago. You were lucky to see them every once in a while. It's mostly a concern for camping, like staying in camps. People are more apprehensive if they have to go camping. Lots of bear sightings.</i> <i>In the summer I see grizzly bears almost anywhere where there is an abundance of meat, such as on the caribou migration routes. I also find that the bears work the eskers for hikhik. They dig out the hikhik and feed on them.</i>	Banci and Spicker 2024	WKR appreciates learning how Inuit value grizzly bear, and their knowledge on their abundance, where they occur on the land, and the animals they prey upon. This information is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A), and it incorporated into the assessment of changes in movement and mortality risk.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A) Section 18.12.2 Change in Movement; Section 18.12.3 Change in Mortality
During project engagement, the Kugaaruk Hamlet shared that grizzly bears started coming up from the south five to 10 years ago (c. 2015-2020); they commented that grizzly bears have been observed in the area of the proposed road. The Kugaaruk Hamlet recommended wildlife monitors be given high-powered rifles in case of human-wildlife conflicts.	GBRP 2025	This information has been incorporated into the assessment of changes in movement and mortality of grizzly bears.	Section 18.12.2 Change in Movement; Section 18.12.3 Change in Mortality
NTKP consultants reported that grizzly bears occur throughout the Project Area although few specific areas for denning were mapped. One consultant mapped a grizzly den on the banks of <i>Kogloktokyo</i> and noted that they den in sandy banks. Others reported: <i>Bears make their dens on the river slopes and around the coast. Long ago Inuit used bows to hunt them. The bears' dens are found where the land is high, on a sandy ground or in rock caves.</i>	Banci and Spicker 2024; NTKP 2018	This information has been incorporated into the assessment of habitat changes for grizzly bear and the potential for changes to seasonal movements from dens to foraging areas.	Section 18.12.1 Change in Habitat; Section 18.12.2 Change in Movement

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Comment	Source	WKR Response	Where Addressed
A Gjoa Haven Hamlet representative noted that polar bears, grizzlies, caribou, and muskox slow when they first see a road, but once they are used to it, they don't slow down to cross.	GBRP 2025; IAG 2025a	WKR appreciates this information on wildlife behaviour and it's been incorporated into the assessment of changes in movement and mortality for grizzly bear and muskox and considered in the development of mitigation measures.	Grizzly bear – Section 18.12.2 Change in Movement; Section 18.12.3 Change in Mortality; Muskox – Section 18.4.2 Change in Movement; Section 18.4.3 Change in Mortality Risk
During a public scoping meeting for the NIRB, Cambridge Bay community members shared that there are moose near the mouth of Tree River. Members also shared that there are moose moving into Cambridge Bay.	NIRB 2025b	WKR appreciates this information on moose distribution in the region. This information is incorporated in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A)
During a public scoping meeting for the NIRB, Gjoa Haven community members expressed concern regarding construction in winter months and how that would affect wildlife.	NIRB 2025b	WKR acknowledges the concerns of the community. The potential effects of construction on wildlife have been assessed for all seasons, with specific mitigation measures in place for winter construction activities. These mitigations are also described in the WMMP.	Muskox – Section 18.4; Moose – Section 18.8; Grizzly bear – Section 18.12; Wolverine – Section 18.16; <i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B).</i>
During a public scoping meeting for the NIRB, community members from Kugaaruk shared that muskox populations have increased near the community.	NIRB 2025b	WKR appreciates this information on muskox population trends near the community. This information is incorporated in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A)

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Comment	Source	WKR Response	Where Addressed
During project engagement, the Kugaaruk Hamlet expressed concerns regarding rocks from trucks injuring wildlife and the potential effects on wildlife from blasting.	GBRP 2025	WKR acknowledges the concerns from community members. These concerns are reflected in the mitigation measures for Change in Habitat and Change in Movement assessments for each Indicator species. These mitigations are also described in the WMMP.	Muskox – Section 18.4; Moose – Section 18.8; Grizzly bear – Section 18.12; Wolverine – Section 18.16; <i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B).</i>
During project engagement, students at the Kugaaruk High School expressed concern regarding the effects on wildlife and wildlife harvesting.	<u>GBRP 2025</u>	WKR appreciates the students' feedback and concerns about how the Project may affect wildlife and future wildlife harvesting. The effects assessment evaluated different potential effects on the Indicator species. Wildlife harvest was identified in the Change in Mortality Risk section for each Indicator species.	Muskox – Section 18.4; Moose – Section 18.8; Grizzly bear – Section 18.12; Wolverine – Section 18.16;
During project engagement, the Taloyoak Hamlet expressed concerns regarding cumulative effects to wildlife due to exploration activity, commenting that wildlife interactions with exploration sites could spread disease. The Taloyoak Hamlet recommended annual wildlife monitoring.	GBRP 2025	The effects assessment considered the cumulative effects on wildlife from activities identified in the Project Inclusion List. Exploration activities were included as both past, present, and reasonably foreseeable future activities, which were incorporated into the cumulative effects assessment (CEA). The Project is committed to annual wildlife monitoring to verify its contribution to cumulative effects on wildlife as described in the follow-up monitoring section of this effects assessment.	Muskox CEA – Section 18.5; Moose CEA – Section 18.9; Grizzly bear CEA – Section 18.13; Wolverine CEA – Section 18.17; Follow-up Monitoring – Section 18.22.
During a public scoping meeting for the NIRB, Talyoak community members shared that smaller terrestrial animals burrow into the land and inquired about the effects on their dens from the Project.	NIRB 2025b	While terrestrial animals smaller than wolverine were not explicitly examined in this assessment, mitigation measures developed for the indicator species, such as pre-construction wildlife sweeps and no-disturbance buffers on identified wildlife features will also apply to smaller animals. These mitigations are described in the WMMP.	<i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B).</i>

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Comment	Source	WKR Response	Where Addressed
NTKP consultants reported that trapping was an important activity for Inuit and part of many other winter harvesting activities. Inuit trapped and traded the pelts of many animals, including caribou, white and red fox, Arctic hares, ground squirrels, grizzly bears, wolverine, wolves and muskrat. However, the primary furbearer that was trapped was Arctic fox (<i>tigiganiak</i>). Wolves and wolverine were not important pelts for sale to the fur market until snowmachines were introduced and Inuit could hunt them effectively. Much of the trapping for wolves, foxes and wolverine was concentrated along ocean shorelines and along river banks where the terrain was gentler and travel was easier. NTKP consultants reported that red fox are semi-migratory. They travel to the coast during springtime for subsistence, with their diet primarily being newborn seals.	Banci and Spicker 2024	WKR appreciates the Inuit's cultural practices of trapping furs, and where trapping efforts were focused on the landscape. This information is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A). The potential for trappers to use the Project to access new areas for trapping is considered in the Change in Mortality Risk section for wolverine.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Wolverine Change in Mortality Risk – Section 18.16.3
NTKP consultants explained that before the fur trade wolverine (<i>kalvik</i>) had little importance to Inuit because they were not common and hard to trap. Mostly they were regarded as pests that caused damage by breaking into caches, destroying property and stealing food. When there was a market, wolverine pelts were consistently high in value and sought after. The use of wolverine fur as trim on parkas is a relatively recent custom but this local use by Inuit became very important. In the past, Inuit used wolverine pelts as fur mats when hunting seals. Inuit hunted wolverine however they could, by stalking them, and by using rifle-traps when firearms became available. When steel traps and snowmachines were introduced Inuit became effective in hunting wolverine and the personal use of pelts increased. Life on the land was often very difficult, and Inuit took advantage of all resources on the land. If they were hungry, they would eat wolverine but they needed to cook the meat for a long time before it was edible.	Banci and Spicker 2024	WKR appreciates how the Inuit valued wolverine and used their pelts, and how harvest practices evolved with the introduction of new trapping tools and snowmachines. This information is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A), and wolverine harvest is addressed in the Change in Mortality Risk of the effects assessment.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Wolverine Change in Mortality Risk – Section 18.16.3

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Comment	Source	WKR Response	Where Addressed
NTKP consultants stated that the distribution of wolverine and wolf (<i>amagok</i>) are essentially the same. All of Bathurst Inlet was important, because of the importance of the area for caribou, and the importance of caribou as a food source for wolverine. <i>This (Bathurst Inlet area) is heavily populated wolverine country. Wolverine like to hang around big rivers. Wolverine country is rugged country, big rivers, where there are mountains and boulder fields. Wolverine stay under rocks or in crevices where they escape to... Here around Kingaok (and southeast Bathurst Inlet) they always go into these crevices and over here too (south of Kongokyoak on Kent Peninsula)... The coast and islands in the Project Area were known as places to get wolverine. I have been trapping in that area (Kogloktokyoak) for many years. There are lots of wolves but not very many foxes there. There are lots of wolverine. Its kind of hard (to harvest there) there because its rugged and rough country. Lots of wolverine along Eglohokyok (Hepburn Island) on the northeast shore, then north on ocean. Also I saw wolverine on ice just west of Eglohokyok when there was water on the ice (spring). I camped on the ice. I followed the shoreline and hunted out on the ice. Nobody was over there then. There were lots of wolverine tracks. I look for tracks and see the wolverine running away. I would chase it. They would go to where it was rocky. Wolverine like rough ground that is very rocky with holes, so there are a lot of wolverine in that area (Grays Bay). There is also shallow water in that area for them to catch fish and berries. They like rough areas like the grizzly.</i>	Banci and Spicker 2024	WKR values Inuit Knowledge on wolverine ecology, the type of terrain and geographical location of where wolverine are found, and how they prey on caribou. This information is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A). The terrain features information helped classify suitable wolverine habitat in habitat suitability modelling, which forms the basis for assessing project-related changes in wolverine habitat. Inuit Knowledge discussed observations of wolverine travelling across sea ice and tendencies to use rocky areas as escape habitats to avoid risk. This is considered in the assessment of project-related change in movement for wolverine.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Wolverine Change in Movement – Section 18.16.2; Change in Mortality Risk – Section 18.16.3

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Comment	Source	WKR Response	Where Addressed
NTKP consultants suggested that wolverine have been scarcer recently because snowmachines had made them easy for Inuit to capture and kill. The habitats most important for wolverine were rocky areas, crevices and cliffs. Rocky areas provided security and hiding cover, to escape wolves, bears and Inuit. Cliffs were used for scavenging and for caching food. Wolverine did not den in eskers or dig holes in the ground for denning. Natal dens were found in rocky areas and areas with cliffs. A den consisted of snow tunnels within boulder fields terminating in a crevice. Wolverine could use willows for bedding material. <i>You find kalvik at caribou crossings.</i> <i>The wolverine hunting and den sites are found where there are caribou because they eat caribou that were killed by other animals... They rest in their dens, in snow dens and in rock crevices. They have snow dens just about anywhere. Some wolverine are very smart when they run away towards rocks or rocky areas.</i> <i>I've seen many wolverine around the rock crevices where they bring back food to their dens... I've also seen them in the rough areas where we have buried food before... I've found dens in the rock crevices and snow banks, when I'm hunting in those areas.</i> <i>There are many, many areas like that (boulders and rugged) in here. All this area (Bathurst Inlet) is so rugged. Everywhere is potential wolverine habitat, denning areas... The areas that (are important for wolverine) have a lot of rabbits.</i>	Banci and Spicker 2024	WKR appreciates the Inuit Knowledge on the terrain wolverine uses for denning, the Elders' knowledge on wolverine population status changing with hunters using snow machines, the type of terrain wolverines use, and how wolverines would scavenge and cache food. This information is reflected in the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A). The terrain features information helped classify suitable wolverine habitat in habitat suitability modelling, which forms the basis for assessing project-related changes in wolverine habitat. Descriptions of wolverine denning habitat are considered in the assessments of baseline conditions, change in movement, and change in mortality risk.	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A); Wolverine Change in Habitat – Section 18.16.1 Change in Movement – Section 18.16.2; Change in Mortality Risk – Section 18.16.3
During project engagement, Kugluktuk HTO representatives indicated that updated wildlife information is available on the caribou herds, as well as on grizzly, wolverine, and wolf populations.	GBRP 2025	The most recent data on wolverine and grizzly bear populations have been acquired from the GN and are incorporated into the <i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A).	<i>Wildlife Baseline Report</i> (see Volume 6, Appendix 16A)

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Comment	Source	WKR Response	Where Addressed
During a public scoping meeting for the NIRB, Kugluktuk community members shared that health of moose and muskox should be looked at.	NIRB 2025b	WKR acknowledges the community's concerns about the possible effects of the Project on moose and muskox health. The Project is not expected to introduce contaminants into the environment at levels that would adversely affect the health of moose and muskox.	<i>Water Resources</i> (see Volume 7, Section 19); <i>Marine Water and Sediment Quality</i> (see Volume 8, Section 21); <i>Human Health Risk Assessment Report</i> (see Volume 9, Appendix 26A)
During a public comment period for the NIRB, Kitikmeot Inuit Association expressed concern for significant impacts on muskox, grizzly bears, wolverines, and their habitats. In particular, Kitikmeot Inuit Association expressed concern about wildlife avoiding human development areas, resulting in long-term shifts in their migration patterns, calving areas, and increased energy expenditures, as well as population-level effects.	NIRB 2024b	WKR shares the KIA's concerns about the potential for significant project effects on habitat and movement patterns of muskox, grizzly bear, and moose. These potential effects are a primary focus of this assessment, with mitigation measures developed to avoid or reduce effects on habitat and movement patterns. These mitigations are also described in the WMMP.	Muskox – Sections 18.4.1 & 18.4.2; Moose – Sections 18.8.1 & 18.8.2; Grizzly bear – Sections 18.12.1 & 18.12.2; <i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B)</i> .
During a public comment period for the NIRB, Kitikmeot Inuit Association identified that construction camps and human use areas can attract grizzly bears and other carnivores and scavengers such as wolverines, if waste is not carefully managed. Kitikmeot Inuit Association recommended mitigation measures to discourage bears from approaching camps and reducing human-wildlife conflicts.	NIRB 2024b	WKR appreciates this information from the KIA about the potential for project activities to attract carnivores and scavengers, which may result in human-wildlife conflict. This pathway of effects has been examined for grizzly bear and wolverine as part of the assessment of Change in Mortality Risk and mitigation measures have been developed to reduce attractants and the potential for human-wildlife conflict.	Grizzly Bear Change in Mortality Section 18.12.3; Wolverine Change in Mortality Risk – Section 18.16.3 <i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B)</i> .
During a public comment period for the NIRB, Inuvialuit Game Council commented that they were especially concerned about disturbances to wildlife and wildlife habitat.	NIRB 2024b	WKR shares the IGC's concerns about the potential for disturbances to wildlife and wildlife habitat and these are a primary focus of the assessment, with mitigation measures developed to avoid or reduce disturbance to wildlife and wildlife habitat. These mitigations are also described in the WMMP.	Muskox – Section 18.4; Moose – Section 18.8; Grizzly bear – Section 18.12; Wolverine – Section 18.16; <i>Wildlife Mitigation and Monitoring Plan (Volume 11, Appendix 34B)</i> .

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Comment	Source	WKR Response	Where Addressed
During a public scoping meeting for the NIRB, community members in Yellowknife expressed concern regarding potential effects on moose and moose harvesting.	NIRB 2025b	Moose were selected as one of the key indicator species for this assessment and the importance of maintaining a managed harvest for all four species, including moose, is reflected in the significance definition applied to the assessment.	Moose – Section 18.8; Significance Definition – Section 18.1.6.
Athabasca Denesųliné Né Né Land Corporation expressed concern regarding changes in predator-prey dynamics.	NIRB 2024b	WKR acknowledges the Athabasca Denesųliné Né Né Land Corporation's concerns about the possible effects of the Project on predator-prey dynamics. The potential for the Project to effect these dynamics was examined in the caribou assessment and was found to be negligible, so is not re-examined for other terrestrial wildlife. WKR is committed to an ongoing wildlife monitoring program throughout all phases of the Project that aims to reduce harm to wildlife and verify the predictions of this assessment and adjust management practices based on the findings of this monitoring.	<i>Assessment of Potential Effects on Caribou</i> (Volume 6, Section 16); <i>Wildlife Mitigation and Monitoring Plan</i> (Volume 11, Appendix 34B).

18.3 Project Interactions with Other Terrestrial Wildlife

The Project has the potential to interact with the indicator species as outlined in Table 18.11. These interactions are indicated by a check mark (potential interaction) or a dash (no interaction) and are discussed in detail in the following sections in the context of effects pathways, standard and Project-specific mitigation measures, and residual effects. Project activities where no interaction is shown are not included in the assessment of project effects.

Some of the Project activities are not anticipated to interact with any of the indicator species that could influence their habitat or movement, nor influence their mortality risk. These activities include desalination operation and wastewater treatment (i.e., indicator species are not influenced by these activities); the activity of refuelling of vehicles and equipment, as well as fuel storage (the fuel storage area is assumed to be constructed during site preparation, and the action of refuelling does not interact with the indicator species); and taxes, contracts, and procurement (i.e., this is an office-based activity).

Some of the Project activities may influence the change in habitat or movement for the indicator species, but not a change in their mortality risk. There is no interaction identified from Project activities associated with the staging of equipment and materials during the Construction phase (i.e., indicator species are assumed to avoid the area when this activity is occurring); marine port use and equipment maintenance activities during the Operations and Maintenance phase (i.e., same avoidance of area by indicator species); and air transport (i.e., air traffic above indicator species does not cause an interaction) as well as water withdrawal and use (i.e., no mortality risk from water withdrawal or spraying it on roads) during all Project phases.

For muskox and moose, Project activities that are not anticipated to interact with them or cause a change in their mortality risk include establishment and operation of the camps (i.e., indicator species will avoid the area), bulk fuel storage (i.e., indicator species are not attracted to fuel storage components), and waste management (i.e., indicator species are assumed not to be attracted to items in the waste management facilities).

The Project activity of the vessel fuel line used to move fuel from a tanker ship to the fuel storage area is not anticipated to influence wolverine for a potential effect. Wolverine is not anticipated to be influenced in their use of habitat, movement, or mortality risk by the presence of a fuel line between the port site and the fuel storage area. For all other indicator species, the fuel line is not anticipated to influence their mortality risk.

Tibbitt to Contwoyto Winter Road construction and use will not interact with grizzly bear, as the species is assumed to be hibernating during this time.

Table 18.11 Project Interactions with Other Terrestrial Wildlife

Project Activities	Effects: Muskox			Effects: Moose			Effects: Grizzly			Effects: Wolverine		
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk
Construction												
Mobilization/demobilization of machinery /equipment, vehicles, materials, and fuel (e.g., by barge, sea lift, boat, or road)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Staging and storage of materials, fuel, equipment and pre-fabricated components	✓	✓	–	✓	✓	–	✓	✓	–	✓	✓	–
Chemical and hazardous material transport, storage and management (including explosives)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Establishment and operation of camps (e.g., mobile camps and permanent accommodations), maintenance yards, and laydowns	✓	✓	–	✓	✓	–	✓	✓	✓	✓	✓	✓
Machinery/equipment and vehicle refueling / fuel storage handling	–	–	–	–	–	–	–	–	–	–	–	–
Site preparation and earthworks of disturbance area (e.g., vegetation clearing, stripping and stockpiling of organic and overburden materials, grading, blasting, drilling)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction of port landside facilities, aerodrome, road, and Jericho Station (e.g., buildings/facilities, fuel storage, laydown areas; public use area; access roads; water intake; power generation – diesel (may include wind turbine or solar array); all-season gravel airstrip)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Project Activities	Effects: Muskox			Effects: Moose			Effects: Grizzly			Effects: Wolverine		
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk
Borrow source and quarry development (e.g., blasting, crushing, sorting, stockpiling of temporary and permanent areas)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water withdrawal to support construction activities (e.g., winter road construction, dust control, material compaction)	–	–	–	–	–	–	–	–	–	–	–	–
Watercourse crossing construction (e.g., bridge and culvert installation)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ground based transportation (e.g., workforce, materials, supplies)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Air transport (e.g., personnel transport, resupply)	✓	✓	–	✓	✓	–	✓	✓	–	✓	✓	–
Waste management and sewage facilities (e.g., development and use of a permanent waste management facility and on-site landfill; handling and storage of hazardous and non-hazardous waste; incineration of domestic waste; open air burning; management of black and grey water)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Construction of marine-based infrastructure (e.g., construction of large vessel wharves, medium vessel wharf, small craft harbour, barge landing area, desalination line, vessel refueling line / fuel line to bulk fuel storage, including nearshore dredging, infilling, pile driving, blasting)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Taxes, contracts, purchases (e.g., procurement of goods and services; employment of workers)	–	–	–	–	–	–	–	–	–	–	–	–

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Project Activities	Effects: Muskox			Effects: Moose			Effects: Grizzly			Effects: Wolverine		
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk
Closure and reclamation of temporary borrow sources/quarries, camps, workspaces, laydowns (e.g., erosion stabilization, revegetation, restoration of natural drainage patterns, prevention of future vehicular access)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Operations and Maintenance												
Port landside operations (e.g., use and maintenance of accommodations, borrows, roads, power generation; aerodrome operations including use and maintenance of airstrip and facilities; and Jericho Station operation and maintenance).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Marine port use and operations (e.g., vessels and cargo loading/unloading, barge landing operations, small craft harbour operations, maintenance dredging)	✓	✓	–	✓	✓	–	✓	✓	–	✓	✓	–
Borrow source and quarry operations (e.g., blasting, crushing, sorting, and stockpiling of permanent areas)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Desalination operation and wastewater treatment (e.g., marine water use and effluent discharge)	-	-	-	–	–	–	–	–	–	–	–	–
Water withdrawal / use (e.g., potable water, dust control, maintenance)	✓	✓	-	✓	✓	–	✓	✓	–	✓	✓	–
Road maintenance / use (e.g., transport of equipment, workers, and supplies; maintenance of bridge/culverts; snow clearing; grading and gravel replacement; dust control)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk fuel storage (e.g., operation of permanent fuel facilities)	✓	✓	–	✓	✓	–	✓	✓	✓	✓	✓	✓

Project Activities	Effects: Muskox			Effects: Moose			Effects: Grizzly			Effects: Wolverine		
	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk	Change in Habitat	Change in Movement	Change in Mortality Risk
Vessel fuel line / refueling (e.g., directly offloading from east wharf or use of floating fuel pipeline; above ground insulated pipeline to bulk fuel storage tanks)	✓	✓	–	✓	✓	–	✓	✓	–	–	–	–
Equipment maintenance	✓	✓	–	✓	✓	–	✓	✓	–	✓	✓	–
Chemical and hazardous material transport, storage and management (including explosives)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Winter road construction and use (e.g., annual winter road construction and maintenance)	✓	✓	✓	✓	✓	✓	–	–	–	✓	✓	✓
Air transport (e.g., personnel transport, resupply)	✓	✓	–	✓	✓	–	✓	✓	–	✓	✓	–
Waste management (e.g., use of a permanent waste management facility and on-site landfill; handling and storage of hazardous and non-hazardous waste; incineration of domestic waste; open air burning; management of black and grey water)	✓	✓	–	✓	✓	–	✓	✓	✓	✓	✓	✓
Taxes, contracts, purchases (e.g., procurement of goods and services; employment of workers)	–	–	–	–	–	–	–	–	–	–	–	–

Notes:
 ✓ = Potential interaction
 – = No interaction

18.4 Assessment of Project Effects on Muskox

18.4.1 Change in Habitat

Inuit Knowledge identified potential effects on muskox habitat and informed the development of mitigation strategies:

- **Acoustic and Sensory Disturbance:** Inuit Knowledge revealed that muskox are afraid of vehicles and noise/exhaust smells. Consultants stated that noise would drive them away, and they would run until they felt safe. This led directly to the recommendation that the wildlife assessment consider the potential impact of noise and exhaust fumes on muskox (as an indirect effect on habitat use) (GBRP 2025, IAG 2025a).
- **Habitat Loss and Degradation:** The destruction of lush green areas where muskox graze and the potential for dust to settle on vegetation are serious concerns for their habitat. Consultants advocated for dust control, progressive site remediation and habitat restoration to protect wildlife ecosystems and maintain healthy, green habitats for caribou and other species (IAG 2025b).
- **Competition and Caribou Displacement:** Inuit Knowledge noted the inverse relationship and competition between muskox and caribou (Banci and Spicker 2024). Any Project effect on caribou or muskox habitat could affect either species.

The influence of Inuit Knowledge ensured that the assessment considered that potential changes to vegetation and terrain could affect muskox behaviour and long-term survival, requiring specific monitoring and mitigation measures.

18.4.1.1 Analytical Assessment Techniques

Direct and indirect loss or alteration of muskox habitat in the LAA and RAA were assessed through habitat suitability modelling. Muskox HSRs were defined to characterize and quantify baseline conditions for muskox habitat during two life-stage periods: summer (i.e., the growing season) and late winter. The land cover data used for the model were obtained from the Northern Land Cover dataset (Olthof et al. 2009). Landcover types in the RAA were ranked using a four-value ordinal scale: high, moderate, low, or nil habitat suitability, based on documented muskox habitat preferences provided by Inuit Knowledge and literature review. Details on the attribution of suitability ratings to each of the land cover types are presented in the Wildlife Baseline Report (see Volume 6, Appendix 16A). To quantify baseline habitat conditions, high- and moderate-ranked patches were considered suitable habitat for muskox.

To quantify direct project effects on habitat suitability, baseline mapping was overlaid with the PDA and all suitable habitat within the PDA was considered lost. ZOIs were used to quantify indirect effects from project activities and components. The ZOIs represent defined distances from the PDA within which habitat suitability is considered to be reduced or lost due to indirect project effects (e.g., sensory disturbance, dust deposition, perceived barriers). Within the ZOIs, high, moderate and low habitat values were reduced by one rating level. Habitat patches reduced from high to moderate represent indirect habitat alteration but remain suitable, whereas areas reduced from moderate to low were considered functional habitat loss (i.e., they become “unsuitable”). For both the summer and late winter periods, and for both project phases, the all-season controlled access road and quarries were assigned a ZOI of

1.5 km around the PDA, while other Project components with more concentrated activity, such as the port facility, airfields, and permanent camps, were assigned a ZOI of 4 km. These distance values were selected based on published studies on muskox and other Arctic ungulate response to anthropogenic noise (e.g., Miller and Gunn 1979; McLaren and Green 1985), ZOIs used for muskox in other approved NU project IS, baseline noise levels for the RAA, and expected attenuation distances for Project generated noise (see Volume 5, Section 13). The ZOIs are entirely contained within the LAA.

The magnitude of the change in muskox habitat due to the Project was calculated as the total amount of suitable summer or winter habitat lost, directly or indirectly, relative to baseline conditions in the RAA. The characterization of residual effects uses the definitions provided in Table 18.4.

18.4.1.2 *Project Effects Pathways*

Direct effects on muskox habitat will occur during the Construction phase and persist through the life of the Project. Vegetation clearing, excavation, and grading will result in direct loss of suitable muskox habitat within the PDA. Direct habitat loss will occur for the all-season road, airstrip, laydown areas, port, and other project components.

Changes in habitat suitability resulting from indirect project effects are expected to occur throughout all phases of the Project. Indirect effects will be created through project activities that produce sensory disturbance (e.g., noise from blasting or vehicle traffic, visual stimuli from infrastructure or equipment) or alter forage quality (e.g., dust deposition). Sensory disturbance from auditory, olfactory, and visual stimuli can reduce habitat effectiveness by altering animal behaviour or causing avoidance of otherwise suitable habitat (Frid and Dill 2002; Leblond et al. 2013; Finnerty et al. 2022). Muskox may alter their regular behaviour as a response to sensory disturbance, which may result in lost feeding time, stress, reduced reproductive potential or habitat avoidance (M.A. McLaren and Green 1985; Miller et al. 1988). Muskox will flee from humans on foot, in vehicles, or aircraft (Gray 1973, in M. McLaren and Green 1985), (Miller and Gunn 1979; Russell 1979).

Based on information from the Air Quality and Vegetation assessments (see Volume 5, Section 11 and Volume 6, Section 15), dust produced from Project-related activities will deposit on the vegetation surrounding the PDA. This deposition can reduce plant cover and growth, and alter the vegetation community (Watkinson et al. 2021), which may influence moose use of that habitat. The extent of dust deposition depends on many factors, such as particle size and local weather patterns, and potential effects on vegetation diminish with increasing distance from dust sources. For example, US EPA (1995) details that larger dust particles (e.g., particulate diameter >100 micrometre [µm]) settle out within about 10 m of the source, while smaller particles (e.g., 30 to 100 µm) tend to be deposited within 100 m of the source (US EPA 1995). Gleason et al. (2007) predict effects from wind-blown dust on vegetation to extend to a distance of 40 m from dust sources.

18.4.1.3 Mitigation, Management, and Enhancement Measures

Mitigation, management, and enhancement measures include engineering design elements, additional mitigations from guidelines or best management practices, and monitoring measures. To reduce the effects of direct and indirect habitat loss on muskox, the following mitigation, management and enhancement measures will be implemented:

- The PDA will be confined to a specific design layout to reduce the Project's potential effect on 'on habitat loss and effectiveness.
- Clearing will be limited to areas required for construction and safe operations and maintenance (i.e., to the width of the Road PDA).
- Construction and quarry development activities will adhere to the recommended setbacks and timing restrictions outlined in the Wildlife Mitigation and Monitoring Plan (WMMP).
- All-terrain vehicle (ATV), utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.
- All machinery, equipment, and vehicles are required to be clean (i.e., decontaminated) and in good working order before coming to the PDA. Machinery, equipment, and vehicles will be regularly maintained and inspected to reduce noise-related sensory disturbance.
- Aircraft will maintain a minimum cruising altitude of 610 m above ground level except during landing and take-off at the airstrip, or for safety reasons due to inclement weather, or when operationally required.
- Dust will be actively suppressed on roads (with water and/or other dust suppressants) when necessary to manage excessive dust. Dust suppression will follow N's *Environmental Guideline for Dust Suppression on Unpaved Roads* (GN 2014).
- Reduced speed limits may be temporarily posted during drier conditions to reduce fugitive dust.

18.4.1.4 Project Residual Effect

Change in Summer Habitat

Under baseline conditions, 77.7% of the RAA (33,478.2 km²) contains suitable muskox summer habitat. The PDA will result in the direct removal of 45.1 km² (0.1%) of suitable muskox summer habitat from the RAA. Indirect habitat disturbance across all project phases will result in the loss of an additional 751.3 km² (2.3%) of suitable summer habitat, as the Project ZOI decreases moderate-rated habitat to low suitability (i.e., suitable to unsuitable). In total, 796.4 km² of suitable muskox summer habitat will be lost due to the Project, representing 2.4% of currently suitable habitat in the RAA. In addition to habitat loss, the suitability rating for 763.3 km² of summer habitat, representing approximately 2.3% of suitable habitat in the RAA, will be reduced from high to moderate ranking by indirect effects, but will remain suitable for muskox. Table 18.12 summarizes the loss of muskox summer habitat for the RAA relative to baseline conditions due to the Project.

Table 18.12 Magnitude of the Change in Muskox Summer Habitat in the RAA due to the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	33,478.2	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	45.1	0.1
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	751.3	2.3
Total Habitat Loss			796.4	2.4

Notes:

A ZOI of 1.5 km was applied around the all-season road and 4 km around high-activity areas, such as the port facility, airfields, and permanent camps.

Change in Late Winter Habitat

Under baseline conditions, 74.7% of the RAA (32,204.6 km²) contains suitable muskox late winter habitat. The PDA will result in the direct removal of 39.8 km² of muskox late-winter habitat, representing 0.1% of the RAA's suitable habitat. Indirect habitat disturbance across all project phases will account for an additional 835.7 km² (2.6%) of suitable late winter habitat loss within the LAA. In total, 875.5 km² of suitable muskox late winter habitat will be lost due to the Project, representing 2.7% of currently suitable habitat in the RAA. In addition to habitat loss, 578.0 km² of late winter habitat, representing 1.8% of suitable habitat in the RAA, will be altered from high-rated to moderate by indirect disturbance, but will remain suitable for muskox. Table 18.13 summarizes the amount of loss of muskox late winter habitat for the RAA due to project effects.

Table 18.13 Magnitude of the Change in Muskox Late Winter Habitat in the RAA due to the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	32,204.6	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	39.8	0.1
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	835.7	2.6
Total Habitat Loss			875.5	2.7

Notes:

A ZOI of 1.5 km was applied around the all-season road and 4 km around high-activity areas, such as the port facility, airfields, and permanent camps.

With the implementation of mitigation measures to limit the area of physical disturbance and reduce potential sensory effects from project vehicles, aircraft, and activities, the predicted magnitude of change to both summer and late winter muskox habitat in the RAA is low (i.e., within 1 to 15% of baseline). The direct loss of muskox habitat in the PDA will occur during construction. Indirect losses will occur during both the Construction and Operations and Maintenance phases within the project ZOI. Both the PDA and ZOI are contained within the LAA, and effects on muskox habitat are not expected to extend into the RAA, so the geographic extent of the effect is within the LAA.

The Project will affect muskox habitat continuously year-round and overlap sensitive periods such as late winter, calving, and rut. However, mitigation, management and enhancement measures for caribou spring migration and calving movement will temporarily reduce sensory disturbance to muskox from vehicles and equipment travelling the road between Hood River and Jericho during much of their calving and post-calving period. Because the Project is intended to be permanent, its effect on muskox habitat will be long-term and irreversible.

18.4.2 Change in Movement

Inuit Knowledge provided input into assessing the Project's potential effects on muskox movement, primarily by describing behavioural responses to disturbance. The key Inuit Knowledge inputs on muskox movement were:

- Behavioural Response to Disturbance: Muskox are afraid of vehicles (IAG 2025a).
 - When muskox see snowmobiles or lights, they will watch for a bit, then run, like a deer in headlights.
 - Noise will move them away, as will smells from exhaust (GBRP 2025).
 - Muskox will stop for a bit, then start to converge, and then they will run and keep running until they feel safer.
- Atypical Movement/Defence: Inuit Knowledge documented a significant shift in muskox behaviour over the years. Historically, muskox formed defensive circles when threatened. However, in more recent observations related to snowmobile disturbance, muskox were noted to sometimes "run like hell" instead of forming a circle, continuing to run until they were "absolutely tired" (Thorpe Consulting Services Ltd. 2014a).
- Habitat Linkage: Their movement is dictated by their preference for high-country habitats and for consuming lichen and dwarf birch. A disturbance that impacts the integrity of these feeding areas would force movement.

This information strongly suggested that the Project's wildlife assessment must consider the potential effects on muskox movement.

18.4.2.1 *Analytical Assessment Techniques*

The assessment of Project effects on muskox movement considers potential effects arising from physical obstructions and sensory disturbances caused by project activities and components. Effects on muskox movement were assessed qualitatively by evaluating the relative change in movement (e.g., disruption of daily movements versus bisection of home ranges by the road) in the RAA compared to baseline conditions, based on information gathered from Inuit, Indigenous, and Community Knowledge, literature review, and professional judgment. Effects are anticipated to commence during the Construction phase and continue through the Operations and Maintenance phase. The effect of roads and other project infrastructure on muskox movement has not been well studied. Therefore, this assessment considers muskox-specific information where available, as well as documented effects on the movement of other large northern terrestrial mammals. This assessment considers all physical project components to have the potential to interfere with muskox movement.

18.4.2.2 *Project Effects Pathways*

The ability to move between patches of suitable habitat or between seasonal ranges is important for the persistence of wildlife species, including large northern herbivores such as muskox (Schmidt et al. 2016). Anthropogenic disturbances, such as roads and other infrastructure, may create temporary or permanent obstructions or filters to movement for many wildlife species (Jalkotzy et al. 1997; Muhly et al. 2015). Project activities and components can affect muskox movement by creating physical obstacles or prompting avoidance due to sensory disturbances (e.g., visual or auditory). Change in movement may affect the ability of individuals to aggregate, access food, breed, and escape predators or move between seasonal ranges and may affect the abundance or distribution of muskox within the RAA. Specific Project activities during the Construction and Operations and Maintenance phases that may affect muskox movement are identified in Table 18.11.

Muskox are distributed throughout the RAA (see Section 18.2.2.1). The all-season controlled access road from Jericho Station to Grays Bay Port is the largest project component and, due to its length through muskox range, has the greatest potential to affect muskox movement within the RAA relative to other components. Other project components, such as the port or temporary work camps, may affect muskox movement, but their effects are expected to be localized.

Physical obstructions to muskox movement created by the road may result from factors such as road elevation, side-slope angle, road aggregate size, and snowbank angle and height (Boulanger et al. 2024). Studies from northeast Alberta have found that snow berms with an average height of 65 cm can deflect the movement of moose, a taller ungulate than muskox, with snow berms of 1.5 m acting as an obstacle for some moose (DA Westworth & Associates 1994 in (Jalkotzy et al. 1997). In the Arctic, where snowbanks are generally firm enough to support the weight of an animal on its surface, snowbank angle is likely more important than height for potentially obstructing movement.

The physical filter effect may be magnified by increased human use, causing sensory disturbance (Dyer et al. 2002; Leblond et al. 2013), or during sensitive periods, such as late winter, when deeper snow increases the energetic costs of movement, or during the calving period from April to June. If access to suitable habitat is impeded by anthropogenic disturbance, individuals may be displaced into other areas,

possibly less suitable, or shift their range entirely (Leblond et al. 2013; Beyer et al. 2016; MacNearney et al. 2016). During both project phases, sensory disturbances from a variety of activities, including earthworks, equipment mobilization, temporary camps, quarries, and water withdrawal, may cause muskox to avoid areas near the disturbances. Muskox have been shown to move away from engine noise and visual stimuli (Miller and Gunn 1979; M.A. McLaren and Green 1985). Avoidance of human activity may prevent muskox from reaching patches of suitable habitat or increase their energetic costs by forcing them to detour during movements. The predicted annual traffic volume during project construction is predicted to be much higher than during operations and maintenance (see Volume 2, Section 2.6).

18.4.2.3 *Mitigation, Management, and Enhancement Measures*

In addition to the mitigation, management and enhancement measures presented in Section 18.4.1.3 to reduce sensory disturbance, other mitigation measures to reduce project effects on muskox movement, which incorporate engineering design and measures from guidelines and best management practices, will be implemented as follows:

- Road design will aim for an elevation of (≤ 1.75 m, low slope inclines (3:1 or ≤ 18.5 degrees) between the adjacent terrain, within small gravel surface materials, where possible.
- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be decreased in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.
- Snowbanks will be maintained so they are not an obstruction to movement for caribou and other wildlife. Creation of snowbanks will generally be avoided (for operational reasons to avoid snow drifts on the road on the lee side of the bank), except where not technically feasible; the height of snowbanks will be maintained at less than 1 m and snow plowing will be conducted in such a way as to limit the angle and vertical height of the snowbank edge.
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.

18.4.2.4 *Project Residual Effect*

Project components, including the road, will not create an impermeable filter to muskox movement through the RAA, and planned mitigation measures are expected to effectively reduce potential effects on movement. The road design, with proposed embankment heights no greater than 1.75 m and 3:1 ($\leq 18.5^\circ$) slope inclines where possible, will permit muskox movement across the structure. During winter road maintenance, tall snowbanks may pose a physical barrier to muskox movement when they reach 1 m in height. Because muskox home ranges and daily movements are smallest during winter, the obstructive effect of snowbanks along the road bisecting a home range may be amplified during that season. However, the mitigation measure to avoid the creation of snowbanks, wherever possible, and to limit their height to <1 m-tall when avoidance is not technically feasible is expected to maintain its permeability through winter and the effect on movement will likely fall within the range of natural variation for muskox movement across the landscape where other obstacles (e.g., rock outcrops, open water, ravines) are encountered.

Project vehicle and equipment traffic, which is expected to influence muskox movement by avoiding sensory disturbance, will be highest during the Construction phase. However, project construction will be completed in segments, and sensory effects on muskox movement will be concentrated in active work areas, not across the entire PDA. During operations and maintenance, sensory effects on muskox movement may be more evenly distributed along the PDA, but at reduced magnitudes due to lower traffic volumes and speed restrictions near muskox. Temporary road closures, based on caribou movement during their spring migration and calving periods, will be implemented in many years. While not specific to muskox, this mitigation measure will also help reduce sensory effects on muskox movement during their sensitive periods, including late winter and calving.

Overall, with mitigation, the residual project effect on muskox movement during both project phases is predicted to be low in magnitude and confined to the LAA. Physical road structure will not impede movement, and while tall snowbanks formed from road maintenance may present some obstruction to muskox during winter, gaps in the snowbanks across the road will allow movement. Muskox avoidance of sensory disturbance is expected to be primarily localized at camps and other high activity facilities such as the port.

The Project's effects on muskox movement will be year-round, but will be greatest during winter, when snowbanks form along the road. During construction, sensory effects on muskox movement will occur as irregular events associated with various localized construction activities. During operations and maintenance, sensory disturbance may continuously affect muskox movement, but mitigation, management and enhancement measures based on caribou presence near the all-season controlled access road during spring migration and calving will reduce sensory effects on muskox movement during part of their calving period. The Project is intended to be permanent, and its effects on muskox movement will be long-term and irreversible.

18.4.3 Change in Mortality Risk

Key Inuit Knowledge inputs related to muskox mortality risk include the following:

- Predation Risk: Muskox calves are prey for grizzly bears. Inuit Knowledge highlighted the need for predator control initiatives, particularly during the caribou calving period, recognizing that the presence of predators adds a constant mortality risk factor to muskox (Banci and Spicker 2024; IAG 2025a).
- Disease: Inuit Knowledge provided information that muskox populations have experienced mortality and displacement due to diseases such as Lyme worm disease, anthrax, and brucellosis. This indicates that the population is already vulnerable to pathogens, and any environmental stress introduced by the Project could potentially exacerbate disease-related mortality (IAG 2025a).

18.4.3.1 Analytical Assessment Techniques

Project-related changes to muskox mortality risk were assessed by identifying and qualitatively evaluating project activities and components that may influence muskox mortality. The assessment considers direct and indirect effect pathways and evaluates risk in the context of existing data on regional muskox populations, current harvest levels, and allowable harvest.

18.4.3.2 Project Effects Pathways

Project activities during the Construction and Operations and Maintenance phases have the potential to affect muskox mortality risk in the RAA both directly (e.g., vehicle-muskox collisions) and indirectly (e.g., increased access for muskox hunting). The all-season controlled access road between Jericho Station and Grays Bay Port will account for most of the project's effect on muskox mortality risk among the project components.

Instances of vehicle collisions with muskox are uncommon, likely due to the rarity of roads through most of muskox range. With the development of the road, the direct mortality risk to muskox may increase due to potential collisions with project traffic and equipment during the Construction and Operations and Maintenance phases. While muskox reside in the RAA year-round and collisions with project vehicles may occur at any time of year, collision risk could be increased if snowbanks created through road maintenance trap muskox which have entered the road, preventing them from moving away from oncoming vehicles. Collision risk is expected to be higher during construction, when more vehicles will be associated with the road than during operations and maintenance (see Volume 2, Section 2.6).

Indirect project-related effects on muskox mortality risk in the RAA are likely to result mainly from increased hunter access to the region. Currently, harvest within the RAA is much lower than west of the Tree River (see Figure 18.3), as described in the Wildlife Baseline Report (see Volume 6, Appendix 16A). The development of an all-season controlled access road through the RAA can provide hunters with access to stage and travel into previously inaccessible areas. Long-term data on muskox harvest rates suggest that a harvest rate of 3% promotes slow population growth, 5% results in stability, and 7% causes population decline (Tener 1965). The RAA is entirely within NU's muskox management unit

MX- 11, which has a current population estimate of 10,246 individuals (Leclerc et al. 2024). In 2023, the TAH for MX-11 was set at the current 350 individuals, an increase from the previous TAH of 225, in response to the management unit's growing muskox population (NWMB 2023). The current TAH represents a harvest rate of approximately 3.4% of the population in MX-11, which is slightly higher than the rate set before 2023 but would still promote slow population growth (Tener 1965). The GN, Kitikmeot Regional Wildlife Board, and the Kugluktuk Hunters and Trappers Organization do not consider the current TAH to threaten the sustainability of the muskox population in MX-11. Since the establishment of MX-11 in 2015, the TAH has never been reached, and the average reported harvest rate across the unit from 2015 to 2024 has been approximately 1%. Improved hunter access to the region provided by the project road may increase the number of muskox harvested in the RAA and may increase the annual harvest rate for MX-11.

18.4.3.3 *Mitigation, Management, and Enhancement Measures*

To reduce the risk of increased muskox mortality due to the Project, the following measures will be implemented:

- A WMMP will be developed and implemented. The WMMP will include detailed monitoring and mitigation measures to be implemented throughout the construction and operations of the Project. Wildlife will have the right-of-way on all Project infrastructure areas as detailed in the WMMP. Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- Wildlife signs will be displayed along the road in areas where caribou and/or other wildlife are commonly observed to inform drivers.
- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers on the road.
- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be decreased in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.

- Random speed audits shall occur when the road is operational, administered by WKR to encourage driver compliance.
- Equipment will be operated on designated workspaces or existing roads only.
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.
- As per the WMMP, all personnel will take wildlife awareness training as part of site orientation. The awareness training will include bear safety, reporting procedures for wildlife-related incidents, protocols to follow when a wildlife feature (e.g., nest, den) is identified, and wildlife sightings.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.
- All aircraft will conduct an initial fly-by of the airstrip to confirm no wildlife located on or in proximity to it before landing. If wildlife are observed within 100 m, pilots will notify construction/grounds personnel and aversion techniques will be implemented to discourage wildlife so aircraft can land safely.
- WKR will control access to the road through user agreements with organizations and individuals. For safety reasons, no access to the port and road will be allowed during the Construction phase.
- Public access to active borrow sites and quarries, and associated access roads will be restricted.
- As per the WMMP, all Project-related wildlife mortalities will be investigated and reported annually.

18.4.3.4 *Project Residual Effect*

Direct mortality events caused by vehicle-muskox collisions will be rare. Muskox are expected to generally avoid project infrastructure, including the all-season controlled access road, to some extent, so there is low potential for interactions between muskox and project vehicles. Mitigation measures implemented for the Project, including speed limits, access restrictions, and wildlife monitoring and reporting, will further reduce the direct mortality risk to muskox from collisions with project vehicles and equipment. Wildlife, including muskox, will have the right-of-way to cross and safely exit the road corridor and maintaining snowbanks below 1 m tall and providing gaps every 500 m will reduce the risk of muskox being trapped on the road. Communication between road users and low speed limits passing nearby muskox, and in areas with high potential for muskox to occur, will decrease the risk of vehicle-caused mortality.

The greatest change to muskox mortality risk will be from the indirect effect of increased hunter access to the RAA. No access to the port and road will be allowed during the Construction phase. Most muskox harvest is expected to take place in the fall and winter seasons, when Inuit Knowledge provided for the Project indicates muskox meat and coats are most desirable. Hunters will be required to check in with WKR before using the road. There are no Project-specific mitigation measures to reduce muskox mortality risk from increased hunting, but muskox harvest in the RAA will occur within the TAH framework established by the GN, regional wildlife boards, and HTOs. An increase in muskox harvest in the RAA is not predicted to threaten the sustainability of the regional muskox population.

Overall, the Project's effect on muskox mortality risk in the RAA is predicted to be adverse but of low magnitude, because interactions between muskox and project vehicles will be rare, and any increase in muskox harvest due to project infrastructure will be within limits set and monitored by the governing authorities. Indirect project effects on muskox mortality risk will occur mainly in the fall and winter, as multiple irregular events, and will extend into the RAA as hunters stage from the road and travel by snowmachine beyond the LAA. The Project effect on muskox mortality risk is predicted to be long-term and, because the Project is intended to be permanent, irreversible.

18.4.4 Summary of Project Residual Effects

With the implementation of mitigation measures, the Project is predicted to result in adverse residual effects on muskox habitat, movement, and mortality risk during both the Construction and Operations and Maintenance phases. Changes in habitat are predicted to be low magnitude because the amount of habitat loss or alteration will be very small relative to that currently available in the RAA. Changes in muskox movement and mortality risk are also predicted to be of low magnitude, falling within the range of natural variation or accepted management standards. Changes to muskox habitat and movement will be confined to the LAA, as sensory disturbance generated from project activities is not predicted to extend beyond 4 km from the PDA. Changes to muskox mortality risk will extend beyond the LAA based on the potential for hunters using the project road to travel outside of the LAA to harvest muskox (see Table 18.14).

Table 18.14 Project Residual Effects on Muskox

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C, O	A	L	LAA	HS	LT	C	I
Change in Movement	C, O	A	L	LAA	HS	LT	IR, C	I
Change in Mortality Risk	C, O	A	L	RAA	HS	LT	IR	I
Key: See Table 18.4 for detailed definitions Project Phase: C: Construction O: Operations and Maintenance Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Wildlife Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable								

18.4.5 Effects of Climate Change on Muskox

The Arctic has been experiencing the effects of anthropogenic climate change for many decades, which have included changes in weather, ice conditions, vegetation, and species distributions among other impacts (McLennan et al. 2022; Banci and Spicker 2024). Within the RAA, Kitikmiut report the northward expansion of the treeline near Contwoyto Lake, more frequent winter rain events, and an increased presence of grizzly bear, a predator of muskox (Banci and Spicker 2024; IAG 2025a). Future climate change will further affect conditions in the RAA and adds complexity and uncertainty to predicting future conditions and potential Project effects. Assessing the effects of climate change on muskox is complicated by the many ways in which weather changes may positively or negatively affect plant communities and energy balances in herbivores (Hurley et al. 2014). Changes in precipitation, snowpack, growing season, extreme weather, and seasonal temperature, can all affect muskox forage availability and energy requirements (Berger et al. 2018). The Assessment of Potential Effects on Climate (see Volume 5, Section 12) includes a climate profile for the Project with information on historical and projected climate conditions for Project-relevant climate parameters and general climate conditions (e.g., annual mean temperature and total precipitation) using intermediate and high-emissions climate change scenarios.

Current and past circumpolar muskox distributions have been shaped by historical climate trends where ranges have contracted northward in correlation with the degree of warming (Canteri et al. 2022, van Beest et al. 2023). Climate change can impact muskox distribution through changes in habitat. In northeastern Greenland, a rapid northward shift in high and moderate suitability muskox habitat, and an increase in low suitability habitat in the southern part of the study area, has been documented since the (van Beest et al. 2023) turn of the century, corresponding to a period of more frequent temperature and precipitation anomalies (van Beest et al. 2023). Anthropogenic climate change could similarly affect the suitability and distribution of muskox habitat in the RAA. Muskox are predominantly grazers of sedge and grass and will also forage on some shrubs and forbs; the northward expansion of the treeline and non-forage species could reduce the amount of suitable muskox habitat in the southern portion of the RAA. As these changes will persist under future climate scenarios, muskox distribution and persistence in formerly occupied areas of the RAA could change.

Changes in weather patterns can directly affect muskox, particularly through increases in rain-on-snow events during winter. When winter temperatures return to subzero following rain, an ice layer is created that can hamper the ability of muskox to reach forage for the remainder of the winter and increase their energy expenditure, affecting body condition and survivorship (Putkonen et al. 2009; Berger et al. 2018; McLennan et al. 2022). A particularly severe rain-on-snow event killed approximately 20,000 muskox on Banks Island, NT in 2003 and NTKP members attribute a local drop in muskox abundance at Bathurst Inlet in the 1970s to freezing rain-on-snow during a harsh winter (Putkonen et al. 2009; Banci and Spicker 2024). A decrease in the skeletal development of muskox calves in utero during rain-on-snow events was documented, an effect detectable for up to three years post-partum (Berger et al. 2018). Smaller body size in juveniles is associated with delayed maturity and increased predation risk (Albon et al. 1987; Forchhammer et al. 1998). Even minor rain-on-snow events can affect the fitness and productivity of Arctic ungulates, leading to long-lasting, population-level effects (Russell et al. 2005; Berger et al. 2018). While rain-on-snow events tend to be localized, both climate change scenarios considered for the IS

predict increases in winter temperatures and precipitation, likely leading to more rain-on-snow events in the RAA.

In addition to changes in muskox habitat, distribution, and forage availability, warming climatic conditions have promoted the range expansion and prevalence of muskox parasites and disease (Kutz et al. 2013; Kafle et al. 2020). The spread of lungworms and bacteria which affect muskox health has been facilitated by warming in the Arctic with infections documented north of the Project on Victoria and Banks islands and west toward Kugluktuk (Wu et al. 2011; Kutz et al. 2015; Kafle et al. 2020). Parasites and infectious disease can alter the fitness and reproductive success of muskox and result in higher mortality (Kutz et al. 2001, 2015). With the expected increase in Arctic warming, the prevalence of parasites and disease may increase in muskox in the RAA.

While adverse effects on muskox are predicted from climate change, the potential effects of climate change do not alter the conclusions of the Project effects assessment on muskox in the RAA. Though the suitability and availability of muskox habitat may be affected by climate change, the relative effect of the Project on changing conditions in the RAA will remain of low magnitude. It is unlikely that climate change will affect the ability of muskox to move through the RAA to an extent that the contribution of Project effects on movement would fall outside the natural range of variation on the landscape. Climate change could affect muskox mortality risk through extreme weather events, but the Project's low magnitude direct effect on mortality risk is not expected to meaningfully add to that risk. Increased muskox harvest in the RAA enabled by Project roads will remain part of the regulated muskox management framework for MX-11 and will be managed by governing agencies in response to future population conditions. Climate projections are uncertain, as are the effects of climate-driven changes to muskox habitat, movement, and mortality risk. It will be important for governing agencies to monitor and adaptively manage muskox in response to future climate change.

18.5 Assessment of Cumulative Effects on Muskox

18.5.1 Project Residual Effects Likely to Interact Cumulatively

Table 1 in Appendix 9A (Volume 4) presents the PIL, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual effects from the Project act cumulatively with residual effects from other projects and physical activities (see Table 18.15), a cumulative effects assessment (CEA) is carried out.

Table 18.15 Interactions with the Potential to Contribute to Cumulative Effects on Muskox

Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Past			
Bathurst Inlet	–	–	–
Snap Lake Mine	–	–	–
Omingmaktok	–	–	–
Present			
Arcadia Bay Project	–	✓	–
B2Gold George Property	–	–	–
B2Gold Marine Laydown Area	–	–	–
Bulk Carriers	–	–	–
Cambridge Bay	–	–	–
Chuk and Fire Shear Blocks	–	✓	–
Commercial Cargo	–	–	–
Commercial and Domestic Harvesting	–	–	✓
Coppermine Project	–	–	–
Coppermine River Project	–	–	–
Diavik Diamond Mine	–	–	–
Ekati Diamond Mine	–	–	–
Epworth Project	–	–	–
Fishing Vessels	–	–	–
Gahcho Kué Diamond Mine	–	–	–
Goose Mine	–	–	–
Hackett River Project	–	–	–
High Lake (Izok Corridor Project)	✓	✓	✓
High Lake East	–	✓	–
Hood River Gold Project	–	✓	–
Hope Bay Project	–	–	–
Hydroelectric	–	–	–
Icebreakers	–	–	–
Itchen Lake Property	–	✓	–
Izok Lake (Izok Corridor Project)	–	–	–
Jericho Mine	✓	✓	✓
Kennady North - Exploration	–	–	–
Kugluktuk	–	–	–
Lupin Mine	✓	✓	✓
Muskox Nickel Property	–	–	–

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Nunavut Community Infrastructure	–	–	–
NT Community Infrastructure	–	–	–
Overflights	–	✓	–
Passenger Ships and Pleasure Craft	–	–	–
Pistol Lake Project	–	✓	–
Rae Copper Exploration Project	–	–	–
Rockinghorse (Koamaogaktok) Project	–	✓	–
Roma Project	–	–	–
Scientific Research	–	✓	–
South Kitikmeot Gold Project	–	–	–
Tanker Ships	–	–	–
Tibbitt to Contwoyto Winter Road	✓	✓	✓
Tourism	–	✓	–
Tree River Lodge	✓	✓	✓
TTMG Project	–	✓	–
Tugs/Barges	–	–	–
Ulu Gold Project	✓	✓	✓
Wolf/Mistake Lake Property	–	✓	–
Yellowknife City Gold Project	–	–	–
Past and Reasonably Foreseeable			
Indin Lake Gold Project	–	–	–
Mon Mine	–	–	–
Yellowknife Gold Project	–	–	–
Project-Related Physical Activities			
Reasonably Foreseeable			
Arctic Economic and Security Corridor	–	–	–
Courageous Lake Mine	–	–	–
NICO	–	–	–
Reasonably Foreseeable, Induced			
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port	–	✓	–
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho	–	✓	–
Grays Bay Road and Port: Airstrip Expansion	–	✓	–
Grays Bay Road and Port: Road Traffic	–	✓	✓
Grays Bay Road and Port: Port Traffic	–	–	–
Grays Bay Road and Port: Air Traffic	–	✓	–

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Grays Bay Road and Port Phase 2 –Jericho Mine to Northwest Territories Border	✓	✓	✓
Hackett River Project	–	–	–
Hackett and Back River Access Road	✓	✓	✓
High Lake Mine (Izok Corridor Project)	✓	✓	✓
Izok Lake Mine (Izok Corridor Project)	–	–	–
Izok Lake Access Road	✓	✓	✓

Notes:

✓ = Residual effect from other projects and physical activities likely to interact cumulatively with Project residual effects.

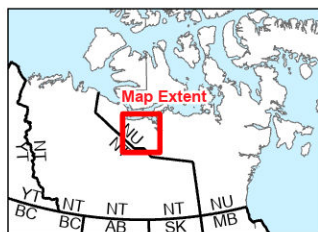
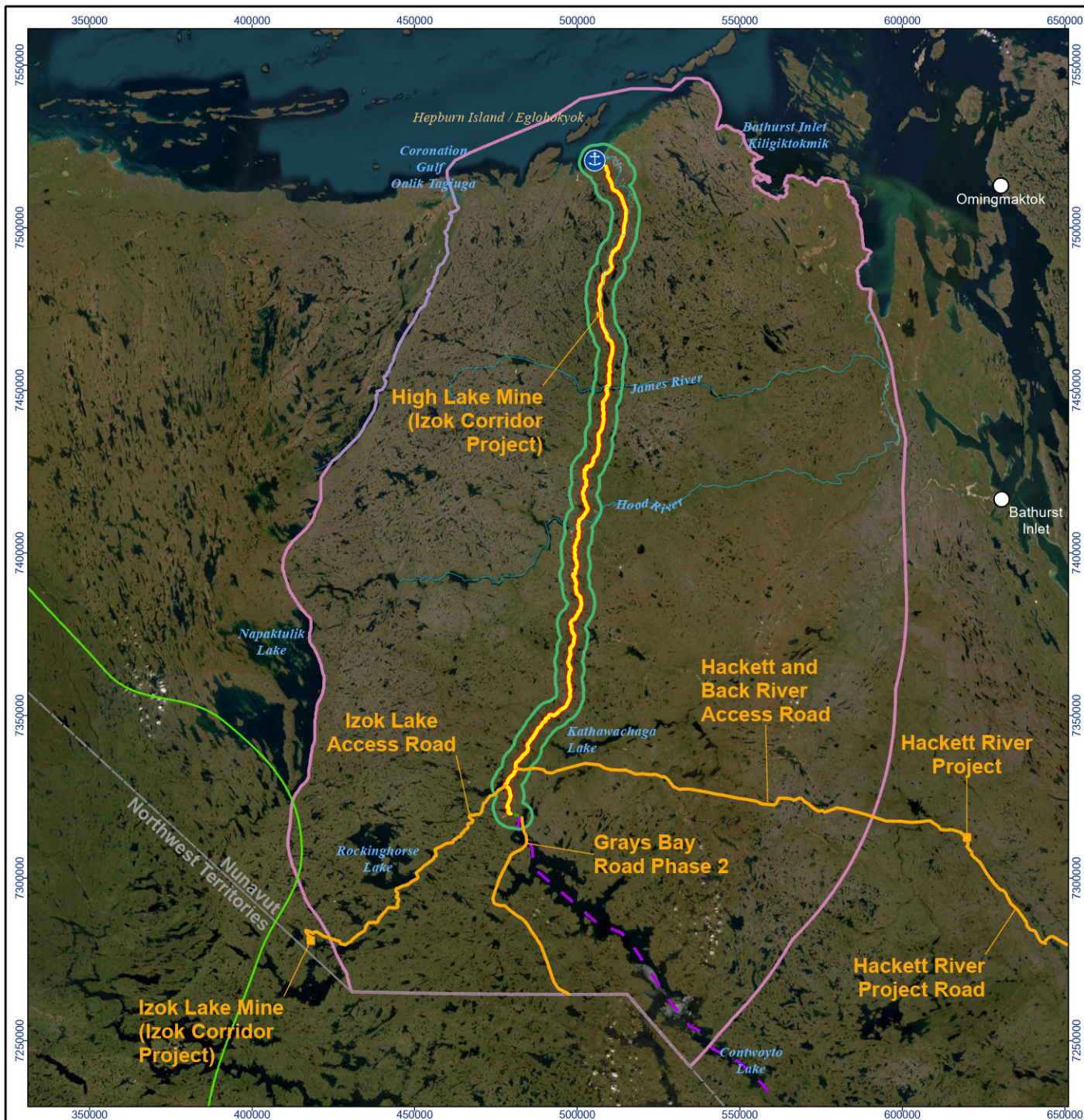
– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

For other projects and physical activities where no cumulative interaction is identified in Table 18.15 between their residual effects and those of the Project (no check mark), a brief rationale is provided below. The assessment of cumulative effects likely to result from the Project, in combination with other projects and physical activities, is discussed in Sections 18.5.2 to 18.5.4.

Only projects that have a development footprint or semi-permanent infrastructure, increase human accessibility, or generate substantial sensory disturbance in the RAA were considered for potential cumulative interactions with Project residual effects. Past and present physical activities in the RAA that may interact with Project effects are incorporated into baseline conditions and were already considered in muskox habitat suitability modelling and the Project effects assessment.

Of future projects and physical activities, none are reasonably foreseeable within the RAA. Therefore, the CEA is solely focused on RFI activities that lie within the RAA, including the extension of the Grays Bay Road (Phase 2 — Jericho Mine to the NT border), 117 km of the Hackett and Back River access road, 89 km of the Izok Lake access road, and the High Lake Mine (see Figure 18.14). Those RFI activities related to the expansion of the Project's airstrip and bulk fuel storage will occur within the current PDA, so will not result in additional effects on muskox habitat, movement, or mortality risk beyond those captured in the Project effects assessment.

During engagement sessions, comments were received on concerns about how the combination of exploration activities and other human developments in the area may cumulatively influence wildlife (see Table 18.10). These concerns were taken into consideration in the CEA.



Notes
 1. Coordinate System: WGS 1984 UTM Zone 12N
 2. Data Sources: Government of Canada, Stantec, Natural Resources Canada, Government of Canada (<https://www.nrcan.gc.ca/earth-sciences/geography/download-geographical-names-data/9245>)
 Publication Date: Unknown
 Downloaded: September 7, 2021
 Last Checked: September 7, 2021

- Grays Bay Port
- Grays Bay Road
- Grays Bay Winter Road
- Tibbitt to Contwoyto Winter Road
- Territorial Boundary
- Treeline
- Watercourse
- RFI Footprints
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)

0 25 50 Kilometres
 (At original document size of 8.5x11) 1:1,800,000



Project Location
 West Kitikmeot Region
 Nunavut

Prepared by OliviaLeblanc on 2026-02-05

Client/Project
 West Kitikmeot Resources Corp (WKR)
 Grays Bay Road and Port

24Y0376

Figure No.
18.14

Title
Distribution of RFI Activities in and around the RAA

18.5.2 Change in Habitat

18.5.2.1 *Cumulative Effect Pathways*

As described in Section 18.5.1, the effects of past and ongoing projects have influenced the baseline conditions and the current extent of muskox habitat in the RAA. Therefore, the assessment of cumulative effects on muskox habitat focuses on RFI activities in the RAA: those that will be induced by the development of the Project, which are expected to follow similar pathways to those of Project effects.

RFI projects and physical activities are likely to cause residual effects on muskox habitat through the development of mines and their associated infrastructure and access roads, and through the Phase 2 — Jericho Mine to the NT border Project road extension. These projects and physical activities will contribute to a cumulative direct loss of suitable muskox habitat within the RAA through the development of each project footprint, as well as indirect habitat loss through sensory disturbance. Direct habitat loss from earthworks and vegetation clearing will occur where the footprints of these RFI activities overlap with suitable muskox habitat, while indirect habitat loss or alteration within a ZOI surrounding their footprints can be expected due to sensory disturbance (e.g., blasting and vehicle traffic) or dust deposition. The “low activity” 1.5 km ZOI used for the assessment of project effects on muskox was used to capture indirect effects associated with the RFI roading activities, while the “high activity” 4 km ZOI was used to account for increased levels of sensory disturbance and dust deposition associated with the High Lake Mine.

18.5.2.2 *Mitigation, Management, and Enhancement Measures for Cumulative Effects*

GN legislation requires that all current and proposed projects implement standard environmental safeguards and project-specific mitigation plans to reduce their potential impacts on wildlife, including muskox. The *Nunavut Land Use Plan*, when finalized, will manage regional development to balance cumulative effects with desired economic and ecological goals. Therefore, the mitigation, management and enhancement measures to reduce Project effects on muskox habitat committed to in Section 18.4.1.3 are suitable for the Project’s contribution to cumulative effects, and no additional measures are proposed. The Project’s monitoring and adaptive management commitments will be a critical component to the evaluation of the Project’s contribution to future cumulative effects on muskox habitat.

18.5.2.3 *Cumulative Effects*

This CEA examines the interactions between Project residual effects on muskox habitat and those of RFI projects in the RAA. It considers both direct habitat loss and indirect habitat loss or alteration by applying all project development areas and ZOIs to the muskox habitat suitability models. Past and current projects have already influenced current habitat suitability for muskox in the RAA and are incorporated into baseline conditions. The combined contributions of the Project on muskox summer and late winter habitat, along with those projects and activities it may induce, are quantitatively assessed below, following the methods described in Section 18.4.1.1, including application of the “high activity” 4 km ZOI around the future High Lake Mine.

The Project will affect the suitability of 2.4% and 2.7% of muskox summer and late winter habitat, respectively, in the RAA, though direct and indirect habitat loss (Section 18.4.1). RFI projects and activities will add their development footprints (i.e., High Lake mine, ~78 ha) and linear features in the RAA (i.e., ~69 km of access roads for Project Phase 2 to the NT border; ~89 km of the Izok Lake access road, and ~117 km of the Hackett/Back River access road). These footprints and their associated ZOI will interact cumulatively with residual Project effects, incrementally increasing direct and indirect muskox habitat loss in the RAA. In a full build-out scenario of the Project and all RFI activities, the total cumulative change in suitable muskox habitat in the RAA relative to baseline is predicted to be the loss of 3.3% in summer habitat and 3.8% in late winter habitat, equating to a low magnitude change for each season. Table 18.16 and Table 18.17 show the contribution of the Project and each RFI activity to cumulative changes in muskox summer and late winter habitat, respectively. An additional 1.6% of summer habitat and 1.5% of late winter habitat will be indirectly altered (i.e., High downrated to Moderate) but remain suitable.

Table 18.16 Project and RFI Activity Contributions to Cumulative Effects on Muskox Summer Habitat

Physical Activity	Direct Habitat Loss (km²)	Indirect Habitat Loss (km²)	Total Habitat Loss (km²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1 (the Project)	45.1	751.3	796.4	2.4
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NT Border	1.4	50.2	51.6	0.2
Hackett and Back River Access Road	3.1	172.3	175.4	0.5
High Lake Mine (Izok Corridor Project)	0.3	1.3	1.6	0.0
Izok Lake Access Road	2.4	73.6	76.0	0.2
Total	52.3	1048.7	1101.0	3.3

Notes:

* = activity occurs within Grays Bay Road and Port Phase 1 PDA.

A ZOI of 1.5 km was applied around RFI roads and 4 km around RFI mines.

Table 18.17 Project and RFI Activity Contributions to Cumulative Effects on Muskox Late Winter Habitat

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1 (the Project)	39.8	835.7	875.5	2.7
Grays Bay Road and Port Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NT Border	1.4	57.3	58.7	0.2
Hackett and Back River Access Road	2.9	192.6	195.5	0.6
High Lake Mine (Izok Corridor Project)	0.3	1.5	1.8	0.0
Izok Lake Access Road	2.3	83.8	86.0	0.3
Total	46.6	1170.9	1217.5	3.8

Note:

* = activity occurs within GBRP Phase 1 PDA

A ZOI of 1.5 km was applied around RFI roads and 4 km around RFI mines.

The geographic extent of additional disturbance will be localized to each footprint and its surroundings within the associated ZOI. However, given the distribution of RFI activities, the overall cumulative effect on muskox habitat will extend across the RAA. Cumulative effects on muskox habitat will persist through the Construction and Operation phases of each RFI project and will constitute long-term disturbance. Some RFI projects, primarily access roads, are assumed to implement similar mitigation, management, and enhancement measures to the Project, where concerns with caribou spring migration and calving exist, to reduce sensory disturbance to muskox during their calving period. It is assumed that other projects will operate year-round, overlapping muskox calving and other sensitive periods (e.g., late winter, fall rut).

While the Project and RFI activities that require ground disturbance are anticipated to each occur as a single event, together they will occur as multiple irregular events as they are initiated through time. Indirect sensory effects on muskox habitat will occur continuously from construction through the life of each project. The Project and some other RFI activities in the RAA will be permanent (e.g., Phase 2 of the Project). Therefore, some portion of cumulative effects on muskox habitat will be irreversible.

18.5.3 Change in Movement

18.5.3.1 Cumulative Effect Pathways

As described in Section 18.5.1, effects on muskox movement from past and ongoing projects in the RAA were used to inform the baseline conditions and assessment of Project effects. Therefore, the CEA on muskox movement focuses on RFI projects and physical activities in the RAA whose effects could interact with those of the Project. Future activities identified as having the potential to cumulatively interact with the Project include the construction and operation of the High Lake Mine, access roads to additional mine sites located outside the RAA, the Grays Bay Road and Port Phase 2 expansion, Project infrastructure expansions, and increased vehicle and air traffic that could occur in the RAA. The pathways of effects identified in Section 18.4.2.2 will apply to all future activities and projects identified.

RFI projects that represent physical or perceptual filters to muskox movement (e.g., the High Lake Mine site) will be localized and relatively few in the RAA. Most changes to muskox movement are expected to derive from sensory disturbance during the construction and operation of each RFI project. These residual effects are expected to act cumulatively with those of the Project to affect muskox movement across the RAA.

18.5.3.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

GN legislation requires that all current and proposed projects implement standard environmental safeguards and project-specific mitigation plans to reduce their potential impacts on wildlife, including muskox. The *Nunavut Land Use Plan*, when finalized, will manage regional development to balance cumulative effects with desired economic and ecological goals. Therefore, the mitigation measures to reduce Project effects on muskox movement committed to in Section 18.4.2.3 are suitable for the Project's contribution to cumulative effects, and no additional measures are proposed. The Project's monitoring and adaptive management commitments will be a critical component of the evaluation of its contribution to future cumulative effects on muskox movement.

18.5.3.3 Cumulative Effects

The CEA on changes to muskox movement considers the interactions between the Project and RFI activities in the RAA. RFI activities include mines, access roads, mineral exploration, and expansions to Project infrastructure. Road projects, due to their extent across the RAA, are expected to contribute the greatest effects to muskox movement. The physical presence of roads is unlikely to pose an impermeable filter to regional muskox movement, although short movements may be influenced by tall snowbanks during winter. Sensory disturbance arising from road construction and ongoing traffic use is likely to have a greater effect on muskox movement, as they avoid visual and auditory stimuli. Most RFI roads in the RAA, including the Grays Bay Road and Port Phase 2 to the NT border (~69 km), Izok Mine access road (~89 km), and Hackett/Back River access road (~117 km), will be built in the southern portion of the RAA to connect with the Project all-season controlled access road (see Figure 18.14). Vehicles associated with RFI activities will use the Project's all-season controlled access road to travel to and from the Port, increasing traffic volumes. Therefore, while the geographic extent of cumulative effects on muskox

movement is the RAA, cumulative effects are likely to be greatest along the length of the LAA, where combined traffic travelling between RFI activities and the Port will increase the sensory disturbance generated along the road.

All future projects in the RAA, including the High Lake Mine and other mine access roads, will be subject to territorial regulations requiring mitigation measures that will reduce their effect on muskox movement. Some RFI roads may incorporate temporary closures aligning with caribou spring migration and calving which will reduce cumulative sensory effects on muskox movement during their sensitive calving period. With assumed mitigation measures, the magnitude of cumulative effects on muskox movement is considered low, as it is unlikely to exceed the range of natural variation in obstacles (e.g., rivers, gorges, lakes) that muskox encounter while moving through the region.

Because the avoidance of sensory disturbance will be the primary cause of changes to muskox movement, the cumulative effect will be continuous throughout the construction and operation of the Project and RFI activities and will be long term in duration. The Project, and some RFI activities will be permanent and therefore, some portion of the cumulative effects on muskox movement will be irreversible.

18.5.4 Change in Mortality Risk

18.5.4.1 Cumulative Effect Pathways

Cumulative effects on muskox mortality are expected to follow the same pathways as described for Project effects in Section 18.4.3.2, vehicle-muskox collisions and increased access for muskox hunters leading to greater muskox harvest in the RAA compared to baseline. As described in Section 18.5.1, the effects of existing projects and muskox harvest were incorporated into the description and baseline conditions and the assessment of Project effects. Therefore, the CEA for muskox mortality focuses on the cumulative effect of the Project and RFI activities in the RAA.

18.5.4.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

GN legislation requires that all current and proposed projects implement standard environmental safeguards and project-specific mitigation plans to reduce their potential impacts on wildlife, including muskox. The *Nunavut Land Use Plan*, when finalized, will manage regional development to balance cumulative effects with desired economic and ecological goals. Therefore, the mitigation measures to reduce direct Project effects on muskox mortality risk committed to in Section 18.4.3.3 are suitable for the Project's contribution to cumulative effects, and no additional measures are proposed.

18.5.4.3 Cumulative Effects

The Project and RFI activities may each contribute to the cumulative effect on direct muskox mortality risk through collisions with vehicles. While the increase of traffic in the RAA, both on RFI roads and from RFI traffic using the Project road will likely increase the direct mortality risk beyond the Project contribution, the mitigation, management and enhancement measures for the Project and similar measures for RFI activities are expected to reduce the potential for collisions on all roads in the RAA.

The road network created by the development of the Project and RFI activities will facilitate hunter access through the RAA and is expected to have the greatest cumulative effect on muskox mortality risk by increasing muskox harvest. While none of the planned roads in the RAA connect to communities in NU, hunters accessing the RAA from seasonal hunting camps at Bathurst Inlet, the Grays Bay Port, or from NT will be able to use the roads to reach areas with little previous harvest. Based on the distribution of muskox in the RAA (Section 18.2.2.1), the Project road may cause a greater incremental increase to the cumulative effect on muskox mortality risk than other RFI roads as it extends to the north through areas of higher muskox density. As discussed in Sections 18.2.2 and 18.4.3, the RAA is fully within muskox management unit MX-11 which currently has a TAH equating to approximately 3.4% of the population, but an average reported harvest rate of approximately 1%. Increased muskox harvest in MX-11 is desired by communities, HTOs, and the GN (NWMB 2023; Leclerc et al. 2024).

Vehicle-muskox collisions will be rare, and because muskox harvest is managed and monitored by the GN with the support of local HTOs, increased harvest in the RAA is unlikely to cause the TAH in MX-11 to be exceeded or to threaten the persistence of local populations. Therefore, the magnitude of cumulative effects on muskox mortality risk is considered low. The cumulative increase in mortality risk will extend throughout the RAA. The timing of the effect will persist throughout the year as multiple irregular events due to the risk of direct mortality, but muskox mortality risk will be greatest during the fall and winter when their meat and hides are most desirable to hunters. Cumulative effects on muskox mortality risk are predicted to be long-term and, because the Project and some RFI activities will be permanent, irreversible.

18.5.5 Summary of Cumulative Effects

The Project's residual effects, combined with RFI physical activities, are likely to cumulatively affect muskox, specifically regarding habitat loss, movement, and mortality risk. Table 18.18 summarizes cumulative effects on muskox. These cumulative effects are generally assessed as low in magnitude, regional in extent, continuous, irreversible, and long-term in duration, with high sensitivity in timing.

For change in habitat, the Project contributes to the loss of an estimated 2.4% of suitable muskox summer habitat and 2.7% of late winter habitat in the RAA. The cumulative loss of both summer and late winter muskox habitat from the Project and all RFI activities interacting with it is projected to be 3.3% to 3.8% (i.e., less than 15% of baseline). Because the Project and some RFI activities are intended to be permanent, some portion of the cumulative effect on muskox habitat is irreversible.

The Project and RFI activities will cumulatively affect muskox movement in the RAA, primarily through sensory disturbance from roads, leading to avoidance of project activities and infrastructure. The Project contribution to effects on movement will be irreversible but will decrease after construction, with considerably lower Project traffic volumes expected as part of operations and maintenance activities. RFI activities will expand the road network and increase traffic on the Project all season road and include some permanent infrastructure contributing to irreversible effects. Because roads will not create impermeable filters and any obstacle roads present to muskox movement is likely to be within the range of natural variation on the landscape, the cumulative effect will be low magnitude.

Table 18.18 Residual Cumulative Effects on Muskox

Residual Cumulative Effect	Residual Cumulative Effects Characterization						
	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	A	L	RAA	HS	LT	C	I
Contribution from the Project to Residual Cumulative Change in Habitat	The Project is expected to result in a small loss of suitable muskox habitat within the RAA (2.4% and 2.7% of suitable summer and late winter habitat, respectively). It will be the single largest contributor to the loss of suitable muskox habitat in the RAA, accounting for approximately 72% of the total cumulative loss of 1,101.0 km² (summer) and 1,217.5 km² (late winter) of suitable habitat, representing 3.3-3.8% of the habitat available at baseline.						
Change in Movement	A	L	RAA	HS	LT	C	I
Contribution from the Project to Residual Cumulative Change in Movement	Project effects on muskox movement will primarily consist of sensory disturbance along the road corridor during construction. Once operational, it will be a minor contributor to effects on change in muskox movement relative to the RFI activities, primarily due to the increased sensory disturbance resulting from considerable increases in road traffic, activity at the Port, and the High Lake Mine.						
Change in Mortality Risk	A	L	RAA	HS	LT	C	I
Contribution from the Project to Residual Cumulative Change in Mortality Risk	The Project will incrementally increase muskox mortality risk through direct collision with Project vehicles and, to a greater extent, by providing increased access for hunters. RFI activities are expected to be the greater contributor to increased mortality risk due to increased traffic volumes and associated collision risk and facilitated hunter access to a wider portion of the RAA than generated by the Project alone.						
Key: See Table 18.4 for detailed definitions Direction: P: Positive A: Adverse N: Neutral Magnitude: NMC: No Measurable Change L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable							

Project effects on muskox mortality risk are predicted to be low magnitude, with the primary pathway being increased harvest through facilitation of hunter access along the road. Cumulative effects on muskox mortality risk will follow similar pathways as access expands, particularly in the southern portion of the RAA. Although the harvest rate may increase in the RAA following the Project and RFI activities, NU's existing harvest management framework, administered by the GN, NWMB, Regional Wildlife Organizations, and local HTOs, sets a TAH and monitors harvest rates to maintain the sustainability of muskox populations across management units. The increase in access in the RAA will be irreversible, but because of the management system in place, the magnitude of the cumulative change in mortality risk from greater harvest opportunities is low.

18.6 Transboundary Effects on Muskox

An assessment of the potential for transboundary effects on muskox is provided in Volume 10, Section 33 Transboundary Effects Assessment.

18.7 Significance of Effects on Muskox

18.7.1 Significance of Project Residual Effects

With the application of mitigation, management and enhancement measures and governing agencies managing muskox harvest in the RAA, the residual effects of the Project on muskox habitat, movement, and mortality risk are predicted to be not significant. This determination aligns with the significance definition provided in Section 18.1.6 in that Project effects will not result in an unacceptable change to the viability and persistence of muskox populations interacting with the RAA. While Project residual effects are characterized as long-term and irreversible due to the permanent nature of the Project, they are expected to be low in magnitude and mostly localized in extent. Project effects on muskox habitat will be minor, with the loss of 2.4% and 2.7% of summer and late-winter habitat, respectively. Effects on muskox movement should be effectively mitigated to reduce physical and sensory obstructions. Direct mortality from collisions with Project equipment are expected to be rare, and any increase in muskox harvest through improved hunter access in the region will be managed by the GN and other responsible agencies. Implementation of the WMMP, adaptive management, and ongoing engagement with communities and wildlife management agencies, will allow for corrective actions to be taken should any effect approach an unacceptable level or management threshold.

18.7.2 Significance of Cumulative Effects

The cumulative effects of the Project and RFI projects and activities are not expected to alter the population viability or persistence of muskox within the RAA and are predicted to be not significant. Future RFI physical activities are anticipated to have similar residual effects to the Project, which can be addressed with comparable mitigation, management and enhancement measures.

18.7.3 Summary of Mitigation, Management, and Enhancement Measures

WKR will implement a WMMP that contains a comprehensive suite of mitigation, management and enhancement measures to reduce potential changes in muskox habitat, movement, and mortality risk. These measures prioritize site clearing that is restricted to the PDA to reduce habitat loss. Other measures focus on reducing sensory disturbance during Project activities. Dust and traffic noise will be controlled. A Borrow Pits and Quarry Management Plan and Explosives Management Plan will be implemented to reduce effects on wildlife. The WMMP also includes general wildlife protection measures such as access and traffic controls, and worker conduct policies.

18.8 Assessment of Project Effects on Moose

Research on moose habitat, movement, and mortality risk in NU or other tundra/permafrost regions is lacking. Where possible, relevant literature was used that relates to the geographical area or habitat features, such as tundra or permafrost. There is abundant literature on moose in Alaska, British Columbia (BC), and Alberta (AB), which was considered when relevant literature from NU or NT was unavailable.

18.8.1 Change in Habitat

Inuit Knowledge provided input to the assessment of the Project's effects on moose habitat by identifying preferred habitat features, noting population trends and range expansion, and detailing how the proposed infrastructure could influence their presence.

Inuit Knowledge defined the preferred habitats and noted recent shifts in moose distribution:

- Preferred Habitat: Moose are found near creeks for several miles where there are shrubs and small willow trees. They like to live where there are tall bushes near the rivers and stay inside the river valleys, in swampy areas mostly (Banci and Spicker 2024).
- Range Expansion: The number of moose is increasing (IAG 2025a). In the past, it was rare to catch a moose near Kugluktuk, but now, there are more being hunted. This increase is often seen as linked to climate change. Moose follow rivers north during hot weather, going back south when it gets cold, though some stay where there are more willows (Banci and Spicker 2024).
- Project Area Presence: Moose are known to be found in the Grays Bay area and the adjacent coast. Specific sightings were noted near the mouth of Wentzel River (*Otkohikhalik*) and Kennarctic River (*Kogloktoktyok*) (Banci and Spicker 2024).

The Inuit Knowledge input related to moose habitat primarily concerns the general impacts of development and environmental change:

- **Noise and Disturbance:** As with muskox, the wildlife assessment was recommended to explicitly consider the potential impact of noise and exhaust fumes on moose, as these factors move animals away.
- **Vegetation/Tree Line Change:** At Contwoyto Lake, members observed that the tree line has moved 40 miles north (IAG 2025a). Since moose are primarily associated with the treeline and riparian shrubs/willows, this observed change might be relevant to the long-term sustainability of their habitat.

By incorporating this knowledge, the assessment has a basis for evaluating project-related effects on moose habitat, given the recent northern shift in the species' range.

18.8.1.1 *Analytical Assessment Techniques*

Direct habitat loss was calculated as the area of wetland or preferred shrub habitat that will be lost within the RAA due to the construction of the road and other facilities forming the PDA. Wetlands and specific shrubby vegetation types provide a coarse approximation of the distribution of potentially suitable moose habitat within the RAA. Moose within the RAA are at the edge of their range in relatively poor habitat and are likely highly selective for areas with sufficient forage. In the RAA, habitat is primarily confined to river valleys and slopes with high shrub cover. The Grays Bay area is cited as having lots of willow that attract moose (Thorpe Consulting Services Ltd. 2014b). Most observations of moose during surveys occurred in valley bottoms or shrub habitats along river systems or coastal plains. These detections are likely related to higher shrub cover in these areas (Thorpe Consulting Services Ltd. 2014b). Accordingly, suitable habitat for moose within the RAA was mapped as consisting of the low shrub, tall shrub, and wetlands land cover classes from the Northern Land Cover dataset developed by Olthof et al. (2009). This 30 m resolution product was created using Landsat data collected around the year 2000 and classified into the main landcover types present in Northern Canadian ecosystems. The habitat suitability mapping produced from the land cover data was adjusted to account for existing landscape disturbances, where present, which were applied across the land cover dataset to map the current distribution of moose habitat suitability within the RAA. The baseline disturbances were informed by the PIL, which considered a variety of information sources to identify physical activities and disturbances (e.g., mines, exploration, roads) (see Appendix 9A of Section 4). In addition to the direct effects (footprints) from past or present PIL physical activities, indirect effects on moose habitat were considered by applying a ZOI buffer around the footprints, as described below.

Indirect habitat loss or alteration was quantified using a ZOI approach. The ZOI defines the area beyond the PDA where Project activities could indirectly affect moose habitat use, potentially resulting in reduced habitat effectiveness or indirect habitat loss. These effects manifest as dust deposition (which reduces forage quality or quantity) and sensory disturbances (e.g., noise, lights, smells, human presence) that can potentially cause moose to reduce use of otherwise suitable habitat adjacent to the PDA.

The size of the ZOI was based on scientific literature reviews of moose sensitivity to specific project components or activities. Laurian et al. (2012) found strong habitat avoidance within 100 m of roadways, which declined to zero beyond 250 m. In a study in AB, vehicle activity within 250 m of moose located in open habitats often caused the moose to leave the area (Horejsi 1979). Additionally, moose showed no disturbance reaction to trucks passing within 200 m to 400 m while they were feeding or bedded down, but the author suggested moose in the study area may be habituated to vehicle traffic (Horejsi 1979). In Alaska, Yost and Wright (2001) found significantly fewer (55%) moose groups within 300 m of a paved road through Denali National Park than expected; however, they suspected that the spatial pattern of preferred forage and cover largely influenced these results. Similarly, Burson et al. (2000) found fewer moose proportionally within 100 m of the Denali Park road between 1972 and 1997; however, the mechanism for the reduced number of detections near the road may have been poorer visibility of moose due to dense vegetation. In Norway, Andersen et al. (1996) found that moose were more responsive to human stimuli (e.g., people walking or skiing) than to mechanical stimuli (e.g., jet overflights), and that they fled from human stimuli at distances of 200 to 400 m. Dust deposition on vegetation at the Project is anticipated to be limited to within 40 m of the PDA and to occur at levels that meet the standards for residential/parkland areas (see Volume 6, Section 15 Vegetation).

Based on the literature reviewed above and an understanding of the proposed project activities and the landscape context in which they will occur, a 300 m ZOI around the PDA was selected to address potential indirect effects on moose habitat. The areas of indirect habitat loss or alteration within the ZOI and of direct habitat loss in the PDA were summed and compared with the baseline amount of shrub habitat in the RAA to determine the magnitude of the change in moose habitat associated with development of the Project.

18.8.1.2 *Project Effects Pathways*

Direct Effects

Direct effects are caused by earthworks (including vegetation clearing and topsoil stripping) that remove habitat, which is expected to be limited to the Project's Construction phase. Habitat removal will occur throughout the PDA. The PDA contains 16.0 km² of shrub habitat potentially available to moose, including 230 riparian crossings that typically include shrubby areas. Nine major crossings are located north of Ulu, where the highest moose densities occur. Willow and shrub habitat exists along the proposed road alignment at most creek crossings, and in some areas within the Aerodrome PDA and the Port PDA, but not at the wharf area, where there are only rock outcrops. Despite some suitable habitat occurring near the southern extent of the Project, limited moose observations or harvest have occurred in that area (see Figure 18.7).

Indirect Effects

Indirect effects may arise from Project activities that produce sensory disturbance (e.g., noise and visual disturbance from blasting and vehicle traffic) or alter forage quality (e.g. dust deposition), reducing habitat effectiveness (i.e., the habitat actually used by moose). These effects are expected to occur throughout all phases of the Project but are limited to within 300 m of the PDA.

Indirect habitat loss or alteration may occur adjacent to the PDA and within the ZOI during both phases of the Project. The ZOI currently contains 39.9 km² of potentially suitable moose habitat. While the habitat may remain relatively intact, moose use may be reduced due to sensory disturbances, leading to reduced habitat effectiveness or even functional habitat loss. Indirect effects include changes in behaviour, resource use, and movements, which can reduce or prevent the use of otherwise suitable habitat (Dyer et al. 2002; Laurian et al. 2012). Wildlife may avoid roads because of vehicle traffic, human activity, noise, light, and dust (Coffin 2007; Polfus et al. 2011; Shannon et al. 2016; Watkinson et al. 2021). Human presence can indirectly affect habitat use. Moose have been found to avoid active roads, humans, and other mechanical stimuli, with avoidance distances ranging from 100 to 400 m (Horejsi 1979; Rudd and Irwin 1985; Andersen et al. 1996; Burson et al. 2000; Yost and Wright 2001).

Based on information from the Air Quality and Vegetation assessments (see Volume 5, Section 11 and Volume 6, Section 15), dust produced from Project-related activities will deposit on the vegetation surrounding the PDA. This deposition can reduce plant cover and growth, and alter the vegetation community (Watkinson et al. 2021), which may influence moose use of that habitat. The extent of dust deposition depends on many factors, such as particle size and local weather patterns, and potential effects on vegetation diminish with increasing distance from dust sources. For example, US EPA (1995) details that larger dust particles (e.g., particulate diameter >100 µm) settle out within about 10 m of the source, while smaller particles (e.g., 30 to 100 µm) tend to be deposited within 100 m of the source (US EPA 1995). Gleason et al. (2007) predict effects from wind-blown dust on vegetation to extend to a distance of 40 m from dust sources.

Blasting and activities at quarries can harm wildlife through noise, vibration, fumes, and flying rock debris (Child et al. 1991; Cunningham et al. 2022). One study from Estonia showed that moose densities increased with increasing distance from quarries, but the most significant factor in moose occurrence was the presence of suitable habitat (Remm and Luud 2003). Water withdrawal is planned for two inland lakes near the Port PDA. Suitable habitat for moose at these lakes is limited as shrubs are not present or sparse.

18.8.1.3 *Mitigation, Management, and Enhancement Measures*

Mitigation, management and enhancement measures encompass practical measures taken to mitigate potential adverse effects on moose. These may include applicable standards, guidelines, and best management practices supported by Inuit Knowledge, Indigenous Knowledge, Community Knowledge, scientific knowledge, or proven practices. The measures identified herein draw on management and monitoring programs from other resource development projects, with an emphasis on road and mining projects in NU.

All relevant habitat-related mitigation, management and enhancement measures will be incorporated into a WMMP and implemented to reduce project-related habitat effects on moose. The WMMP will include detailed monitoring and mitigation measures to be implemented throughout construction and the Project's operations and maintenance.

To reduce the effects of direct habitat loss on moose, the following management measures will be implemented:

- The PDA will be confined to a specific design layout to reduce the Project's potential effect on habitat loss and effectiveness.
- Quarries will not be situated on sensitive habitat features where possible.

To reduce the effects of indirect habitat loss on moose, the following management measures will be implemented:

- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation in use outside the PDA must be pre-approved by the WKR representative onsite. Construction and operations and maintenance personnel will be prohibited from using ATVs and snowmachines for recreational purposes while working on the Project.
- Modified blasting techniques will be considered to reduce noise.
- All machinery, equipment, and vehicles are required to be clean (i.e., decontaminated) and in good working order before coming to the PDA. Machinery, equipment, and vehicles will be regularly maintained and inspected to reduce noise-related sensory disturbance.
- Aircraft will maintain a minimum cruising altitude of 610 m above ground level except during landing and take-off at the airstrip, or for safety reasons due to inclement weather, or when operationally required.
- Dust will be actively suppressed on roads (with water and/or other dust suppressants) when necessary to manage excessive dust. Dust suppression will follow the GN's *Environmental Guideline for Dust Suppression on Unpaved Roads* (GN 2014).
- Reduced speed limits may be temporarily posted during drier conditions to reduce fugitive dust.

18.8.1.4 *Project Residual Effect*

During the Construction and Operations and Maintenance phases, adverse effects on moose habitat are anticipated, but are expected to be negligible in magnitude. For this assessment, it has been assumed that all potential habitat that overlaps with the PDA will be lost to moose for the life of the Project, so changes in habitat are long-term in duration; however, the activities that will result in direct habitat loss are confined to the Construction phase. Direct habitat loss within the PDA will include 16.0 km² of shrubby habitat for moose, representing 0.2% of shrub habitat available to moose in the RAA (see Table 18.19). An additional 39.9 km² of shrubby habitat is expected to be indirectly affected by the Project (within the ZOI portion of the LAA), for a total of 55.9 km² of direct and indirect habitat effects. Within the RAA, this represents a 0.8% decrease in shrubby habitat relative to baseline conditions, which is negligible (i.e., <1%).

Table 18.19 Magnitude of the Change in Suitable Moose Habitat due to the Project

Condition / Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	7,158.7	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	16.0	0.2
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss or Alteration	39.9	0.6
Total Habitat Change			55.9	0.8

Notes:

A ZOI of 300 m around the PDA was applied to capture indirect effects on moose habitat.

Indirect effects are anticipated to occur continuously throughout both phases of the Project, but with considerably fewer sources and occurrences of sensory disturbance in the Operations and Maintenance phase. The geographic extent of the residual effect is limited to the LAA. The timing of the habitat changes is expected to overlap with the late-winter critical period for moose, so the timing is high in sensitivity. The Project will result in the construction of permanent infrastructure, so the effects will be irreversible.

18.8.2 Change in Movement

Inuit Knowledge provided input for assessing the Project's potential effects on moose movement by documenting their specialized use of the landscape and their recent northward expansion patterns. Key Inuit Knowledge regarding moose movement includes:

- Reliance on River Corridors and Riparian Zones:
 - Moose predominantly travel through and inhabit river valleys and creek systems, specifically where there are tall shrubs and small willow trees (Banci and Spicker 2024).
 - Movement is seasonally dictated by these corridors; they follow rivers north into the Project area during hot weather and generally return south when it gets cold, although some individuals now remain year-round where willows are abundant (Banci and Spicker 2024).

Based on these behavioural insights, IAG members recommended that the Project's wildlife assessment consider how the Project might affect wildlife (including moose) movement.

18.8.2.1 Analytical Assessment Techniques

Changes in moose movement can occur through physical and perceptual filters during all Project phases and may occur within or around the PDA. Filters are when the infrastructure is not a complete barrier to wildlife movement but may prevent some individuals from travelling through an area. Physical filters include infrastructure that can potentially obstruct movement (e.g., fences, road berms), potentially fragmenting habitat and making it inaccessible to moose. Perceptual filters are derived from visual and auditory cues (i.e., sensory disturbance, rapidly approaching objects) that elicit risk-averse behavioural responses (Frid and Dill 2002). Changes in movement and space use are the direct result of these filters, which subsequently cause indirect habitat loss from avoidance within a ZOI (see Section 18.8.2).

Project effects on movement were qualitatively assessed based on information from literature reviews and professional judgment informed by baseline conditions within the RAA. Inuit Knowledge notes that moose have used river corridors to move northwards (Banci and Spicker 2024). The literature reviews included information on roads, infrastructure, snow berms, and sensory stimuli affecting moose movement.

18.8.2.2 *Project Effects Pathways*

Moose movements are generally greatest during the spring and summer (cow moose) and rut (bull moose), and the lowest movement rates occur during winter when energetic costs are the greatest (Henriksson 2007). Studies have found that moose seasonal movements range from 1 to 57 km (Rolley and Keith 1980; Hundertmark 1998; Joly et al. 2015) and that movement patterns can vary from season to season or year to year (Sweanor and Sandegren 1989; White et al. 2014; Rolandsen et al. 2017; Berg et al. 2019; Hetta 2025). While moose movement in the LAA is not well understood, Inuit Knowledge (see Section 18.1.1) and the findings from baseline studies (see Section 18.2.3) have identified moose occurrence and distribution primarily in the northern portion of the Project area. Project-related activities can potentially influence moose movement across the landscape. A description of the activities and their potential influence on moose movement is provided below.

Road

The physical presence of a road typically does not influence moose behaviour or movement; rather, the amount of human activity associated with the road can influence moose response to it (Jalkotzy et al. 1997). Moose have shown little to no aversion to low-use roads (less than 10 vehicles per day) (Wattles et al. 2018). Predicted numbers of vehicles on-site for the Project show considerably more vehicles during the Construction phase than during the Operations and Maintenance phase. Construction traffic is anticipated to reach approximately 193 vehicles and pieces of equipment spread across the PDA. In contrast, the Operations and Maintenance phase will have a lower traffic level of approximately 30 vehicles (see Volume 2, Sections 1 to 3).

The Project will likely interact most often with moose in the northern portion of the PDA (see Figure 18.6 and Figure 18.7). Moose occurrence in proximity to the Project occurs in the High Lake to Grays Bay area, specifically from 10 to 15 km south of High Lake to the coast (approximately the northern half of the LAA). Moose have been seen in this area from March through October during baseline surveys, and Inuit Knowledge notes that they are also observed there in winter (NTKP 2018).

Moose tend to avoid areas located adjacent to active roads with vehicle traffic. Moose have been known to avoid areas within 250 m of vehicle activity in open habitats (Horejsi 1979). Hunted wildlife populations exhibit stronger disturbance reactions to people along roads than non-hunted populations (Rolley and Keith 1980; Jalkotzy et al. 1997; Baskin et al. 2004; Plante et al. 2018). A study in Alaska found that when vehicle traffic increased by 50% along a highway, moose observations decreased by 72% (Singer and Beattie 1986). In forested areas, moose avoidance of roads usually dissipates after 250 m (Wasser et al. 2011; Laurian et al. 2012), but some moose will avoid roads up to 750 m (Laurian et al. 2012). However, some moose that had habituated to human activity were not strongly influenced by human development and did not avoid roads or developed areas (Belant et al. 2006). In open areas, such as tundra

landscapes, moose may avoid roads or humans at greater distances due to a lack of cover and perceived predation risk (Bjørneraas et al. 2011; Neumann et al. 2013). Moose may avoid roads because of vehicle traffic, human activity, noise, light, and dust (Coffin 2007; Polfus et al. 2011; Shannon et al. 2016; Watkinson et al. 2021). Moose have been found to avoid active roads, humans, and other mechanical stimuli, with avoidance distances ranging from 100 to 400 m (Horejsi 1979; Rudd and Irwin 1985; Andersen et al. 1996; Burson et al. 2000; Yost and Wright 2001). However, the behaviours of individual moose may vary, and female moose with calves seem to avoid humans more often than males (Stankowich 2008; Lykkja et al. 2009).

Moose at a study site in AB were noted to increase their use of roads, especially in winter, to reduce energy expenditure, indicating that plowed roads may facilitate moose travel (Cunningham et al. 2022). However, the Project is located in an open landscape (i.e., movements are unobstructed by trees), where snow hardens due to low air temperatures and high wind speeds (Lackner et al. 2022); snow compaction on roads is unlikely to provide greater ease of movement than the surrounding landscape.

Snow Berms

Snow berms created by road plowing can be a potential filter for moose movement, with sight lines and the height of the berms important attributes that affect moose movement (Jalkotzy et al. 1997). Snow berms can prevent animals from crossing roads and moving to adjacent habitats, and they can also trap animals within the roadway (Horejsi 1979; Rudd and Irwin 1985). In Wyoming, moose selected to escape from plowed roads in areas with less slope, and in areas where the snow depth of the berm was less than the average depth along the road (65 cm vs 73 cm; Rudd and Irwin 1985). In AB, moose have been deflected by snow berms averaging 65 cm in height, and berms of 1.5 m in height were barriers to movement of some moose (DA Westworth & Associates 1994 in Jalkotzy et al. 1997). In another AB study, moose were observed walking through soft snow berms up to 54 cm in height, and on hardened snow berms, up to 59 to 93 cm in height (Horejsi 1979). Another study in AB found that dirt berms 30 to 210 cm high were not obstacles to moose when breaks/gaps were present or when the height was lower than the surrounding berm height (Morgantini 1985). In the Arctic, where snowbanks are generally firm enough to support the weight of an animal on its surface, snowbank angle is likely more important than height or the presence of gaps for potentially obstructing movement.

Human Activity

Non-lethal disturbance stimuli cause wildlife to alter their movement to avoid perceived risk, which in turn reduces the time wildlife spend on fitness-enhancing activities such as feeding or caring for young (Frid and Dill 2002). Harris et al. (2014) found that non-motorized disturbances have a greater effect (moose move further away) than motorized disturbances, suggesting that the presence of people would have a greater effect than the presence of vehicles. Neumann (2009) found that moose responded to human presence and motorized disturbance similarly with increased movement rates, although the behavioural change was short-lived (2 to 4 hours). Additionally, moose moved from areas near inhabited houses to areas with lower human activity, with female moose moving farther away due to a higher perceived risk when they have calves (Lykkja et al. 2009).

18.8.2.3 Mitigation, Management, and Enhancement Measures

Mitigation, management and enhancement measures encompass practical measures taken to mitigate potential adverse effects on moose. These may include applicable standards, guidelines, and best management practices supported by Inuit, Indigenous, and Community Knowledge, scientific knowledge, or proven practices. The mitigation, management and enhancement measures identified herein draw on management and monitoring programs from other resource development projects, with an emphasis on road and mining projects in NU.

Mitigation, management and enhancement measures used to reduce Project-related effects on moose are specific to different Project phases (i.e., Construction and Operations and Maintenance).

All relevant movement-related mitigation, management and enhancement measures will be incorporated into a WMMP and implemented to reduce Project-related effects on moose. The WMMP will include detailed monitoring and mitigation measures to be implemented throughout the construction, operations, and maintenance of the Project.

Road Design, Snow Berms, and Traffic

The primary means of reducing physical barriers to moose movement is through road design. The constructed will aim to be ≤ 1.75 m in elevation relative to adjacent terrain, with slope inclines ≤ 18.5 degrees and small gravel surface materials where possible. This elevation and slope will reduce the effort required for moose to traverse it.

Additional mitigation, management and enhancement measures that will be implemented to reduce physical filters to movement include:

- Snowbanks will be maintained so they are not an obstruction to movement for caribou and other wildlife. Creation of snowbanks will generally be avoided (for operational reasons to avoid snow drifts on the road on the lee side of the bank), except where not technically feasible; the height of snowbanks will maintained at less than 1 m and snow plowing will be conducted in such a way as to limit the angle and vertical height of the snowbank edge.
- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be reduced in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road-crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.
- Wildlife will have the right-of-way on all Project infrastructure areas as detailed in the WMMP.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).

- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.

Human Activity

To reduce changes to moose movement through perceptual filters, the following mitigation, management and enhancement measures will be implemented:

- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.

18.8.2.4 *Project Residual Effect*

The Project's residual effects on moose movement during the Construction phase are anticipated to be low in magnitude. The amount of human activity during the Project's Operations and Maintenance phase will be less than during the Construction phase; therefore, the residual effects on moose movement will be reduced to a negligible magnitude during the Operations and Maintenance phase. The Project is not anticipated to create impermeable filters to moose movement.

Moose in the RAA have likely had little or no interactions with humans and may therefore exhibit increased risk avoidance of areas being used by humans (Stankowich 2008). During the Construction phase, moose will likely avoid the Project initially. This risk-avoidance behaviour is expected to decrease over time as moose have been shown to adapt to human development, including roads (Belant et al. 2006; Stankowich 2008; Bjorge et al. 2018).

During the Operations and Maintenance phase, some local moose will likely exhibit tolerance to human activity due to their adaptability. Moose interactions with the road will vary based on their individual responses. Some individual moose will completely avoid roads at great distances, resulting in a barrier to movement (Baskin et al. 2004; Laurian et al. 2012). Some individuals may not be bothered by the physical road and will cross it as long as human presence and traffic are low (Jalkotzy et al. 1997), while others will forage alongside roads or use them as travel corridors (Cunningham et al. 2022).

Even with the implementation of mitigation measures (see Section 18.8.2.3), such as restricting road access and use and giving wildlife the right-of-way, residual effects on moose movement during construction may occur largely due to road traffic, human presence, and construction-related noise. Effects on movement will be adverse in direction, low in magnitude, and will be limited to the LAA. Construction activities will occur year-round, including during sensitive time periods for moose (late winter: February to April), and will follow a regular schedule. Effects are anticipated to be short-term as effects related to construction will cease once construction is completed, but the residual effects are irreversible as the Project is permanent.

With the implementation of the WMMP and other activity-specific management plans, which will include key mitigation measures such as traffic control measures and managing snowbanks, and the adaptation of moose to the presence of road and humans, residual effects to moose movement during the Operations and Maintenance phase are anticipated to be negligible and contained within the LAA. With less human activity during this project phase, moose interactions with the Project will likely be sporadic and irregular, but may occur during highly sensitive periods. The effects will be long-term and irreversible, as the Project is permanent.

18.8.3 Change in Mortality Risk

Inuit Knowledge contributed to assessing potential project effects on moose mortality risk by identifying the species' habitat preferences and indirectly indicating risks from disturbance, which included the potential influence of blasting on moose.

18.8.3.1 Analytical Assessment Techniques

Changes in moose mortality risk caused by the Project were assessed qualitatively by identifying how Project-related activities could increase mortality risk. The qualitative assessment involved literature reviews and the evaluation of various factors that can influence the risk of collisions (e.g., traffic volumes, embankment characteristics, roadside attractants, speed limits), how moose may interact with different Project infrastructure (e.g., aerodromes, quarries), and how the Project may indirectly influence hunting pressure. The results of the qualitative assessment were then presented within the context of understanding moose occurrence and documented moose mortalities within the RAA.

18.8.3.2 Project Effects Pathways

The Project can influence moose mortality by vehicle collisions (Child et al. 1991; Cunningham et al. 2022) aircraft collisions (Lievense 2024), interactions with quarries and blasting (Sevelka 2022), and potential increased hunter access into areas that previously lacked access (Frair et al. 2008).

Vehicle Collisions

The road constructed for the Project will be the primary vector for increased moose mortality from vehicle collisions and improved access for hunters. Moose-vehicle collisions are typically higher at night, during early to mid-winter, in areas of high moose density, and in areas where roads cross valleys or moose movement corridors (Child et al. 1991; Del Frate and Spraker 1991; Dussault et al. 2006; Cunningham et

al. 2022). The Project's predicted vehicle numbers will be considerably higher during the Construction phase compared to the Operations and Maintenance phase.

Increased mortality from vehicle collisions is related to a variety of factors, including speed (exceeding 80 km/h) and traffic volume, location, and visibility (e.g., darkness and vegetation) (Del Frate and Spraker 1991; Jalkotzy et al. 1997; Huijser et al. 2008). Other factors, such as areas of the landscape with higher moose use that overlap with roads (i.e., valley bottoms), poor light conditions, and tall or extended snowbanks along road edges, may influence the risk of vehicle collisions (Stuart 1984; Child et al. 1991; Joyce and Mahoney 2001; Dussault et al. 2006; Danks 2007; O'Keefe and Rea 2012).

Deeper snow conditions have been known to exacerbate moose mortality risk along roadways, as animals use areas near roads or on roads that have less snow than surrounding areas (Del Frate and Spraker 1991, Jalkotzy et al. 1997). However, in the tundra snow pack can become dense and hard due to low air temperatures and high wind speeds (Lackner et al. 2022).

Several studies have shown that vehicle collisions with moose tend to occur more frequently during nighttime hours (dusk, dawn, darkness) (Belant 1995; Langley et al. 2006; Laurian et al. 2008; Cunningham et al. 2022). For the Project, the extended darkness during late fall and winter suggests this mortality risk will be more pronounced during those periods.

Aircraft

The Project anticipates greater aircraft activity (both helicopters and fixed-wing) during the Construction phase than during the Operations and Maintenance phase (see Volume 2, Section 2.6 for details). Although rare, aircraft collisions with moose or other mammals have occurred (Seiler and Helldin 2006; Lievense 2024), resulting in wildlife mortality (Kelly and Allan 2006). Between 1990 and 2003, seven aircraft-moose collisions were documented in the United States of America (USA) (Cleary et al. 2004). In winter, snowbanks along airport airstrips can block the visibility of moose that may be nearby (Lievense 2024), and there have been reports of mammals habituating to aircraft if the angle of approach is not direct, or the vertical or horizontal distance is not perceived as a threat (Kelly and Allan 2006). Aircraft collisions with mammals primarily occurred at night or dusk, and many collisions with ungulates occur in October and November (Wright and Dolbeer 1998; Cleary et al. 2004).

Quarries and Blasting

Blasting and activities at quarries can harm wildlife through noise, vibration, fumes, and flying rock debris (Sevelka 2022). Inuit Knowledge identified a concern with blasting activities and how they may influence wildlife (see Table 18.10). One study from Estonia showed that moose densities increased with increasing distance from quarries, but the most significant factor in moose occurrence was the presence of suitable habitat (Remm and Luud 2003).

Hunting

The Kitikmeot Inuit Association expressed concern regarding increased hunting pressure on moose and muskox as the road may bring in outside hunters (KIA 2024). Increased hunting pressure (legal and illegal) can result from increased access (Boer 1990; Jalkotzy et al. 1997; Beazley et al. 2004; Kneeshaw et al. 2010). The Project may facilitate new hunting opportunities in areas that have received limited hunting pressure due to its remoteness and inaccessibility. Records of documented moose harvest within the RAA are shown in Figure 18.7. Several studies in forested areas have shown that hunters typically kill moose within 1.6 km of roads (Boer 1990; Jalkotzy et al. 1997).

The introduction of the road is expected to increase travel and access to traditional resources, sites, or areas for Kitikmiut, other potentially affected Indigenous groups, and non-Indigenous people (see Volume 9, Section 24). These changes may result in both positive and adverse residual effects (Kneeshaw et al. 2010). Potential positive effects of new roads on Inuit include easier access for hunters to TLMRU areas, landmarks for wayfinding, and increased access to remote areas for practicing traditional and cultural activities. Potential adverse effects include increased competition for traditional resources, increased human presence in TLMRU areas, and increased hunters and tourists.

18.8.3.3 *Mitigation, Management, and Enhancement Measures*

Mitigation, management and enhancement measures encompass practical measures taken to mitigate potential adverse effects on moose. These may include applicable standards, guidelines, and best management practices supported by Inuit, Indigenous, and Community Knowledge, scientific knowledge or proven practices. The mitigation, management and enhancement measures identified herein draw on management and monitoring programs from other resource development projects, with an emphasis on road and mining projects in NU. There are no project-specific mitigation measures to reduce moose mortality risk from increased hunting. Harvest of moose in the RAA will occur within the current regulatory and management framework for moose in NU.

All relevant mortality-related mitigation, management and enhancement measures will be incorporated into a WMMP and implemented to reduce Project-related effects on moose. The WMMP will include detailed monitoring and mitigation measures to be implemented throughout construction and the Project's operations and maintenance.

Vehicle/Wildlife Collisions

To reduce the risk of increased moose mortality due to the Project, the following mitigation, management and enhancement measures will be implemented:

- Wildlife will have the right-of-way on all Project infrastructure areas as detailed in the WMMP.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).

- Snowbanks will be maintained so they are not an obstruction to movement for caribou and other wildlife. Creation of snowbanks will generally be avoided (for operational reasons to avoid snow drifts on the road on the lee side of the bank), except where not technically feasible; the height of snowbanks will be maintained at less than 1 m and snow plowing will be conducted in such a way as to limit the angle and vertical height of the snowbank edge.
- The all-season roadside slopes, where possible, will be designed to 3:1 (≤ 18.5 degrees) to facilitate caribou and other wildlife crossings using finer material where applicable in "high potential areas" identified by: 1) local knowledge; 2) collar data; 3) experience during road operations; 4) camera monitoring.
- Wildlife signs will be displayed along the road in areas where wildlife are commonly observed to inform drivers.
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers of the road.
- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.
- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be reduced in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road-crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.
- Random speed audits shall occur when the road is operational, administered by WKR to encourage driver compliance.
- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Equipment will be operated on designated workspaces or existing roads only.
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.

Other Potential Sources of Mortality

- All aircraft will conduct an initial fly-by of the airstrip to confirm no wildlife located on or in proximity to it before landing. If wildlife are observed within 100 m, pilots will notify construction/grounds personnel and aversion techniques will be implemented to discourage wildlife so aircraft can land safely.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.
- WKR will control access to the road through user agreements with organizations and individuals. For safety reasons, no access to the port and road will be allowed during the Construction phase.
- Public access to active borrow sites and quarries, and associated access roads will be restricted.
- Use of firearms within the designated safety buffer zones around operations (one mile) is prohibited, as per Section 5.7.17 of the *Nunavut Land Claims Agreement Act*.
- Blasting at quarries will be temporarily suspended if moose are identified within 0.5 km of the blast site. Blasting may continue once moose move outside of the exclusion zone.

18.8.3.4 *Project Residual Effect*

Residual effects on moose mortality risk remain apparent after implementing the mitigation measures presented in Section 18.4.3.3; however, these effects are anticipated to be of low magnitude during both project phases (i.e., Construction and Operations and Maintenance). The Project will provide new opportunities for hunting access. The number of hunters who will take advantage of this new access is expected to be low given the area's remoteness. The mitigations identified for interactions with aircraft and blasting activities will reduce the potential mortality risk to moose.

Motor vehicle collisions with moose are predicted to have a low likelihood of occurrence due to the low moose density in the RAA, the limited geographic area where they occur (the north half of the RAA), and the open landscape, which offers good visibility for drivers to see wildlife. However, reduced visibility in winter, due to less sunlight and greater obscuration from blowing snow, will increase mortality risk throughout the Project's life. Lower speed limits (below 80 km/h, especially below 60 km/h) can reduce the risk of vehicle collisions with moose, especially at night or in areas with suitable habitat (Joyce and Mahoney 2001; Seiler 2005; Danks 2007, Arctic Canadian Diamond Company 2022). The road is not expected to serve as a movement corridor for moose, as occurs in boreal landscapes. Research has shown that mortality events from collisions rarely become a population-limiting factor (Forman and Alexander 1998).

Induced effects from increased harvest rates within the RAA, facilitated by the Project's access, are more challenging to mitigate. Inuit hunters in NU have free, unrestricted access to moose. Annual harvest for non-Inuit resident, non-resident, and non-resident foreigner is limited to one moose per year, with no closed season (GN 2024). In NU, hunting is regulated through territorial legislation, community-based wildlife management systems, and co-management bodies established under the *Nunavut Land Claims Agreement Act*, including the NWMB, and local HTOs. Therefore, increased access does not inherently imply overharvest; however, it is likely to shift the spatial distribution of harvest to the RAA from elsewhere in the region. A residual effect remains because the Project may facilitate lawful access to some areas that are currently less frequently harvested. However, given the regulatory frameworks and the availability

of adaptive tools to address changes in harvest patterns, if required, the residual induced harvest-related mortality attributable to the Project is expected to be low.

The mortality risk is projected to be adverse in direction but low in magnitude during both project phases. The geographic extent of the induced increase in moose harvest will likely extend beyond the LAA into the RAA (primarily the north half based on moose occurrence), as hunters/trappers can use the road as a jumping off point to travel farther than the 4 km distance around the Road PDA that defines the LAA. Project activities will occur year-round, including during the most sensitive time period for moose (i.e., late winter: February to April). The mortality risk is considered long-term, as it will persist throughout the Project. Mortality risk will occur at multiple irregular intervals, and the residual effects on mortality risk are irreversible.

18.8.4 Summary of Project Residual Effects on Moose

Table 18.20 summarizes Project residual effects on moose. Following the implementation of mitigation and management measures, the Project is projected to result in adverse residual effects on moose habitat, movement, and mortality risk in both the Construction and Operations and Maintenance phases. Changes in habitat are predicted to be negligible in magnitude in both project phases. Changes in movement are expected to be low magnitude during the Construction phase and negligible during the Operations and Maintenance phase. The change in mortality risk is predicted to be low in magnitude in both project phases, resulting in a detectable change from baseline conditions but within the range of natural variation and/or accepted standards. The Project's effects on changes in habitat and movement during both project phases will be restricted to the LAA, mainly due to the extent to which sensory disturbance from project activities (e.g., noise and vibration) can extend. Effects on mortality risk may extend beyond the LAA into the wider RAA. Project activities may occur during highly sensitive time periods for moose, and their effects will be long-term, variable in frequency, and irreversible, as the Project is permanent.

Table 18.20 Project Residual Effects on Moose

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C, O	A	N	LAA	HS	LT	C	I
Change in Movement	C, O	A	L, N	LAA	HS	ST, LT	IR	I
Change in Mortality Risk	C, O	A	L	RAA	HS	LT	IR	I
Notes: See Table 18.4 for detailed definitions Project Phase: C: Construction O: Operations and Maintenance Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Wildlife Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable								

18.8.5 Effects of Climate Change on Moose

Temperatures have increased globally in the atmosphere, oceans, and over land, and they will continue to increase (IPCC 2021). Studies have shown that anthropogenic global warming has affected most biological and ecological processes, including wildlife and their population distributions, physiology, and life history (Parmesan 2006; Scheffers et al. 2016; Díaz et al. 2019). Recorded temperature increases have contributed to large-scale impacts on biodiversity, including species distribution, phenology, population dynamics, community structure, and ecosystem function (Pearce-Higgins et al. 2015; IPBES 2019; Díaz et al. 2019). Moose have expanded their range worldwide (Lister 1993), and within the Arctic as a result of climate change (Tape et al. 2016b). Within the RAA, Inuit Knowledge has noted that, overall, river water levels are lower for most of the year (due to less snow and rain), with spring runoff occurring earlier and a shorter, sustained freshet (see Volume 5, Section 12.3.1). With lower overall water levels in creeks and rivers, more sediment may be exposed along the shoreline, facilitating an increase in shrub germination and proliferation, thereby creating more habitat for moose within the RAA.

The RAA is predicted to experience a warming trend (see Volume 5, Appendix 12A), especially during the winter months. The region is projected to become warmer and wetter, with a lengthening growing season, reduced frozen ground/ice, and a high likelihood of shrub expansion. Historically, moose were primarily known and used by Inuit living near the treeline, but recently they have increased in numbers and distribution, much further north than anticipated, presumably due to climate change (Banci and Spicker 2024). Moose have become more abundant above the treeline as shrub habitat has increased with a warming climate (Harsch et al. 2009; Tape et al. 2016b). The effects of climate change on moose include an increase in the numbers of moose at the northern extent of their range and a northward shift in moose populations (Rosa 2020; Deb et al. 2020; Rempel et al. 2021).

Climate change models predict an increase in tundra fires and burned areas in the Arctic (Joly et al. 2012). These fires might benefit moose, which prefer the shrubby, deciduous early-successional vegetation that can grow well after a tundra fire; consequently, moose habitat will increase in the Arctic.

Overall, the potential effects of climate change on moose in the RAA do not alter the conclusions of the Project effects assessment on moose.

18.9 Assessment of Cumulative Effects on Moose

18.9.1 Project Residual Effects Likely to Interact Cumulatively

Table 9A.1 in Appendix 9A (Volume 4) presents the PIL, which identifies other projects and physical activities that might act cumulatively with the Project. Potential interactions may occur with past, present, reasonably foreseeable, and RFI projects, as well as with physical activities. Interactions with past and present physical activities within the RAA were already considered in the assessment of Project effects (see Section 18.8). Thus, the CEA builds on the Project effects assessment by considering reasonably foreseeable and RFI conditions. No reasonably foreseeable physical activities in the PIL occur within the RAA, but several applicable RFI activities may occur because of the Project. Some projects or activities listed in Table 18.21 occur outside the RAA (e.g., Bathurst Inlet, Izok Lake, Yellowknife Gold), making overlapping effects unlikely; therefore, they were not included in the CEA. Where residual effects from the Project may act cumulatively with the RFI activities identified within the RAA (see Table 18.21), a CEA is carried out.

RFI physical activities are conditional on advancing only if the Project is first approved and then operational (see Volume 4, Appendix 9A). RFI physical activities that may interact with Project residual effects include the High Lake Mine (assumed footprint size of 0.78 km²) and induced access roads linking to the Project from other RFI projects located outside the RAA (see Figure 18.14). Portions of these induced access roads (assumed to be 28 m wide) are located within the RAA, including 69 km for the Grays Bay Road and Port Phase 2 — Jericho Mine to NT Border, 89 km for the Izok Lake Access Road, and 117 km for the Hacket and Back River Access Road. RFI physical activities related to expansions of the Project (other than Grays Bay Road and Port Phase 2) occur within the proposed PDA (e.g., bulk fuel storage expansions and airstrip expansion) and, therefore, do not add to surface disturbances in the RAA.

During engagement sessions, comments were received on concerns about how the combination of exploration activities and other human developments in the area may cumulatively influence wildlife (see Table 18.10). These concerns were taken into consideration in the CEA.

Table 18.21 Interactions with the Potential to Contribute to Cumulative Effects on Moose

Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Past			
Bathurst Inlet	-	-	-
Omingmaktok	-	-	-
Snap Lake Mine	-	-	-
Present			
Arcadia Bay Project	-	✓	-
B2Gold George Property	-	-	-
B2Gold Marine Laydown Area	-	-	-
Bulk Carriers	-	-	-
Cambridge Bay	-	-	-
Chuk and Fire Shear Blocks	-	✓	-
Commercial Cargo	-	-	-
Commercial and Domestic Harvesting	-	-	✓
Coppermine Project	-	-	-
Coppermine River Project	-	-	-
Diavik Diamond Mine	-	-	-
Ekati Diamond Mine	-	-	-
Epworth Project	-	-	-
Fishing Vessels	-	-	-
Gahcho Kué Diamond Mine	-	-	-
Goose Mine	-	-	-
Hackett River Project	-	-	-
High Lake (Izok Corridor Project)	✓	✓	✓
High Lake East	-	✓	-
Hood River Gold Project	-	✓	-
Hope Bay Project	-	-	-
Hydroelectric	-	-	-
Icebreakers	-	-	-
Itchen Lake Property	-	✓	-
Izok Lake (Izok Corridor Project)	-	-	-

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	Change in Habitat	Change in Movement	Change in Mortality Risk
Jericho Mine	✓	✓	✓
Kennady North - Exploration	-	-	-
Kugluktuk	-	-	-
Lupin Mine	✓	✓	✓
Muskox Nickel Property	-	-	-
Nunavut Community Infrastructure	-	-	-
Northwest Territories Community Infrastructure	-	-	-
Overflights	-	✓	-
Passenger Ships and Pleasure Craft	-	-	-
Pistol Lake Project	-	✓	-
Rae Copper Exploration Project	-	-	-
Rockinghorse (Koamaogaktok) Project	-	✓	-
Roma Project	-	-	-
Scientific Research	-	✓	-
South Kitikmeot Gold Project	-	-	-
Tanker Ships	-	-	-
Tibbitt to Contwoyto Winter Road	✓	✓	✓
Tourism	-	✓	-
Tree River Lodge	✓	✓	✓
TTMG Project	-	✓	-
Tugs/Barges	-	-	-
Ulu Gold Project	✓	✓	✓
Wolf/Mistake Lake Property	-	✓	-
Yellowknife City Gold Project	-	-	-
Past and Reasonably Foreseeable			
Indin Lake Gold Project	-	-	-
Mon Mine	-	-	-
Yellowknife Gold Project	-	-	-
Project-Related Physical Activities			
Reasonably Foreseeable			
Arctic Economic and Security Corridor	-	-	-
Courageous Lake Mine	-	-	-
NICO	-	-	-

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality Risk
Reasonably Foreseeable Induced			
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port	-	✓	✓
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho	-	✓	-
Grays Bay Road and Port: Airstrip Expansion	-	✓	-
Grays Bay Road and Port: Road Traffic	-	✓	✓
Grays Bay Road and Port: Port Traffic	-	-	-
Grays Bay Road and Port: Air Traffic	-	✓	✓
Grays Bay Road and Port Phase 2 –Jericho Mine to NT Border	✓	✓	✓
Hackett River Project	-	-	-
Hackett and Back River Access Road	✓	✓	✓
High Lake Mine (Izok Corridor Project)	✓	✓	✓
Izok Lake Mine (Izok Corridor Project)	-	-	-
Izok Lake Access Road	✓	✓	✓

Notes:

✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual effects.

– = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

Physical activities associated with marine traffic at Grays Bay Port (e.g., cargo ships, fuel tankers, tugs and barges, small craft, etc.), and its associated infrastructure are not likely to affect moose habitat, movement, or mortality risk as they are marine-based activities. Project expansions to bulk fuel storage capacity at the Port and Jericho Station, along with the airstrip expansion, were included in the assessment of Project effects on habitat change, as these expansions will all occur within the existing PDA. However, traffic associated with vehicle and equipment use of the fuel storage facilities may cumulatively influence moose movement and mortality risk. Based on moose distribution identified by Inuit Knowledge and Project surveys, most moose occur in the northern half of the RAA, whereas most RFI projects occur at the southern extent of the RAA (except for High Lake Mine, and third-party use of the Grays Bay Road and Port). Interactions of moose with RFI activities in the southern portion of the RAA are expected to be rare.

18.9.2 Change in Habitat

18.9.2.1 Cumulative Effect Pathways

As described in Section 18.8.1, existing habitat disturbances due to past and present physical activities have shaped the baseline condition of suitable moose habitat in the RAA. The RFI physical activities identified include the construction of new mines and roads for other projects, Grays Bay Road and Port expansions, and traffic from the RFI activities that use the Project road. The infrastructure and development from these potential future activities will likely cause additional adverse effects on moose habitat.

The potential effects pathways identified in Section 18.8.1.2 for the Project are assumed to apply to all RFI activities. Direct habitat loss will occur cumulatively within the RAA from the Project and the RFI activities. Sensory disturbances (dust, noise, visual stimuli) from both the Project and the RFI activities may elicit risk-averse behavioural responses in moose (Frid and Dill 2002), thereby altering habitat use within the RAA. Human presence tends to affect moose more than the presence of novel infrastructure (Horejsi 1979; Jalkotzy et al. 1997).

All RFI projects and activities have a known spatial footprint, either areal (e.g., mine site) or linear (e.g., roads). Direct habitat loss from earthworks and vegetation clearing will occur where the footprints of these RFI activities overlap with suitable moose habitat, while indirect habitat loss or alteration within a ZOI surrounding their footprints can be expected due to sensory disturbance (e.g., blasting and vehicle traffic) or dust deposition. The 300 m ZOI used to assess project effects on moose was used to capture indirect effects associated with the RFI roading activities, while a 4 km ZOI was used to account for increased levels of sensory disturbance and dust deposition related to the High Lake Mine.

18.9.2.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

No additional mitigation, management and enhancement measures beyond those identified in the Project's effects assessment are proposed, given that all current and proposed projects in NU are obligated by laws and regulations to implement appropriate environmental safeguards and project-specific mitigation plans.

18.9.2.3 Cumulative Effects

The CEA for changes in moose habitat considers both direct habitat loss and indirect habitat loss or alteration that can affect habitat suitability or availability. A quantitative assessment of the cumulative effects of change in moose habitat was primarily conducted in accordance with the methods described in Section 18.4.1.1, except for the use of a larger ZOI around the RFI mine to assess indirect effects.

The cumulative effects of the Project and RFI activities on the amount of suitable moose habitat within the RAA are presented in Table 18.22. Cumulatively, these future physical activities are predicted to result in the direct loss of 17.9 km² and indirect loss or alteration of 92.9 km² of suitable moose habitat, for a total loss of 110.8 km². The Project is the major contributor to these losses, accounting for approximately half of the total. The total loss of suitable moose habitat amounts to 1.6% of the potentially suitable habitat available in the RAA at baseline, representing a low-magnitude effect (i.e., 1 to 15% change in suitable habitat).

Table 18.22 Magnitude of the Cumulative Effects on Moose Habitat

Physical Activity	Direct Habitat Loss (km²)	Indirect Habitat Change (km²)	Total Habitat Change (km²)	% Suitable Habitat in RAA
Greys Bay Road and Port Phase 1	16.0	39.9	55.9	0.8
Greys Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Greys Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Greys Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Greys Bay Road and Port Phase 2 – Jericho Mine to NT Border	0.3	6.8	7.2	0.1
Hackett and Back River Access Road	0.9	18.9	19.7	0.3
High Lake Mine (Izok Corridor Project)	0.0	12.4	12.4	0.2
Izok Lake Access Road	0.8	14.9	15.6	0.2
Total	17.9	92.9	110.8	1.6

Notes:

* = activity occurs within GBRP Phase 1 PDA.

A ZOI of 300 m was applied around RFI roads and 4 km around RFI mines.

The Project's residual effects are anticipated to interact with those of RFI projects and activities located throughout the RAA. Therefore, the cumulative effect of habitat change is at the scale of the RAA. The timing of habitat changes associated with current and RFI projects and activities is uncertain. Some projects and activities may overlap with sensitive periods (i.e., late winter) for moose. Consequently, the timing of the cumulative effect is predicted to have high sensitivity. Most portions of the Project and other activities in the RAA will be permanent, resulting in long-term, irreversible cumulative effects. The Project and other RFI projects and activities that require vegetation clearing are anticipated to occur as one-time events at specific locations. However, ongoing sensory disturbances (e.g., vehicle traffic, human presence) associated with current and likely future projects and activities (e.g., roads) may result in continuous habitat alteration. Therefore, the cumulative effect is continuous.

18.9.3 Change in Movement

18.9.3.1 Cumulative Effect Pathways

As described in Section 18.8.2, existing effects on moose movement due to past and ongoing developments were captured in the baseline conditions within the RAA. The effects of the RFI projects will cumulatively add to the project's residual effects on moose movement within the RAA. The Project's contribution to change in moose movement is predicted to occur within the LAA.

The potential effects pathways identified in Section 18.8.2.2 for the Project are assumed to apply to all RFI projects and activities identified for assessment. Physical infrastructure, such as new roads and mines, can potentially alter moose movement. Sensory disturbances (dust, noise, visual stimuli, human presence) from additional activities may elicit risk-averse behavioural responses by moose (Frid and Dill 2002). Human presence tends to affect moose more than the presence of novel infrastructure (Horejsi 1979; Jalkotzy et al. 1997).

18.9.3.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

No additional mitigation, management and enhancement measures beyond those committed to in the Project's effects assessment are proposed. All current and future activities and resource uses in NU are required to produce and adhere to mitigation, management and enhancement measures and monitoring strategies designed to safeguard environmental components, as outlined in their respective approvals and permits. These are expected to be similar to those contained in the WMMP for this Project, which identifies WKR's wildlife management and monitoring obligations.

18.9.3.3 Cumulative Effects

Moose occurrence and distribution across the landscape do not appear to be strongly influenced by human development, and individuals appear tolerant and habituated to roads or developed areas (Belant et al. 2006). However, physical or perceptual filters created by future activities and resource uses, coupled with the Project's own filters (e.g., road), are predicted to cause further changes in moose movement adjacent to those activities. Individual moose reactions to roads and human presence will vary, with some moose being tolerant of project activities or infrastructure and others temporarily avoiding them until they become habituated (Baskin et al. 2004; Belant et al. 2006; Stankowich 2008; Lykkja et al. 2009; Laurian et al. 2012).

Increased traffic on the Project road is anticipated due to the movement of equipment, supplies, and personnel travelling to and from the RFI. This increase in traffic will act cumulatively on moose movement. Although some moose movement may be affected initially by the increased traffic, most moose are likely to become tolerant of human activity on the Project and the RFI projects. They will continue to use the landscape adjacent to these developments. As a result, the magnitude of cumulative change in moose movement is expected to be low. The RFIs are located within the Project's RAA; therefore, the geographic extent of the cumulative residual effects occur within the RAA. The timing of the RFI projects' residual effects is unknown, but some may overlap with a high-sensitivity period for moose (i.e., late winter). The duration of the cumulative residual effects on moose movement will occur throughout the life

of the Project and are therefore considered long term. The all-season roads and port landside are expected to be subject to frequent use, so the cumulative residual effect will occur continuously throughout the life of the Project and RFI activities. Some of the RFI project components will be permanent and will continue to influence moose movement throughout the life of the Project; therefore, the residual effects are irreversible.

18.9.4 Change in Mortality Risk

18.9.4.1 Cumulative Effect Pathways

As described in Section 18.8.3, existing effects on moose mortality due to past and ongoing developments were captured in the baseline conditions within the RAA, so have been considered in the assessment of project effects. The Project, combined with the RFI projects, may result in activities that could increase moose mortality risk beyond that caused by the Project alone. Activities that could influence moose mortality include the construction and operation of the High Lake Mine, increased vehicle traffic due to additional all-season roads associated with RFI mining projects and third-party use of project infrastructure and increased human access for hunting. The Project's residual effects on moose mortality will cumulatively contribute to changes in mortality risk with the RFI projects within the RAA. Moose are an important harvested species for Inuit and other people within NU, which will likely require continued harvest management

18.9.4.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

Given that all current and proposed projects in NU are required to implement appropriate environmental safeguards and project-specific mitigation plans (e.g., wildlife mitigation and management plan) to protect wildlife, including moose. No additional mitigation measures beyond those committed to in the Project's effects assessment are proposed. Harvest of moose in the RAA will occur within the current regulatory and management framework for moose in NU. Wildlife monitoring and adaptive management mitigation, management and enhancement measures will be important to evaluate the Project's contribution to cumulative effects on moose mortality.

18.9.4.3 Cumulative Effects

Even with the implementation of the mitigation, management and enhancement measures, cumulative effects from the Project in combination with past, present, and RFI activities will increase moose mortality risk within the RAA. Direct mortality from vehicle collisions is predicted to occur infrequently, and research has shown that such events rarely become a population-limiting factor for moose (Forman and Alexander 1998). Increased harvest activity in the RAA due to expanded hunter access is likely to be the primary contributor to cumulative effects on moose mortality risk. Although the harvest rate of moose may increase in the RAA following the development of the Project and RFI activities, it is the responsibility of the GN to manage and regulate harvest at sustainable levels. As a result, the cumulative residual effects on moose mortality risk are predicted to be incrementally higher than those for the Project alone but remain low in magnitude. The geographic extent of the cumulative effects on mortality risk is expected to occur within the RAA. The Project and the RFI projects may occur during the most sensitive period for

moose (i.e., late winter: February to April). The cumulative residual effects on moose mortality risk are considered long-term, as both the Project and some of the RFI projects' infrastructure will be permanent. Moose mortality risk will occur at multiple irregular intervals, and the cumulative residual effects on mortality risk are irreversible.

18.9.5 Summary of Cumulative Effects

The Project's residual effects, combined with RFI projects, will cumulatively affect moose habitat, movement, and mortality risk. These cumulative effects are assessed as low in magnitude, regional in geographic extent, high sensitivity in timing due to interactions during the late-winter season (the most sensitive time for moose), long-term in duration, and will occur either continuously (for cumulative effects on habitat and/or movement) or as irregular events (for cumulative effects on mortality risk). Table 18.23 summarizes cumulative effects on moose.

The Project contributes approximately half of the cumulative effect of moose habitat loss in the RAA, with a cumulative alteration from all the Project and RFI projects or activities projected to be 1.6% of the amount of suitable moose habitat available in the RAA at baseline. This effect is considered irreversible due to the permanent nature of the Project and most of the RFI activities in the RAA.

To adapt to changes in movement, moose are known to be tolerant and adaptable to human activity. While some individuals may initially change their movements due to the Project and the RFI projects, moose are predicted to habituate to human activity and continue to move through the landscape adjacent to these developments. The magnitude of the Project and RFIs to influence moose movement is predicted to be low.

Cumulative effects on moose mortality risk are expected from the Project and RFI activities in the RAA, with the primary pathways being increased collision risk and increased harvest through facilitated hunter access along the expanded road network. RFI activities are expected to be the greater contributor to long-term mortality risk due to increased traffic volumes and associated collision risk on the developed road network, and to facilitate hunter access to a broader portion of the RAA than generated by the Project alone. Assuming similar mitigation, management and enhancement measures to the Project are applied at other RFI projects or activities and effective management of moose harvest by the GN, it is expected that collision risk with moose will be negligible and, although harvest levels in the RAA may increase, they will remain within sustainable limits, so the cumulative effect is predicted to be low in magnitude.

Table 18.23 Residual Cumulative Effects on Moose

Residual Cumulative Effect	Residual Cumulative Effects Characterization						
	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	A	L	RAA	HS	LT	C	I
Contribution from the Project to Change in Habitat	The Project is the single largest contributor to the loss of suitable moose habitat in the RAA, accounting for approximately 50% of the total cumulative loss of 110.8 km² of suitable habitat, which represents 1.55% of the habitat available at baseline.						
Change in Movement	A	L	RAA	HS	LT	C	I
Contribution from the Project to Change in Movement	Operations and maintenance activities at the Project are expected to have a negligible effect on moose movement. RFI activities are expected to be the major contributors to sensory disturbances, potentially leading to a low-magnitude cumulative effect on moose movement due to considerable increases in port, road, and aircraft activity associated with third-party users of the Project and the development of three new all-season roads and a mine within the RAA.						
Change in Mortality Risk	A	L	RAA	HS	LT	IR	I
Contribution from the Project to Change in Mortality Risk	The Project was predicted to result in a low-magnitude effect on moose mortality risk from vehicle collisions and increased hunter access. RFI activities are expected to result in an incrementally small increase in this risk and to be the greater contributor to mortality risk over the long term due to increased traffic volumes and associated collision risk, and to facilitated hunter access to a wider portion of the RAA than generated by the Project alone.						
Notes: See Table 18.4 for detailed definitions Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable							

18.10 Transboundary Effects on Moose

An assessment of the potential for transboundary effects on moose is provided in Volume 10, Section 33 Transboundary Effects Assessment.

18.11 Significance of Effects on Moose

18.11.1 Significance of Project Residual Effects

The assessment identified adverse residual effects of the Project on moose habitat, movement, and mortality in both phases. Based on the characterization of these effects (see Table 18.20), the overall residual effect of the Project on moose is not significant. This conclusion is reached by comparing the predicted changes in moose populations and habitat within the RAA to the significance threshold defined in Section 18.1.6, which considers effects on the long-term viability and persistence of moose and their ability to contribute to ecological function. The assessment predicts that while some habitat loss and alteration (i.e., < 1% of the RAA) and potential changes in mortality and movement patterns may occur, these changes are too small to compromise the viability or persistence of moose populations that interact with the RAA. The area affected by the Project represents a very small portion of available, suitable habitat, and the mitigation, management and enhancement measures are expected to reduce the Project's effects on movement and mortality risk. The predicted residual effects are considered small changes from baseline conditions for moose in the RAA, including species distribution, habitat availability, and known ecological stressors.

18.11.2 Significance of Cumulative Effects

The assessment process identified cumulative effects on moose, including adverse effects on habitat, movement, and mortality. Based on the characterization of these effects (see Table 18.23), the overall cumulative effect of the Project and RFI activities on moose is not significant. This conclusion is reached by comparing the predicted changes in moose populations and habitat within the RAA resulting from the Project and RFI projects and activities to the significance threshold defined in Section 18.1.6, which considers effects on the long-term viability and persistence of moose and their ability to contribute to ecological function. The assessment predicts that while some additional habitat loss or alteration (i.e., < 2% of the RAA) and potential changes in movement patterns and mortality may occur due to the RFI activities, the cumulative changes with those of the Project remain small relative to baseline conditions, so are not expected to compromise the viability or persistence of moose populations that interact with the RAA.

18.11.3 Summary of Mitigation, Management, and Enhancement Measures

WKR will implement a comprehensive suite of mitigation, management and enhancement measures to avoid potential changes in moose habitat, movement, and mortality risk. These measures prioritize site clearing that is restricted to the approved PDA to reduce habitat loss or alteration. Further mitigation, management and enhancement measures focus on reducing sensory disturbance during Project activities. Dust and noise will be controlled. A Borrow Pits and Quarry Management Plan and Explosives Management Plan will be implemented to reduce effects on wildlife. The WMMP includes wildlife protection measures such as access and traffic controls, and worker conduct policies.

18.12 Assessment of Project Effects on Grizzly Bear

18.12.1 Change in Habitat

Inuit Knowledge provided spatial and descriptive information about where grizzly bears live and prefer to spend their time (primarily summarized in [Banci and Spicker \(2024\)](#)):

- **Rough Terrain:** Grizzly bears, much like wolverine, favour rough ground that is very rocky with holes, especially near the Grays Bay area. The Bathurst Inlet area, being generally rugged, is identified as a widespread habitat area.
- **Eskers and Shrubbery:** Grizzly bears use eskers for denning and foraging for Arctic ground squirrels. They also hide behind rocks, cliffs, or snow banks to cool off from heat and biting insects during the summer.

Inuit Knowledge provided specific knowledge on denning habits:

- **Den Location:** Grizzly bears prefer dens on high ground, on sandy ground or in rock caves. They choose dens on the leeward side of slopes (southeast-facing slopes) where snow banks build up first.
- **Denning Cycle:** Grizzly bears den in the fall before winter and emerge in the spring. This seasonal timing is relevant to project activities.
- **Atypical Denning:** One Inuit consultant noted finding dens in the "oddest places" like the sides of cliffs or in unexpected locations, suggesting flexible den selection.

Incorporating that information, an assessment of the Project's potential effects on grizzly bear habitat was conducted as described in the following sections.

18.12.1.1 Analytical Assessment Techniques

The assessment of habitat change considers both direct loss and indirect losses (e.g., due to sensory disturbances, edge effects, perceptual filters, dust deposition) of grizzly bear habitat. Grizzly bear HSR were defined to characterize and quantify the baseline amount of suitable habitat within the RAA (see Section 18.2.2.3; Figure 18.11). The rating scheme qualitatively characterized habitat using an ordinal scale, with ratings of high, moderate, low, or nil quality.

To quantify direct habitat loss, the effect of the Project on grizzly bear habitat is characterized based on project-related effects to areas rated as Suitable habitat (High or Moderate suitability ranking) in the RAA (Section 18.1.5). Suitable habitat that overlaps with the PDA is considered lost to grizzly bear, and the assessment of such direct changes conservatively assumes that existing habitat in the PDA will be of no value for grizzly bear during the life of the Project. The magnitude of the direct change in habitat is quantified as the amount of suitable habitat lost in the PDA relative to the baseline amount of suitable habitat available to grizzly bear in the RAA.

Indirect habitat loss or alteration in the RAA, which will occur throughout the life of the Project, was quantified using a ZOI approach, wherein areas within a defined proximity to the PDA (i.e., within a ZOI) are considered as altered (less suitable) or lost (no longer suitable). The ZOI is defined as the area beyond the PDA in which project activities could indirectly affect grizzly bear habitat use, thereby reducing habitat effectiveness. These indirect effects occur primarily through sensory disturbances (e.g., noise, lights, smells, human presence), but may also include other factors (e.g., edge effects, dust, perceptual filters, road densities) that can alter habitat and reduce habitat suitability. Bears generally avoid areas within ~500 m of roads, with avoidance increasing with traffic volume (Roever et al. 2010). Several analyses report avoidance up to ~800 m for gravel/resource roads (low-to-moderate traffic). This distance captures typical noise, lights, dust, and persistent human scent/attractants associated with maintenance and routine traffic (Roever et al. 2010; Northrup et al. 2012). In higher activity areas (e.g., camps, port facilities), avoidance and displacement can extend up to 2 km (Chruszcz et al. 2003; Apps et al. 2004), with bears potentially using nocturnal activity shifts to mitigate risk (Roever et al. 2010).

Since these distances were derived from forested habitats in western AB, bear behaviour in the open Arctic may differ; however, no studies have assessed such differences to date. Therefore, given the currently available scientific literature regarding the sensitivity of grizzly bear to project components and an understanding of the proposed project activities, an 800-m ZOI was used to downgrade habitat suitability for grizzly bear in proximity to the all-season road, based on the range of habitat avoidance from gravel roads with low/moderate traffic. A 2 km radius buffer was used to downgrade habitat suitability relative to permanent structures, such as work camps, the airstrip, and the port, based on distance from higher-activity areas. The ZOIs are contained entirely within the LAA.

Indirect habitat loss or alteration was quantified by applying a habitat suitability reduction factor to HSR within the ZOI. For habitat within 800 m of the road and within 2 km of permanent structures, suitability ratings were reduced by one level (i.e., High becomes Moderate, Moderate becomes Low, etc.). Thus, a habitat that was reduced in quality from High to Moderate was considered altered but still Suitable, while that reduced in quality from Moderate (Suitable) to Low (Not Suitable) was considered indirect habitat loss). The total amount of direct and indirect loss of Suitable grizzly bear habitat due to the Project was used as the metric to assess the magnitude of habitat change.

18.12.1.2 *Project Effects Pathways*

The Project is expected to result in a change in habitat availability through direct and indirect effect pathways. Direct habitat loss is expected during the Construction phase, with effects persisting for the life of the Project. Indirect effects of habitat loss or alteration will occur in both phases but are expected to decrease during the Operations and Maintenance phase, since activities that are purely associated with worker presence and use of already-built facilities (e.g., use of road, permanent facilities) are not expected to result in additional changes in habitat availability.

Construction will result in direct habitat loss due to vegetation clearing and soil disturbance during site preparation, and linear disturbance during the creation of the road, airstrip, and port. These activities will require physical removal or alteration of suitable grizzly bear habitat.

Indirect habitat loss or alteration during construction stems from sensory disturbance (e.g., noise, dust, lights, human activity), increased human presence (e.g., workers, camps), physical or perceptual filters to habitat use (e.g., road corridor, vegetation clearing), and anthropogenic attractants (e.g., fuel, food waste). These habitat effects extend beyond the PDA (but are contained within the LAA), as dust dispersion from quarrying, blasting, other ground disturbance activities, and road traffic may decrease vegetation palatability or quality, while changes to water quality could affect water and forage sources downstream of the PDA.

Habitat alteration can be positive or negative for grizzly bear. In areas such as road rights-of-way, forage availability may increase due to slow, natural regeneration of suitable forage plants, increased nutrient and water availability, and vehicle-killed carrion (Nagy and Russell 1978; MacHutchon and Mahon 2003; Roever et al. 2008). This increase in forage can provide valuable nutrition, but when located in areas with higher human activity, it can present a greater risk of mortality (see Section 18.12.3). In addition, because grizzly bears rely on different habitat types at different times of year, the severity of impacts (direct and indirect) will vary by habitat type and season. Seasonal shifts in habitat use occur from spring through summer and fall as individual grizzly bears respond to changes in food availability, digestibility, and nutritional quality (Bunnell and Hamilton 1983; McLellan and Hovey 1995; MacHutchon and Wellwood 2003).

Bears are most sensitive to disturbance during the denning season (BC Ministry of Environment and Climate Change Strategy 2019), which runs from October through May, with females entering dens earlier and denning longer than males (McLoughlin et al. 2002b). Disturbance from anthropogenic activities can elevate heart rates and wakefulness, and subsequent energy use, for denning bears (Reynolds et al. 1986) which can lead to den abandonment (Craighead and Craighead 1972; Reynolds et al. 1976; Harding and Nagy 1980), potential loss of cubs (Schoen et al. 1987), and displacement from denning areas (Craighead and Craighead 1972; Schoen et al. 1987). Based on these factors, activities during the denning period (October to May) are considered high-sensitivity.

Direct and indirect habitat loss can subsequently affect reproduction, health, survival, and alter territories and demographic distribution (COSEWIC 2012). Whether this results in population-level consequences for grizzly bears depends on the extent of changes to habitat availability and the mitigation, management, and enhancement measures applied.

18.12.1.3 Mitigation, Management, and Enhancement Measures

The Project has integrated multiple management measures into its design and operational procedures to prevent, manage, and reduce the potential effects on grizzly bear habitat. Mitigation, management and enhancement measures include engineering design, additional mitigations based on guidelines or best management practices, and monitoring. To reduce the effects of direct and indirect habitat loss on grizzly bears, the focus is on reducing disturbance areas to the extent feasible and avoiding sensitive times and habitats to the extent practicable. Below are mitigation, management and enhancement measures to mitigate the effects of habitat loss and alteration on grizzly bears.

- The PDA will be confined to a specific design layout to reduce the Project's potential effect on habitat loss and effectiveness.
- Site clearing will be limited to areas required for construction and safe operations and maintenance (i.e., to the width of the Road PDA).
- Wildlife sweeps will be completed to identify wildlife sensitivities (i.e., active nests, dens, other wildlife features) ahead of construction activities. No-disturbance buffers will be established around any sensitivities identified. If disturbance within a no-disturbance buffer is unavoidable, site-specific protection measures will be developed by a Qualified Professional.
- The Project will use previously disturbed areas for project activities, project infrastructure and workspaces, to the extent practical (e.g., Jericho Station).
- Quarries will not be situated on sensitive habitat features like watercourses, water bodies, or land bridges.
- Riparian vegetation will be maintained whenever possible.
- Vegetation buffers will be used to protect riparian vegetation, as appropriate.
- Dust will be actively suppressed on roads (with water and/or other dust suppressants) when necessary to manage excessive dust. Dust suppression will follow NU's *Environmental Guideline for Dust Suppression on Unpaved Roads* (GN 2014).
- Construction and quarry development activities will adhere to the recommended setbacks and timing restrictions outlined in the WMMP.

18.12.1.4 Project Residual Effect

Site clearing within the PDA for construction is anticipated to result in the direct loss of up to 44.2 km² of suitable grizzly habitat, while both project phases are projected to result in an indirect loss of another 140.8 km² (Table 18.24). The percentage of direct suitable habitat loss amounts to 0.1% of suitable habitat in the RAA at baseline, while that of indirect habitat loss during both phases is 0.4% of baseline suitable habitat within the RAA. Overall, the projected loss of habitat totals 185.0 km², which is 0.6% of the RAA's baseline suitable habitat. A further 213.8 km² of habitat was predicted to experience indirect habitat alteration due to the Project (i.e., a reduction in rating from High to Moderate) but remain suitable. With the implementation of measures to reduce the area of direct disturbance and intensity of sensory disturbances to grizzly bear, it is anticipated that less than 1% of suitable grizzly habitat currently available within the RAA will change due to the Project, which equates to a negligible magnitude of change in habitat at the RAA scale.

The direct loss of potential grizzly bear habitat is expected to be limited to the PDA and to activities that occur during the Construction phase. In contrast, indirect effects on potential grizzly bear habitat are expected to occur within the LAA, within 800 m of the road and 2 km of high-activity areas in the PDA (ZOI) during each phase of the Project. Therefore, the geographic extent of the residual effect of change in habitat is limited to the LAA. The timing of the habitat changes is expected to overlap with the natal denning season, a critical period in the grizzly bear lifecycle when females may be giving birth and raising young. Therefore, the effect is predicted to be highly sensitive to timing. The Project will result in the construction of permanent infrastructure; consequently, direct habitat loss within the PDA, as well as indirect habitat loss in the LAA, is anticipated to persist for the lifespan of the Project infrastructure. As a result, the residual effects are long-term. While the direct loss of grizzly bear habitat due to Project activities is expected to occur once during construction, the indirect loss of habitat within the LAA is anticipated to be continuous throughout the Project's life. Therefore, the frequency of habitat changes is predicted to be continuous. Similarly, since infrastructure is permanent and will not be decommissioned, the effects of habitat change are deemed irreversible across all phases.

Table 18.24 Magnitude of the Change in Suitable Grizzly Bear Habitat due to the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	31,299.2	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	44.2	0.1
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	140.8	0.5
Total Habitat Loss			185.0	0.6

Notes:

A ZOI of 800 m was applied around the all-season road and 2 km around high-activity areas, such as the port facility, airfields, and permanent camps.

18.12.2 Change in Movement

Inuit Knowledge indicated that human infrastructure and activities, including traffic, blasting, and waste management, might influence grizzly bear movement patterns, forming the basis of the Project's analysis of their effects.

- **Following Prey:** Grizzly bear movement is closely linked to the distribution and migration of their prey. They follow caribou and will go scavenging over polar bear kills (seal carcasses) on the ice in April. This suggests their movement is often dictated by hunting and scavenging opportunities (Banci and Spicker 2024).
- **Human-Wildlife Conflict:** The movement of bears toward human activity (camps, airstrips, etc.) and their scavenging behaviour directly increases the potential for human-wildlife conflict. The attraction of bears to improperly managed waste (landfills) is a direct contributor to conflict risk (Banci and Spicker 2024).

18.12.2.1 *Analytical Assessment Techniques*

Changes in grizzly bear movement are possible through physical or perceptual filters to movement during both project phases and may occur within or surrounding the PDA. Physical filters to movement include infrastructure (e.g., roads, berms, buildings) that can obstruct movement; such obstructions are often impermeable or semi-permeable to bear passage, potentially fragmenting habitat and making it inaccessible to bears. The focus was on various project components that could influence daily and seasonal grizzly bear movement, with consideration that effects on large-scale movements could result in population effects, such as reduced genetic connectivity.

As there are no prescribed thresholds for evaluating and determining the Project's influence on changes in movement for grizzly bear, this parameter was evaluated through a qualitative assessment of the Project's influence on grizzly bear movements within the PDA, LAA, and RAA, that considered information provided by Inuit, Indigenous, and Community Knowledge, baseline conditions in the RAA, the anticipated pathways of effects of project activities, a literature review on specific topics relating to bear movement, and the availability and effectiveness of mitigation measures.

Much of the literature on the effects of roads on bears comes from southern (forested, mixed-use with highways and other landscape disturbances) areas of BC and AB, where high road density and heavy use can substantially affect grizzly bear distribution, interactions with humans, and survival. Given that barren-ground grizzly bears have large home ranges, move farther, and potentially interact with far fewer roads and people than the bears studied in southern BC and AB, the effects assessed in the western science literature may translate into more muted responses in the open Arctic tundra.

18.12.2.2 *Project Effects Pathways*

Construction and operations and maintenance of the Project are likely to result in changes to grizzly bear movement patterns within the LAA, particularly in areas where dens have been recorded, as bears regularly move through these areas; however, changes in movement beyond the LAA are expected to be limited. The same mechanisms that can result in indirect habitat loss or reduced habitat effectiveness (e.g., sensory disturbance — see Section 18.12.1.2) can also disrupt short-term (i.e., daily) and long-term (i.e., seasonal) movement patterns. Therefore, where road and other infrastructure construction occur in previously undisturbed coastal and/or inland habitats that provide denning or foraging opportunities, daily movements and seasonal travel from den sites to foraging areas may be affected by project activities (Miller et al. 1982), particularly during the Construction phase, but continuing through the Operations and Maintenance phase.

During construction, grizzly bears are expected to avoid active work areas due to high levels of noise, vibration, human presence, and heavy equipment. Studies from southern populations (e.g., Chruszcz et al. 2003; Apps et al. 2004; Roever et al. 2010) show that grizzly bears often avoid industrial noise, particularly during daylight hours when construction activity is highest, and that avoidance zones can range from several hundred m to several km, depending on the type of construction activities. However, since barren-ground grizzly bears occupy much larger home ranges (often greater than $>1,000$ to $2,000 \text{ km}^2$) and exist at low densities compared to other grizzly bear populations in more productive ecosystems (McLoughlin et al. 2000, 2002a), the displacement is less likely to disrupt their ability to meet

foraging or movement needs at the regional scale, even if bears in the PDA and LAA temporarily shift movements to avoid areas of active construction.

Once construction of a road segment or other project components is complete, barren-ground grizzly bears may reoccupy areas adjacent to new infrastructure more quickly than southern bears. Inuit Knowledge notes that bears initially avoid new roads but can become accustomed over time (Banci and Spicker 2024), suggesting that construction-related displacement is primarily a short-term effect. Notably, habituation shows sex-biased patterns: males may resume foraging in suitable habitat along road edges, while females continue to avoid crossings. Benson (2014) In the Gwich'in Settlement Area of the NT, it is described that bears initially avoid roads but gradually become less wary and may cross or travel along them; however, adult females with cubs consistently show stronger avoidance, supporting the idea that gender and reproductive status influence habituation and risk tolerance.

Temporal avoidance is expected to decrease during the Operations and Maintenance phase, based on Inuit Knowledge and the literature, primarily due to reduced activity relative to the Construction phase. Inuit Knowledge indicates that bears initially avoid roads but habituate with repeated exposure (Benson 2014; GBRP 2025). Such behavioural plasticity has been observed in western science studies, where habituated bears may begin to cross roads more readily or even use them as travel corridors (Berland et al. 2008). Traffic volumes are expected to substantially decrease during the Operations and Maintenance phase. Predictable vehicle schedules may habituate some individuals (Burson et al. 2000). Bears may continue to avoid areas immediately adjacent to the road, port, or airstrip during periods of high traffic or activity, especially if traffic volumes exceed thresholds documented to influence bear behaviour (>20 vehicles/day; (Northrup et al. 2012). However, the predicted traffic volumes for the Project are very low by southern standards (see Section 18.4.3.2); consequently, the immediate short-term displacement effects are likely to be minor relative to southern systems where daily traffic can number in the thousands. Over the long term, the presence of permanent infrastructure may contribute to functional habitat loss by creating avoidance zones, but the extent of these zones is expected to be smaller in the Arctic than suggested by southern studies. Barren-ground bears are adapted to low-productivity environments and already range widely to meet energetic needs; displacement from a narrow corridor or localized facility was found to result in a negligible change in overall habitat availability at the RAA scale (see Section 18.12.1.4). However, localized effects in high-use seasonal habitats (e.g., riparian corridors, denning eskers, berry patches) could be pronounced, where avoidance of even a small area may disproportionately reduce habitat quality.

Recent work by Gunther et al. (1998) in Yellowstone and Palm et al. (2025) in the southern Canadian Rockies documented pronounced avoidance of point disturbances by female grizzly bears during the spring and summer seasons, indicating that construction noise, lighting, and human presence at port construction locations may displace reproductive females from historically favoured estuarine habitat that Inuit Knowledge describes as bear-rich (Banci and Spicker 2024). Displacement pressures will be most pronounced if construction work overlaps with spring emergence and late-summer hyperphagia.

While the above-cited grizzly bear research in southern areas provides valuable insights, its direct application to this Project likely overestimates the scale of long-term movement impacts in the central Arctic. The large home ranges, lower densities, and broader habitat use of barren-ground grizzlies mean that regional displacement risks are smaller than in southern systems, where bear densities are higher

and seasonal ranges are more concentrated. Consequently, short-term construction avoidance and localized displacement in high- and medium-quality seasonal habitats are deemed as the most important effects pathways for changes in grizzly bear movement, while regional-scale movement effects are expected to be limited.

18.12.2.3 *Mitigation, Management, and Enhancement Measures*

The Project has integrated multiple management measures into its design and operational procedures to avoid, manage, and reduce the magnitude, duration, and extent of potential project-related effects to grizzly bear movement. Mitigation and management measures include engineering design, additional mitigations from guidelines or best management practices, and monitoring measures, as follows:

- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway. All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
- When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be decreased in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road-crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers of the road.
- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.
- Wildlife signs will be displayed along the road in areas where wildlife are commonly observed to inform drivers.
- Construction and quarry development activities will adhere to the recommended setbacks and timing restrictions outlined in the WMMP.

18.12.2.4 *Project Residual Effect*

For the Construction phase, the extent of residual effects on change in movement will be confined to the LAA. Residual effects are considered adverse in direction, low in magnitude, highly sensitive timing, short in duration, and regular in frequency. Many project-related effects on movement during construction, such as avoiding drilling and blasting sites, will diminish once the Construction phase is complete, as noise and human presence will be reduced. The residual effects are considered regular events during construction, and will be irreversible as the Project transitions from the Construction phase to the Operations and Maintenance phase. This rationale considers that bears will temporarily detour around active work segments during the Construction phase, but that this localized displacement is expected to be of short duration and low magnitude when mitigation measures are applied. The timing of works will be highly sensitive to critical bear life stages (e.g., den emergence, spring foraging).

For the Operations and Maintenance phase, residual effects on movement are adverse in direction but negligible in magnitude. Maintenance activities such as grading may affect grizzly bear movement, but mitigation measures will reduce these effects, which will occur only at certain points in time. With low traffic volumes, a permeable design (e.g., at drainages/eskers), and speed limits, local and regional movement patterns should remain intact. Some bears, specifically females with cubs, may remain risk-averse and continue to adjust movements around infrastructure; however, given the large Arctic home ranges, population-level movement constraints are unlikely. Effects will primarily be localized, with reluctance to approach/cross near high-use areas and during occasional peak activity within the LAA. Operations and maintenance activities are expected to occur as irregular events. The timing of these activities is uncertain but could overlap with critical bear life stages (e.g., den emergence, spring foraging), so it is considered to have high sensitivity. The road and port are permanent developments and will affect movement throughout the Project's life. Therefore, the Project's effect on grizzly movement is predicted to be long-term. Project effects are predicted to be irreversible, as project infrastructure will be permanent and may continuously affect local movements of grizzly bear.

18.12.3 *Change in Mortality Risk*

Inuit Knowledge provided input to the assessment of potential Project effects on grizzly bear mortality risk by identifying behaviours, ecological relationships, and external factors that increase their vulnerability.

- **Scavenging and Human Conflict Risk:** Grizzlies are known to be attracted to human activities as they scavenge for food (Banci and Spicker 2024). This tendency to be drawn to project sites or camps increases the risk of human-wildlife conflict, a primary source of direct mortality.
- **Need for Predator Control:** The risk posed by grizzlies to vulnerable caribou calves also contributed to the recommendation for grizzly bear management and predator control programs, which aims to modify bear movement and reduce their presence around critical caribou areas (IAG 2025b).
- **Mitigation for Mortality Control:** The risk posed by grizzlies to caribou and muskox calves directly influenced the assessment of management actions. Inuit consultants emphasized a need to establish predator control programs (for wolves, grizzly bears, and wolverine), especially during the calving season. WKR was asked to provide resources, shelter, and fuel to hunters conducting this control (IAG 2025b).

18.12.3.1 Analytical Assessment Techniques

Project-related changes in mortality risk for grizzly bear mortality risk were assessed through the identification and qualitative evaluation of Inuit Knowledge and relevant literature, in relation to potential project-related factors that may affect grizzly bear mortality. Potential sources of mortality resulting from the Project include collisions with grizzly bear on the road, potentially lethal interactions with specific project infrastructure or activities (e.g., airstrip, blasting), lethal control of problem animals, and increased hunting and trapping facilitated by the presence of the port and road.

Changes in mortality risk are expected within the LAA throughout the Project's Construction and Operations and Maintenance phases, due to improved access and increased human presence. These changes will be primarily associated with three pathways: vehicle collisions, improved hunter access, and human-bear conflicts (i.e., DLP). For all three pathways, factors that are expected to contribute to changes in mortality risk include the level of human access, the availability of suitable grizzly bear habitat, and the anticipated effectiveness of mitigation measures.

The potential increase in grizzly mortality risk from facilitated access for harvest was assessed qualitatively by considering current harvest regulations and rates, the potential for increased access into previously remote areas provided by the port and road, and the likelihood of increased harvest given facilitated access. The results of the qualitative assessment were then presented within the context of existing knowledge of grizzly bear population size and mortality risk in the west Kitikmeot Region.

18.12.3.2 Project Effects Pathways

Population viability modelling from the WKSS indicates that even small increases in human-caused mortality can substantially increase the probability of grizzly bear population decline in northern Canada (McLoughlin et al. 2003a). Because grizzly bears are long-lived, have low reproductive rates, and rely on the high survival of adult females for population stability, any increase in mortality among breeding females can have long-term population-level consequences (McLoughlin et al. 2003b; Garshelis et al. 2005). Available telemetry and harvest data for western Kitikmeot indicate annual apparent female survival rates of approximately 90%, corresponding to an overall 10% mortality rate from all causes, including both natural (e.g., starvation, intraspecific competition) and human-caused sources such as harvest, DLP, and potential collisions (McLoughlin et al. 2003b, Awan et al. 2025). Apparent survival, which is the probability that an animal survives and remains within a study area over a specific time, can be lower than true survival because it includes both mortality and permanent emigration from the study site—apparent survival and recruitment sum to provide an estimate of the rate of change.

Female survival is the most critical demographic driver of grizzly bear population growth (McLoughlin et al. 2003b; Garshelis et al. 2005). However, density estimates ratios for 2008–2009 and 2021 (Awan et al. 2025) suggest that the west Kitikmeot Region may be seeing an increase in adult female bears (or a decrease in males), resulting in a relatively stable population.

Although no formal TAH has been established for grizzly bear in NU, the guidelines in (Wildlife Research Section 2007) and subsequent management guidance recommend maintaining conservative harvest levels and limiting female harvest to prevent population declines. Under current co-management, Inuit have unrestricted harvesting rights under the *Nunavut Land Claims Agreement Act*, while sport hunts for

non-beneficiaries are regulated by quotas established by the NWMB (GN-DOE 2017). Consequently, the Project's influence on mortality risk will depend primarily on indirect pathways, such as increased vehicle collisions, DLP kills near infrastructure, and improved access for hunters, rather than formal harvest regulation.

The effect of human access, and related actions resulting in mortality to grizzly bear, is the leading cause of grizzly bear population declines across the species' range (McLellan 1990; Schoen 1990; Banci et al. 1994; Mattson and Merrill 2002; Maraj 2007), with human-caused mortality accounting for the majority of grizzly bear mortality in some areas (McLellan et al. 1999). Human-caused grizzly bear mortality is consistently associated with linear infrastructure and human activity centres, particularly where roads intersect high-suitability habitats or facilitate access to remote areas (Benn 1998; Johnson et al. 2004; Nielsen et al. 2004; Boulanger and Stenhouse 2014; Lamb et al. 2017). For the Project, three primary effects pathways are identified:

1. Vehicle collisions — possible during construction and operations, particularly as bears habituate to road corridors and traffic volumes increase
2. Improved hunter access — potential to increase sport or subsistence harvest pressure if quotas (or TAH) and enforcement are insufficient.
3. DLP incidents — possible where bears are attracted to food waste, camps, or infrastructure.

Vehicle Collisions

Vehicle collisions are a potential source of grizzly bear mortality during both phases of the Project, but primarily during the Construction phase due to higher traffic volumes. No documented grizzly-vehicle collision mortalities are recorded in the Kitikmeot Region, reflecting its historical absence of all-season roads, and even in Arctic areas where roads have been built in conjunction with industrial development (e.g., Ekati Mine, NT), grizzly-vehicle collisions remain rare (ERM Consultants Canada Ltd. 2025b). However, studies in AB, BC, and the contiguous USA, where the relationship between roads and grizzly bear mortality risk has been well documented, demonstrate that collision and mortality risks for grizzly bear increase rapidly once roads are introduced into occupied habitats (Chruszcz et al. 2003; Ciarniello et al. 2004; Northrup et al. 2012; Lamb et al. 2018). Research by (Gunther et al. 1998) found that higher vehicle speeds (especially ≥ 88 km/h) and road design (straight, wide, paved roads with shoulders) were significant predictors of wildlife-vehicle collisions, over and above posted speed limits.

Construction traffic is anticipated to reach approximately 193 vehicles and pieces of equipment spread across Jericho Station, port, north, and south road segments, whereas operations and maintenance will have a lower traffic level of approximately 30 vehicles (see Volume 2, Sections 1 to 3). Vehicle numbers will be higher at the northern end (port camp and north road with 106 vehicles) than at the southern terminus (Jericho Station Camp and south road with 81 vehicles) during construction. However, the first year of construction will include a substantially higher volume (approximately 1,000 vehicle round trips, which equates to $\sim 2,000$ individual passages) along the Tibbitt to Contwoyto Winter Road to transport major equipment, fuel, and supplies to the Jericho Station Camp. This usage pattern will occur only during February and March and will decline significantly in later construction years, when traffic will primarily involve resupply (food, fuel, equipment) and waste transport. Traffic volumes are anticipated to drop off dramatically during the Operations and Maintenance phase, indicating that the relative risk of

vehicle–bear collisions will be substantially higher during the first year of construction, with a lower (yet persistent) risk during subsequent construction years and throughout the Operations and Maintenance phase.

Inuit Knowledge and Western science indicate that grizzly bear distribution is highest on the coast and in the southern portion of the Project (see Figure 18.9 and Figure 18.10; (Awan et al. 2025) supports the assumption that collision risk will be highest in these areas during both phases of the Project. Research on the responses of grizzly bear to traffic further indicates the following:

- Bears tend to cross roads with <20 vehicles/day but avoid those with 20 to 100 vehicles/day and strongly avoid roads with >100 vehicles/day, often shifting their movement to nighttime (Northrup et al. 2012).
- Behaviorally, bears showed altered movement patterns near roads, reflecting avoidance even at moderate traffic volumes (Roever et al. 2010).

The concentration of winter road traffic into a short seasonal window, combined with coastal and southern bear density patterns, could indicate that early construction years pose an increased collision risk; however, since usage is limited to February and March, grizzly bears will be in hibernation and not interacting with the road/vehicles.

If bears become habituated to the road or if attractants are present, even modest traffic volumes (e.g., <200 vehicle-days annually) can introduce meaningful collision risk, which may increase over time as additional road segments become operational. Although males often have larger movement ranges, evidence indicates that females with older cubs or yearlings experience the highest road-related mortality risk, likely due to increased roadside habitat use and reduced ability to avoid traffic while tending dependent offspring (Graham et al. 2010; Boulanger and Stenhouse 2014).

Improved Hunter Access

Mortality risk of grizzly bears increases disproportionately with increases in both the amount of active roads and the number of armed humans using those roads (Ciarniello et al. 2007; Johnson et al. 2004; Mattson et al. 1996; McLellan 2015; Schwartz et al. 2010). Within NU (territory-wide), approximately 22 grizzly bears were legally harvested annually between 2013 and 2019, of which 13 bears per year were harvested in the Kitikmeot subregion (Awan 2021). These figures are consistent with the historic harvest rates from the central Canadian Arctic from 1958 to 2000, which were reported as 13.4 grizzly bears/year (McLoughlin et al. 2003b), albeit across a much larger study area.

Hunting-related grizzly bear mortalities in the assessment area between 1995 and 2016 were low, with only a few sport-hunted mortalities occurring in the northeast section of the RAA (Figure 18.10). However, bear harvest is tightly linked to hunter accessibility—in late winter/early spring, hunters use snowmachines to access areas further from communities, and in summer, ATVs are used to access areas around communities, while boats are used to extend hunting off water channels (Awan et al. 2025). Construction of the new all-season road, as well as the port, could change the distribution and seasonality of the harvest in the RAA, particularly in areas where baseline grizzly bear hunting mortality is currently low (Figure 18.10).

Human-Bear Conflicts

The *Nunavut Grizzly Bear Co-Management Plan* (GN-DOE 2017) reports that a total of 172 grizzly bears were killed for DLP between 1980 and 2014—an average of approximately five bears per year—comprising about 27% of all reported grizzly deaths in the territory. A similar number was provided for the period from 1990 to 1999 (COSEWIC 2012), with 172 grizzly bear mortalities recorded annually due to DLP, equating to a mean rate of DLP kill of about 34% of reported grizzly deaths.

During the Construction phase, anticipated project requirements include four temporary mobile camps and two stationary camps, the latter located at Grays Bay and Jericho Station (see Volume 2, Section 2.5.2.2). Each camp will house 40 to 80 personnel, and between 250 to 400 persons are expected to rotate through the remote camps annually. The mobile camps will be moved in a leapfrog pattern as road construction progresses, with the expectation of moving camps every three to four months. All camps will include kitchen and medical facilities, as well as fuel and wastewater storage, and temporary solid waste storage.

The primary reason for human-bear conflict around areas of human activity is the pursuit of anthropogenic foods (non-natural, human-created food sources) by bears, including garbage, wastewater, sewage, petroleum-based products, animal food, and barbeques. These attractants, particularly when improperly handled, can attract bears into areas of human activity, including work sites and camps (Mining and Petroleum Environment Research Group 2008). Grizzly bears that become accustomed to anthropogenic food sources can become habituated and food-conditioned, and subsequently become a hazard to humans; these 'problem bears' are frequently killed in management actions or DLP actions when translocation is not an option (McLellan 1990). Garbage is the greatest source of human-bear conflict, with about 70% of conflicts being due to a bear being attracted to improperly managed human garbage (McLellan 1990).

In contrast to the territory-wide rates of DLP mortality, most mortalities within the RAA between 1995 and 2016 were DLP-related, with most occurring near the coast, where one of the stationary camps will be located (Figure 18.10). During the Construction phase, the presence of several temporary camps with fuel and waste storage, occupied by rotating personnel, are expected to increase the chances of human-bear conflict and the associated risk of grizzly bear mortality in the central and southern portions of the RAA. Similarly, during the Operations and Maintenance phase, the presence of permanent camps and quarries along the road carries a risk of human-bear encounters and increased risk of bear mortality, resulting from DLP. Decommissioning activities for temporary borrow sources/quarries, camps, and other non-permanent project infrastructure poses similar risks of increased mortality until all bear attractants have been removed.

18.12.3.3 Mitigation, Management, and Enhancement Measures

The Project has integrated multiple management measures into its design and operational procedures to prevent, manage, and reduce the magnitude, duration, and extent of potential effects on grizzly bear mortality. WKR will control access to the road through user agreements with organizations and individuals. For safety reasons, no access to the port and road will be allowed during the Construction phase. Effects management measures for grizzly bear, therefore, focus on minimizing risks of vehicle collisions, minimizing/controlling potential bear attractants associated with project activities, and monitoring bear activity in proximity to the Project. Provided below are measures to mitigate the effects of change in mortality.

Vehicle/Aircraft Collisions:

- Speed limits will be posted along the completed portions of the road during construction activities. Traffic speed will be limited to 60 km/h on project road surfaces, which may be decreased in certain areas depending on terrain conditions and geometric constraints, and in areas of high potential for caribou or other wildlife occurrence (i.e., identified wildlife road crossing locations). In instances where terrain conditions and geometric constraints allow, and in areas of low potential for caribou or other wildlife occurrence, speeds may be increased to 80 km/h.
- Wildlife will have the right-of-way on all Project infrastructure areas as detailed in the WMMP.
- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation of use outside of the PDA must be pre-approved by the WKR representative on site.
- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers of the road.
- Wildlife signs will be displayed along the road in areas where caribou and/or other wildlife are commonly observed to inform drivers.
- Any dead wildlife on or immediately adjacent to the roadway will be moved at least 100 m away from the road to reduce the potential for wildlife-vehicle collisions with scavengers.

- As per the WMMP, all project-related wildlife mortalities will be investigated and reported annually.
- All aircraft will conduct an initial fly-by to confirm that no wildlife is on or near the airstrip before landing. If wildlife are observed within 100 m, pilots will notify ground personnel and aversion techniques will be implemented to discourage wildlife so aircraft can land safely.

Human-Bear Conflicts:

- Personnel will not feed, harass, or hunt wildlife while working on the Project.
- Food wastes will be stored in wildlife proof bins and will be incinerated daily to avoid attracting wildlife.
- Petroleum-based products (i.e., gasoline, diesel, lubricating oils, anti-freeze) will be stored in leak-proof containers to reduce odours and stored in structures where bears and other wildlife cannot access them.
- Any spills will be cleaned up as per the requirements in the Spill Contingency Plan.
- A bear deterrent procedure will be developed that follows guidance in the GN's document *Bear Safety: Reducing Bear-People Conflicts in Nunavut* and in consultation with the GN's bear deterrent specialist to determine appropriate bear deterrents (e.g., temporary fencing, bear bangers) and safety procedures.
- Raised, heated buildings will be skirted to prevent wildlife access under the buildings for use as shelters, dens or building entry points; skirting should use wire mesh, sheet metal sheathing, or other chew-resistant material.

18.12.3.4 Project Residual Effect

The direct effects of the Project on changes in grizzly bear mortality risk (i.e., vehicle collisions and euthanasia of problem animals) during all project phases are expected to be mitigated through implementation of the WMMP and associated mitigation and management measures (see Section 18.12.3.3); however, a low residual effect on grizzly bear mortality risk will remain. As demonstrated in ERM Consultants Canada Ltd. (2025b), where similar mitigation measures were implemented for a diamond-mine development, a low risk for grizzly bear-vehicle interactions remains within the ZOI, specifically near bear activity peaks and low-visibility conditions (i.e., timing and duration risk parameters), or when there are attractants along the road (i.e., magnitude and frequency parameters). For example, the Ekati project reported two incidents in June 2024 where grizzly bears were deterred from the road using a vehicle, and another incident that involved a grizzly bear being startled by the arrival of a vehicle. However, in over 27 years of operation and with over 200 km of roads, this project has never recorded a vehicle strike-related grizzly bear mortality (ERM Consultants Canada Ltd. 2025b).

For DLP-related mortalities, tracking the effectiveness of mitigation measures and mortalities within the LAA is required to quantify residual risk that may persist due to poor attractant hygiene, unusual food years, or den emergence near camps and other project infrastructure.

Induced effects from increased harvest rates within the RAA, facilitated by the Project's access, are more challenging to mitigate. In NU, grizzly bear hunting is highly regulated through territorial legislation, community-based wildlife management systems, and co-management bodies established under the *Nunavut Land Claims Agreement Act*, including the NWMB, regional wildlife organizations, and local HTOs. These institutions collectively manage harvest through reporting requirements, licensing for non-beneficiaries, seasonal restrictions, tag allocations, and adaptive decision-making processes that are reviewed regularly. As a result, increased access does not inherently imply overharvest; however, it is likely to shift the spatial distribution of harvest to the RAA from elsewhere in the region. A residual effect remains because the Project may facilitate lawful access to some areas that are currently less frequently harvested, and harvest reporting for beneficiaries is voluntary. Because adult female survival is the key demographic driver, even infrequent mortality events may be consequential. However, given the regulatory frameworks, ongoing co-management oversight, and the availability of adaptive tools to address changes in harvest patterns, if required, the residual induced harvest-related mortality attributable to the Project is expected to be low.

The timing of induced effects on mortality is expected to be highly sensitive during both phases of the Project, since hunting is permitted year-round, including during spring den emergency, a highly sensitive period for grizzly bear. Induced effects of increased harvest are expected to begin at the end of the Construction phase and persist throughout the Project's lifespan. Therefore, the Project's effects on mortality are expected to be long term. The increased mortality risk from facilitated hunting access will be mostly continuous when assessed over multiple years but will show seasonal intra-annual fluctuations. Project infrastructure will be permanent, so the effect is likely to be irreversible.

18.12.4 Summary of Project Residual Effects

Table 18.25 summarizes the Project's residual effects on grizzly bear. Following the implementation of mitigation and management measures, the Project is projected to have adverse residual effects on grizzly bear habitat (loss and alteration), movement, and mortality risk across all phases; however, the magnitude of these effects varies.

The magnitude of residual effects from habitat loss and alteration is negligible across both phases and geographically confined to the PDA and LAA. At the RAA scale, the PDA represents a very small proportion of available suitable habitat, and the large home ranges of barren-ground grizzly bears (hundreds to thousands of km²) allow for redistribution and continued access to alternative habitats.

Residual effects on change in movement are expected to be low in magnitude but highly sensitive to timing during the Construction phase and negligible in the Operations and Maintenance phase. Temporary avoidance of active work areas may occur, with bear movement being deemed more sensitive to disturbance during the natal denning period. During the Operations and Maintenance phase, road design should permit wildlife permeability, and low traffic volumes will reduce the likelihood of behavioural displacement. Although some females with cubs may continue to exhibit localized avoidance of road segments, barren-ground grizzly bear have extensive home ranges and strong seasonal mobility, minimizing population-level effects. The Project is therefore unlikely to interfere with regional connectivity or seasonal migration patterns.

Residual mortality risk remains the most important consideration for long-term population sustainability. Change in mortality residual effects is predicted to be low in magnitude during both phases, resulting in a detectable change from baseline conditions but within the range of natural variation and/or accepted standards, once mitigation measures have been implemented. For both phases, the residual risk stems from vehicle collisions and DLP incidents in the PDA and LAA due to unavoidable overlap between Project activities and bear movements. The Project's effect on change in mortality risk could extend into the RAA for improved hunter access, as the road could facilitate harvest further than 4 km from the PDA. The effects of the change in mortality risk during the Operations and Maintenance phase are expected to be long-term and continuous, as the increased access for harvesting will persist as long as the port and road remain in place.

Table 18.25 Project Residual Effects on Grizzly Bear

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C, O	A	N	LAA	HS	LT	C	I
Change in Movement	C, O	A	N-L	LAA	HS	ST, LT	R	I
Change in Mortality Risk	C, O	A	L	RAA	HS	LT	C	I
Key: See Table 18.4 for detailed definitions Project Phase: C: Construction O: Operations and Maintenance Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable								

18.12.5 Effects of Climate Change on Grizzly Bear

Grizzly bear populations in NU are distributed across large tundra and coastal environments, where seasonal resource availability and denning conditions strongly influence survival and reproduction. Inuit Knowledge and western science indicate that environmental changes, particularly shifts in vegetation productivity, permafrost dynamics, and access to coastal resources, are already affecting baseline ecological conditions for barren-ground grizzly bear (Mueller 1995; Barker 2011; Benson 2014)

Inuit Knowledge observations suggest that climate-related habitat shifts, potentially combined with industrial development or changing ecological conditions, are contributing to the northward movement and coastal expansion of grizzly bears

Grizzly bears started to come up from the south five to ten years ago (e.g., Cambridge Bay people would go south and see many bears in the area and on the road). (GBRP 2025)

These days there are lots of bears. Long ago never used to be any bears on Victoria Island, but now lots of grizzly bears are coming. They are moving north (NTKP 2018).

Climate projections for Grays Bay, Ulu, and Jericho Station-Lupin, selected to represent the northern, central, and southern portions of the Project, show substantial warming consistent with that predicted for the broader Canadian Arctic (Awan et al. 2025) (see Volume 5, Appendix 12A Climate Profile Technical Data). Under the high emission SSP5-8.5 scenario, mean annual temperatures are projected to increase by approximately 4.5 degrees Celsius (°C) by 2050 and 8.2°C by 2080. The intermediate emissions SSP2-4.5 scenario shows a mean increase of approximately 3.2°C by 2050, with warming continuing at a slower pace through the end of the century (see Volume 5, Appendix 12A Climate Profile Technical Data). Both scenarios project increases in growing degree days, precipitation, and shrub expansion, with implications for food availability and denning substrates.

These changes imply altered availability and timing of key foods and substrates important to barren-ground grizzly bears (e.g., shrubs/berries, small mammals, denning landforms) and are consistent with studies linking grizzly bear habitat suitability to food resource dynamics under climate change (Roberts et al. 2014). In warmer conditions, activity patterns can shift with temperature, with documented temperature-related changes in bear activity that are relevant to future heat extremes in the North (McLellan and McLellan 2015). Projected shifts may increase overall productivity in the region but also elevate climate variability, including late freeze-ups and flooding events that can affect den stability, travel conditions, and caribou migration. Because barren-ground grizzly bears rely heavily on caribou, climate-driven stressors on caribou herds could indirectly influence bear foraging success (Gau et al. 2002; Banci and Spicker 2024).

At larger Arctic scales, climate-related distribution shifts are supported by documented northward expansion of grizzly bears and increased overlap with polar bears, including a confirmed hybridization event involving a female polar bear and eight hybrid offspring (Pongracz et al. 2017; Miller et al. 2024; IAG 2025a). In West Kitikmeot, DNA-based mark-recapture studies show a stable but low-density population (~5 to 6 bears/1,000 km²) tied strongly to shrub growth, caribou abundance, and coastal access (Awan et al. 2025). Climate-driven changes to these factors—especially under SSP5-8.5—may alter seasonal movement and local foraging patterns independent of the Project.

With planned mitigation and environmental management measures, climate-related changes are not expected to interact with project residual effects in a way that alters the characterization of project effects. Both Inuit Knowledge and scientific literature highlight the importance of adaptive monitoring to detect future changes in habitat use, seasonal timing, and northward range expansion of grizzly bear, given the uncertainty inherent in long-term climate projections.

18.13 Assessment of Cumulative Effects on Grizzly Bear

18.13.1 Project Residual Effects Likely to Interact Cumulatively

Table 1 in Appendix 9A (Volume 4) presents the PIL, which identifies other projects and physical activities that might act cumulatively with the Project. Where residual effects from the Project cumulatively interact with those from other projects and physical activities, a CEA is carried out.

Effects identified in Table 18.26 as not likely to interact cumulatively with residual effects of other projects and physical activities (no check mark) are briefly discussed below. The assessment of the cumulative effects likely to result from the Project, in combination with other projects and physical activities, is discussed in subsequent sections.

During engagement sessions, comments were received on concerns about how the combination of exploration activities and other human developments in the area may cumulatively influence wildlife (see Table 18.10). These concerns were taken into consideration in the CEA.

Table 18.26 Interactions with the Potential to Contribute to Cumulative Effects on Grizzly Bear

Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
Past			
Bathurst Inlet	–	–	–
Omingmaktok	–	–	–
Snap Lake Mine	–	–	–
Present			
Arcadia Bay Project	–	✓	–
B2Gold George Property	–	–	–
B2Gold Marine Laydown Area	–	–	–
Bulk Carriers	–	–	–
Cambridge Bay	–	–	–
Chuk and Fire Shear Blocks	–	✓	–
Commercial Cargo	–	–	–
Commercial and Domestic Harvesting	–	–	✓
Coppermine Project	–	–	–
Coppermine River Project	–	–	–

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
Diavik Diamond Mine	–	–	–
Ekati Diamond Mine	–	–	–
Epworth Project	–	–	–
Fishing Vessels	–	–	–
Gahcho Kué Diamond Mine	–	–	–
Goose Mine	–	–	–
Hackett River Project	✓	✓	✓
High Lake (Izok Corridor Project)	✓	✓	✓
High Lake East	–	✓	–
Hood River Gold Project	–	✓	–
Hope Bay Project	–	–	–
Hydroelectric	–	–	–
Icebreakers	–	–	–
Itchen Lake Property	–	✓	–
Izok Lake (Izok Corridor Project)	✓	✓	✓
Jericho Mine	✓	✓	✓
Kennady North - Exploration	–	–	–
Kugluktuk	–	–	–
Lupin Mine	✓	✓	✓
Muskox Nickel Property	–	–	–
Nunavut Community Infrastructure	–	–	–
NT Community Infrastructure	–	–	–
Overflights	–	✓	–
Passenger Ships and Pleasure Craft	–	–	–
Pistol Lake Project	–	✓	–
Rae Copper Exploration Project	–	–	–
Rockinghorse (Koamaogaktok) Project	–	✓	–
Roma Project	–	✓	–
Scientific Research	–	✓	–
South Kitikmeot Gold Project	–	–	–
Tanker Ships	–	–	–
Tibbit to Contwoyto Winter Road	✓	✓	✓
Tourism	–	✓	–
TTMG Project	–	–	–
Tree River Lodge	✓	✓	✓
Tugs/Barges	–	–	–

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
Ulu Gold Project	✓	✓	✓
Wolf/Mistake Lake Property	–	✓	–
Yellowknife City Gold Project	–	–	–
Past and Reasonably Foreseeable			
Indin Lake Gold Project	–	–	–
Mon Mine	–	–	–
Yellowknife Gold Project	–	–	–
Project-Related Physical Activities			
Reasonably Foreseeable			
Arctic Economic and Security Corridor	–	–	–
Courageous Lake Mine	–	–	–
NICO	–	–	–
Reasonably Foreseeable Induced			
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port	–	✓	–
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho	–	✓	–
Grays Bay Road and Port: Airstrip Expansion	–	✓	–
Grays Bay Road and Port: Road Traffic	✓	✓	✓
Grays Bay Road and Port: Port Traffic (Marine)	–	–	–
Grays Bay Road and Port: Air Traffic	✓	✓	✓
Grays Bay Road and Port Phase 2 – Jericho Mine to NT Border	✓	✓	✓
Hackett River Project	–	–	–
Hackett and Back River Access Road	✓	✓	✓
High Lake Mine (Izok Corridor Project)	✓	✓	✓
Izok Lake Mine (Izok Corridor Project)	–	–	–
Izok Lake Access Road	✓	✓	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with Project residual effects.
- = Interactions between the residual effects of other projects and residual effects of the Project are not expected.

Most physical activities listed in Table 18.26 determined not to contribute to cumulative effects on grizzly bear habitat, movement, or mortality were characterized as such due to their location outside of the RAA. Physical activities associated with marine traffic at the port (e.g., icebreakers, bulk carriers) and port infrastructure are not likely to affect grizzly bear habitat, movement, or mortality, as bears will not use the ocean or sea ice as habitat. Project expansions to the airstrip and bulk fuel storage capacity at the Grays Bay Port and at Jericho Station will occur within the existing PDA, so will not result in effects on grizzly bear habitat beyond those already considered in the assessment of project effects.

The effects of past and present physical activities within the RAA have been captured in the baseline conditions for grizzly bear, so have already been considered in the assessment of project effects and therefore are not included in the CEA. No reasonably foreseeable activities occur within the RAA. The assessment of cumulative effects on grizzly bear likely to result from the Project, in combination with RFI physical activities (see Figure 18.14), is discussed in subsequent sections.

18.13.2 Change in Habitat

18.13.2.1 Cumulative Effect Pathways

As described in Section 18.13.4.1, existing habitat disturbances due to past and ongoing development and natural disturbances have influenced the RAA, shaping the current extent and condition of grizzly bear habitat. RFI physical activities with the potential to act cumulatively with the Project to affect grizzly bear habitat include the extension of the Grays Bay Road (Phase 2 – Jericho Mine to the NT border), 117 km of the Hackett and Back River access road, 89 km of the Izok Lake access road, and the High Lake Mine. The three RFI roads are in the southern portion of the RAA, while the High Lake Mine is in the central northern portion of the RAA. Changes to grizzly bear habitat due to these RFI activities will follow similar pathways to those described previously for Project effects, and their cumulative effects on habitat are expected to be mostly additive to the residual effects of the Project on grizzly bear habitat.

Direct habitat loss from earthworks and vegetation clearing will occur where the footprints of these RFI activities overlap with suitable grizzly bear habitat, while indirect habitat loss or alteration within a ZOI surrounding the footprints can be expected due to sensory disturbance (e.g., blasting and vehicle traffic) or dust deposition. The “low activity” ZOI used for the assessment of project effects on grizzly bear habitat is considered adequate to capture indirect effects associated with the RFI roading activities; however, to account for increased levels of sensory disturbance and dust deposition associated with mining activities, the “high activity” ZOI was increased from 2 km to 4 km around the footprint of the High Lake Mine to assess its indirect effects.

18.13.2.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

No additional mitigation, management and enhancement measures beyond those identified in the Project's effects assessment are proposed, given that all current and proposed projects in NU are obligated by laws and regulations to implement appropriate environmental safeguards and project-specific mitigation plans. Wildlife monitoring and adaptive management measures at the Project will be critical to continuously evaluate its contribution to cumulative effects on grizzly bear habitat in the RAA.

18.13.2.3 Cumulative Effects

The CEA for changes in grizzly bear habitat considers both direct habitat loss and indirect habitat loss or alteration that can affect habitat suitability or availability. This CEA examines the interactions between the Project's residual effects and those of RFI projects and activities within the RAA. As detailed in Section 18.12.1, existing habitat disturbances from past and current projects have already shaped the current grizzly bear habitat conditions in the RAA. The additional contributions of these RFI projects and activities to cumulative effects on grizzly bear habitat were assessed quantitatively, mostly in accordance with the methods described in Section 18.12.1.1, except for the use of a larger ZOI around the RFI High Lake Mine to assess indirect effects.

The cumulative effects of the Project and RFI activities on the amount of suitable grizzly bear habitat within the RAA are presented in Table 18.27. Cumulatively, these future physical activities are predicted to result in the direct loss of 51.4 km² and indirect loss of 312.4 km² of suitable grizzly habitat, for a total loss of 363.7 km². The Project is the single largest contributor to these losses, accounting for approximately half of the total. The total loss of suitable habitat amounts to 1.2% of the potentially suitable habitat available in the RAA at baseline, representing a low-magnitude effect (i.e., 1 to 10% change in suitable habitat). An additional 437.3 km², including 213.8 km² due to the Project, is predicted to experience indirect alteration but remain suitable grizzly bear habitat.

Table 18.27 Magnitude of the Cumulative Effects on Grizzly Bear Habitat

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1	44.2	140.8	185.0	0.6
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NT Border	1.4	39.1	40.4	0.1
Hackett and Back River Access Road	3.0	58.8	61.8	0.2
High Lake Mine (Izok Corridor Project)	0.3	17.8	18.1	0.1
Izok Lake Access Road	2.5	55.9	58.4	0.2
Total	51.4	312.4	363.7	1.2

Note:

* activity occurs within the Grays Bay Road and Port Phase 1 PDA.

A ZOI of 800 m was applied around RFI roads and 4 km around RFI mines.

The Project's residual effect of habitat loss, which is expected to be limited to the LAA, is anticipated to interact with the residual effects of RFI activities that extend into the RAA. Therefore, the cumulative effect of habitat loss is predicted to have a regional geographic extent. The timing of habitat changes associated with current and RFI projects and activities is uncertain; some may overlap with sensitive periods for grizzly bear (e.g., den emergence in early spring). Consequently, the timing of the cumulative effect is predicted to have high sensitivity. Construction of the Project and other RFI projects and activities that require ground disturbance are anticipated to occur as one-time events at specific locations.

However, ongoing sensory disturbances (e.g., vehicle traffic, human presence) associated with current and likely future projects and activities (e.g., roads) may result in continuous habitat alteration. Therefore, the cumulative effect is predicted to be continuous. Most portions of the Project and other activities in the RAA will be permanent, given that not all disturbed areas will be reclaimed or revegetated. As a result, most of the cumulative effect of change in habitat is considered to be long-term and irreversible.

18.13.3 Change in Movement

18.13.3.1 Cumulative Effect Pathways

The potential effects pathways for change in grizzly bear movement identified in Section 18.12.2.2 for the Project are expected to be similar for the RFI projects or activities and are primarily associated with sensory disturbances. Cumulative effects on changes in grizzly bear movement patterns are likely to occur as a result of sensory disturbances associated with the construction and operation of the three RFI roads, construction and operation of the High Lake Mine, and increased port, road, and aircraft traffic and human activity at the Project. As operations and maintenance activities at the Project were predicted to have negligible effect on grizzly bear movement, increased activity on the Grays Bay Road and Port Road and at the port and airstrip due to RFI activities is expected to be additive to the effects of the Project. New access roads create additional linear features that may alter crossing behaviour, whereas airstrip and port activity add episodic overflight/berth noise that can widen short-duration sensory zones. Cumulatively, impacts on permeability may increase where several corridors converge, sightlines are constrained, or activity is frequent. As there is limited spatial overlap of the Project with the new RFI road network and the mine, the effects of these RFI activities on grizzly bear movements within the RAA are also expected to be largely additive to those of the Project.

18.13.3.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

No additional mitigation, management and enhancement measures beyond those identified in the Project's effects assessment are proposed, given that all current and proposed projects in NU are obligated by laws and regulations to implement appropriate environmental safeguards and project-specific mitigation plans. Wildlife monitoring and adaptive management measures at the Project will be critical for continuously evaluating the contribution of the Project to cumulative effects on grizzly bear movement.

18.13.3.3 Cumulative Effects

Construction and operation of the three RFI roads, third-party use of the project road, and increased activity at the port and airstrip are expected to be the primary contributors to future changes in grizzly bear movement in the RAA. Studies of the effects of road networks on grizzly bears show displacement distances vary widely with traffic and context (<100 m to ~4 km), but population-level movement constraint is unlikely where permeability and crossings at watercourses are maintained and traffic is controlled (Apps et al. 2004; Ciarniello et al. 2004; Graham et al. 2010). Large home ranges further buffer regional-scale movement effects, although females with dependent young can be more risk-averse near busy segments (Graham et al. 2010; Awan et al. 2025). As a result, the magnitude of cumulative change in movement patterns is expected to be low.

While the Project's residual effect on movement was predicted to be limited to the LAA, the residual effects of RFI activities will extend into the RAA. Therefore, the cumulative effect of change in movement is predicted to have a regional geographic extent. The timing of residual effects associated with RFI activities is unknown, but some of these effects may overlap with sensitive periods for grizzly bears; therefore, the timing of the residual cumulative effects is expected to be highly sensitive. Cumulative effects on grizzly bear movement will be long-term in duration and irreversible, as the RFI activities involve the construction and use of permanent road infrastructure. The cumulative effect on movement is expected to be continuous due to persistent sensory disturbances, primarily associated with third-party use of the road networks. The timing of the cumulative effects will likely overlap the high-sensitivity period (e.g., early spring den emergence).

18.13.4 Change in Mortality Risk

18.13.4.1 Cumulative Effect Pathways

Barren-ground grizzly bears are culturally and ecologically important in NU, and changes in mortality risk require management attention. Roads associated with RFI mining projects, along with third-party use of Project infrastructure, represent the primary pathways through which cumulative mortality effects are expected to occur.

Additional roads and increased traffic from RFI activities could elevate the risk of vehicle collisions with grizzly bear and provide increased opportunity for hunter access. These influences would add to existing pressures already reflected in baseline conditions. While the Project's residual effects on mortality were expected to occur primarily within the LAA, they would contribute cumulatively to broader mortality risk across the RAA.

18.13.4.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

The mitigation, management and enhancement measures identified in Section 18.12.3.3 are also expected to apply to RFI projects and activities. Measures such as awareness training and speed limits are anticipated to help keep bear-vehicle collisions low across all RFI project-related road use. However, an increase in road length or traffic within the RAA could elevate mortality risk through higher collision potential and greater human access for hunting. The cumulative presence of additional human activity

and infrastructure could therefore increase overall mortality pressure on the population, particularly where new access routes improve hunting opportunities. There are no project-specific mitigation measures to reduce grizzly bear mortality risk from increased hunting, but harvest in the RAA will occur within the current regulatory and management framework for grizzly bear in NU. Wildlife monitoring and adaptive management measures at the Project will be necessary to evaluate the Project's contribution to cumulative effects on grizzly bear mortality within the RAA.

18.13.4.3 Cumulative Effects

This assessment considered Project-related mortality of grizzly bears in the context of projected future regional stressors, focusing on the types and general intensities of other activities, their spatial and temporal overlap with grizzly bear distribution, and the overarching regulatory frameworks. The Project's residual effect on change in mortality is predicted to interact with the residual effects of RFI activities that extend across the RAA. Therefore, the cumulative effect of change in mortality is predicted to have a regional geographic extent. While cumulative mortality risk increases qualitatively with added roads and traffic, its magnitude is directly related to the effectiveness of mitigation, management and enhancement measures. Additional road use by RFI projects or activities will increase encounter frequency and collision probability, while localized growth at mines, ports, airstrips can raise DLP risk if attractants are not rigorously managed. Improved access may also lead to additional induced harvest pressures, complicating attribution and monitoring. However, even when considering cumulative effects, it is unlikely that harvest will increase to a level which puts the viability of grizzly bear populations at risk, as the RAA will remain highly remote and challenging to access. As a result, the magnitude of the cumulative effects of mortality change is predicted to be low.

The timing of residual effects from RFI projects and activities varies, but some are expected to continuously overlap with seasonally sensitive periods for grizzly bears (e.g., den emergence, spring foraging). Therefore, the effect is expected to be high sensitivity in timing. Harvesting activity is likely to occur as irregular events in the RAA. Increased access for harvest will result from the development of permanent road infrastructure; therefore, cumulative effects on grizzly bear movement are predicted to be long-term and irreversible.

18.13.5 Summary of Cumulative Effects

The Project's residual effects, combined with RFI physical activities, are likely to have cumulative effects on grizzly bears, specifically regarding habitat (direct and indirect loss), movement, and mortality. These cumulative effects are generally assessed as low in magnitude, regional in extent, irreversible, and long-term in duration, as well as highly sensitive in timing, due to potential overlap with critical grizzly bear life stages. Table 18.28 summarizes the cumulative effects on grizzly bear.

Table 18.28 Residual Cumulative Effects of RFI Projects and Activities on Grizzly Bear

Residual Cumulative Effect	Residual Cumulative Effects Characterization					
	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	L	RAA	HS	LT	C	I
Contribution from the Project to Residual Cumulative Change in Habitat	The Project is the single largest contributor to loss of suitable grizzly bear habitat in the RAA, accounting for approximately 50% of the total cumulative loss of 363.7 km² of suitable habitat, which represents 1.16% of that available at baseline.					
Change in Movement	L	RAA	HS	LT	C	I
Contribution from the Project to Residual Cumulative Change in Movement	Once operational, the contribution of the Project to changes in movement was determined to be negligible. RFI activities are expected to be the major contributors to sensory disturbances that may have localized and temporary effects on grizzly bear movement, primarily due to considerable increases in port, road, and aircraft activity associated with third-party users of the Project and the development of three new all-season roads and a mine within the RAA.					
Change in Mortality	L	RAA	HS	LT	IR	I
Contribution from the Project to Residual Cumulative Change in Mortality	Both the Project and RFI activities are expected to result in a low magnitude increase in grizzly bear mortality risk. RFI activities are expected to be the greater contributor to increased mortality risk due to increased traffic volumes and associated collision risk, increased human activity and potential for human-bear conflict, and facilitated hunter access to a wider portion of the RAA than generated by the Project alone.					
Key: See Table 18.4 for detailed definitions						
Magnitude: NMC: No Measurable Change L: Low M: Moderate H: High		Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity		Frequency: S: Single event IR: Irregular event R: Regular event		
Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area		Duration: ST: Short-term MT: Medium-term LT: Long-term		Reversibility: R: Reversible I: Irreversible N/A: Not applicable		

The Project contributes approximately half of the cumulative effect of grizzly bear habitat loss in the RAA, with a cumulative alteration from all the Project and RFI projects or activities projected to be 1.2% of the amount of suitable grizzly bear habitat available in the RAA at baseline. This effect is considered irreversible due to the permanent nature of the Project and the RFI projects in the RAA.

Effects on grizzly bear movement, primarily due to sensory disturbance from RFI activities, are also expected to be a low-magnitude, cumulative effect. Again, this effect is considered irreversible, as RFI activities will be ongoing, except for the High Lake mine as the effects will cease following mine closure and reclamation. Other future activities are expected to be the greatest contributors to changes in grizzly bear movement in the RAA due to increased levels of sensory disturbance associated with RFI activities compared to operations and maintenance activities at the Project. These activities are expected to be a relatively consistent source of sensory disturbance for grizzly bear.

Cumulative effects of the Project and RFI activities on grizzly bear mortality are predicted to be of low magnitude, with the primary pathway being a redistribution of harvest opportunities from the wider region to the RAA, as residents gain seasonal access to a network of all-season roads. Although access may change where harvesting occurs, NU's existing harvest-management framework—including territorial wildlife legislation, the NWMB Regional Wildlife Organizations, and local HTOs—provides tools to monitor harvest outcomes and respond adaptively if sustainability concerns arise. Because the Project and RFI roads will be permanent, this redistribution of access is considered irreversible.

18.14 Transboundary Effects on Grizzly Bear

An assessment of the potential for transboundary effects on grizzly bear is provided in Volume 10, Section 33 Transboundary Effects Assessment.

18.15 Significance of Effects on Grizzly Bear

18.15.1 Significance of Project Residual Effects

After applying mitigation, management and enhancement measures, the residual effects of the Project on changes in grizzly bear habitat, movement, and mortality are predicted to be not significant. The Project is not expected to cause population-level changes that would affect the long-term viability, persistence, or sustainability of grizzly bear populations that interact with the RAA, because the residual effects represent small changes to baseline conditions and are highly localized. This conclusion reflects the limited magnitude and spatial extent of habitat loss (<1% of available suitable habitat within the RAA), the localized and temporary nature of movement effects, and the low predicted increase in mortality risk following implementation of the WMMP and other management measures. Implementation of the WMMP, adaptive management, and ongoing engagement with communities and co-management partners will facilitate early detection of project-related mortalities or behavioural changes to be addressed through corrective measures.

18.15.2 Significance of Cumulative Effects

The cumulative effects of the Project and RFI projects and activities are predicted to be not significant as they are not expected to alter the population viability or persistence of grizzly bear within the RAA. The RFI physical activities are anticipated to result in relatively small incremental increases in magnitude across all three effects, assuming implementation of comparable mitigation, management and enhancement measures to the Project.

18.15.3 Summary of Mitigation, Management, and Enhancement Measures

Mitigation, management and enhancement measures are designed to mitigate the Project's influence on grizzly bears, including risks to habitat, movement, and mortality. Changes in grizzly bear habitat can result from vegetation clearing, sensory disturbance, and infrastructure construction, potentially leading to measurable habitat loss or degradation. Mitigation and management measures reduce this risk by minimizing clearing footprints, planning infrastructure to avoid sensitive landforms, and applying dust suppression and noise controls. As a result, total direct and indirect habitat change remains <1% of available suitable habitat in the RAA, a negligible magnitude that does not limit habitat availability or function. Through the implementation of targeted measures, residual habitat effects are deemed not significant.

Construction activities can temporarily disrupt local movements, but by applying applicable measures, such as timing restrictions near denning habitat, speed limits, wildlife monitors, and permeable designs at key habitat features, changes to grizzly bear movement will be minimized. These measures limit displacement to short-duration, localized avoidance, with no indication of population-level movement restriction. Since movement effects only become significant if bears lose access to key resources across broader areas, which mitigation and management measures prevent, residual movement effects are deemed not significant.

Changes in grizzly bear mortality was the project effect with the greatest potential to become significant without mitigation. Mitigation and management measures target vehicle collisions, attractants, human-bear conflict, and access-related harvest risk. Speed limits, mandatory wildlife reporting, attractant-proof storage, daily waste incineration, wildlife safety training, and controlled road access all reduce opportunities for bears to be killed or habituated. These measures help prevent mortality from reaching levels that could affect adult female survival, the key demographic driver of population stability. Because population-level impacts are expected in the absence of harvest management, the residual mortality risk is deemed not significant.

18.16 Assessment of Project Effects on Wolverine

18.16.1 Change in Habitat

Inuit Knowledge provided baseline data and ecological context for assessing the Project's effects on wolverine habitat by defining preferred terrain, denning requirements, and critical food-source dependencies. Inuit Knowledge gathered by Banci and Spicker (2024) characterizes wolverine habitat as inherently rugged and closely tied to the presence of prey:

- Preferred Terrain: Wolverines are most commonly found in rugged country characterized by big rivers, mountains, and boulder fields. In the Project area, they are known to frequent the coast and islands, particularly Hepburn Island and rocky areas west of it.
- Shelter and Security: The animals rely on rocky areas, crevices, and cliffs for security and hiding cover to escape predators like wolves and bears, as well as humans.
- Dietary Linkages: Wolverine distribution is fundamentally linked to the distribution of caribou, their primary food source. They are frequently found at caribou water crossings and along migration routes where they scavenge carcasses killed by other predators. They also frequent areas with high populations of Arctic hares.

Inuit consultants provided specific details on denning habits that inform the assessment of ground disturbance and construction impacts:

- Den Locations: Natal dens are situated in rocky areas, crevices, and boulder fields.
- Structure: A wolverine den typically consists of snow tunnels within these boulder fields that terminate in a rock crevice, sometimes using willows as bedding material. Unlike wolves or foxes, wolverines do not den in eskers or dig holes directly into the ground.

Inuit consultants identified sensory disturbance as a pathway through which the Project could affect these habitats:

- Noise: Wolverines are noted to be sensitive to noise and sensory disturbances. Heavy industrial activity, such as blasting and constant helicopter traffic, can drive animals away from established habitats and denning sites.

18.16.1.1 Analytical Assessment Techniques

The assessment of habitat change considers both direct loss and indirect loss (e.g., due to sensory disturbances, edge effects, physical and perceptual filters to habitat use, dust deposition) of wolverine habitat. Wolverine HSRs were defined to characterize and quantify the baseline amount of suitable habitat within the RAA (see Section 18.16.1.4). The rating scheme qualitatively characterized habitat using an ordinal scale, with ratings of high, moderate, low, or nil quality (see Figure 18.13). As these wolverine habitat ratings were relatively consistent with regional Inuit Knowledge accounts of wolverine habitat, they were used to quantify the change in habitat associated with the Project.

The effects of the Project on wolverine habitat are characterized based on project-related effects on areas considered as Suitable habitat (High or Moderate suitability rating) for wolverine. Suitable habitat that overlaps with the PDA is considered lost to wolverine due to direct habitat loss during the Construction phase. Areas within a defined proximity to the PDA (i.e., ZOI) are considered to be altered, or rendered less suitable, which can also ultimately result in habitat loss.

Indirect habitat loss was quantified using a ZOI approach. The ZOI is a defined proximity from the PDA where project activities may indirectly reduce habitat effectiveness or use. These indirect effects occur primarily through sensory disturbances (e.g., noise, lights, smells, human presence), but may also include other factors (e.g., edge effects, dust, perceptual filters to use, road densities) that can alter habitat and reduce habitat suitability. Wolverines select areas with minimal human disturbance (i.e., low road densities), and increased road density may adversely affect habitat use. Wolverines in Norway were found to avoid habitat within 1.5 km of private roads (May et al. 2012), while other research has shown wolverines tend to avoid areas with road densities greater than 0.44 km/km² (Rowland et al. 2003; Dawson et al. 2010; Scrafford and Boyce 2015; Kortello et al. 2019). Studies have found wolverine den sites in the boreal forest to be located 0.9 km to 1.0 km from operational roads (AB and Ontario) and 0.4 km to 12 km from petroleum wells and roads (AB), though another study found 87.5% of den sites to be within 5 km of a forest road (Jokinen et al. 2019; Scrafford and Ray 2022; Hausleitner et al. 2024). While wolverine clearly avoid road infrastructure, evidence suggests that the degree of avoidance is lower for roads that are not heavily travelled (May et al. 2012; Scrafford and Ray 2022). Traffic on the Project road will be relatively limited during the Operations and Maintenance phase, though it will be heavier during the Construction phase. Thus, a ZOI of 1 km around the PDA was used to assess indirect effects on suitable wolverine habitat, based on the range of habitat avoidance from roads determined by May et al. (2012) and findings on road densities adversely affecting wolverine habitat use (Rowland et al. 2003; Dawson et al. 2010; Scrafford and Boyce 2015; Kortello et al. 2019). In academic research on wolverine habitat selection, 1 km has been cited as an appropriate buffer to represent the larger area in which wolverine movement and habitat use may be influenced by proximity to roads (Johnson et al. 2005). This ZOI distance was also determined to be appropriate for capturing disturbances from all construction activities (e.g., drilling and blasting), as sound levels from construction activities are predicted to return to baseline levels within 1 km of the edge of the PDA (see Volume 5, Section 13). The ZOI is contained entirely within the LAA.

Indirect habitat loss was quantified by applying a reduction factor to habitat ratings within the ZOI, reducing suitability ratings by one level (e.g., High becomes Moderate, Moderate becomes Low, and so on). Habitat that was downrated from Moderate (Suitable) to Low (Not suitable) was considered to represent indirect habitat loss, while that downrated from High (Suitable) to Moderate (Suitable) was considered to represent indirect habitat alteration. This approach reflects evidence that wolverines may still use high-quality habitat within the ZOI despite human activities (Scrafford et al. 2018).

The total area of direct and indirect loss of suitable wolverine habitat due to the Project was used as the metric for assessing the magnitude of habitat change. Due to the large home range size of wolverine (Whitman et al. 1986), the magnitude of the change in habitat was quantified by referencing it to the baseline amount of Suitable habitat in the RAA and comparing the resulting percentage to the quantitative categories of magnitude described in Table 18.4.

18.16.1.2 *Project Effects Pathways*

Vegetation clearing and stripping during the Construction phase will result in a direct loss of suitable wolverine habitat in the PDA. Habitat loss will occur along the road, at the airstrip, at the barge site, and at various laydown/storage areas. Project activities that will result in direct habitat loss are limited to the Construction phase but will persist throughout the Project's lifetime. Indirect effects include reduced habitat effectiveness in the ZOI, primarily due to sensory disturbance (e.g., noise and human activity), edge effects, and, in extreme development environments, fragmentation (Chapin et al. 1998; Hargis et al. 1999; Krebs et al. 2007). Indirect effects may include changes in behaviour and resource use, which can reduce or prevent the use of otherwise suitable habitat (Dyer et al. 2002; Laurian et al. 2012). While the habitat may remain relatively intact, wolverine use may be reduced due to sensory disturbances that degrade habitat function. Wildlife may avoid roads because of vehicle traffic, human activity, noise, light, and dust (Coffin 2007; Polfus et al. 2011; Shannon et al. 2016; Watkinson et al. 2021). Dust produced from project-related activities will deposit on the vegetation surrounding the PDA. This deposition can reduce plant cover and growth, altering the vegetation community (Watkinson et al. 2021), which may influence habitat use of species which wolverine prey upon. Indirect habitat effects will occur within the 1 km ZOI around the PDA in both phases of the Project, but at a reduced intensity during the Operations and Maintenance phase.

18.16.1.3 *Mitigation, Management, and Enhancement Measures*

The Project has integrated multiple management measures into its design and operational procedures to avoid, manage, and reduce the amount of change to wolverine habitat. Mitigation, management, and enhancement measures for wolverine focus on reducing the development area to the extent feasible and avoiding sensitive times and habitats. Below are mitigation and management measures to mitigate the effects of habitat loss or alteration on wolverine.

Mitigation Measures to Reduce Direct Habitat Loss

- The PDA will be confined to a specific design layout to reduce the Project's potential effect on habitat loss and effectiveness.
- Quarries will not be situated on sensitive habitat features like watercourses, water bodies, land bridges, or within caribou calving ranges.
- Construction and quarry development activities will adhere to the recommended setbacks and timing restrictions outlined in the WMMP.
- Wildlife sweeps will be completed to identify wildlife sensitivities (i.e., active nests, dens, other wildlife features) ahead of construction activities. No-disturbance buffers will be established around any sensitivities identified. If disturbance within a no-disturbance buffer is unavoidable, site-specific protection measures will be developed by a Qualified Professional.

Mitigation Measures to Reduce Indirect Habitat Loss

- Aircraft will maintain a minimum cruising altitude of 610 m above ground level except during landing and take-off at the airstrip, or for safety reasons due to inclement weather, or when operationally required.
- ATV, utility task vehicle, and snow machine use will be limited to within the PDA boundaries during construction. Any deviation in use outside of the PDA must be pre-approved by the WKR representative on site.
- Dust will be actively suppressed on roads (with water and/or other dust suppressants) when necessary to manage excessive dust. Dust suppression will follow NU's *Environmental Guideline for Dust Suppression on Unpaved Roads* (GN 2014).

18.16.1.4 Project Residual Effect

Baseline conditions of 15,502.4 km² of suitable wolverine habitat within the RAA (see Table 18.29) (36.0% of total RAA area) were calculated based on HSR results (see Section 18.16.1.4). Site clearing within the PDA for construction is anticipated to result in the direct loss of up to 18.5 km² of suitable wolverine habitat, while in combination, the two project phases are projected to result in 33.1 km² of indirect habitat loss. A further 148.0 km² of habitat was predicted to experience indirect habitat alteration due to the Project (i.e., a reduction in rating from High to Moderate) but remain suitable. The percentage of direct suitable habitat loss is 0.1% of the RAA's baseline suitable habitat, while the percentage of indirect habitat loss across both phases is 0.2% of baseline suitable habitat within the RAA. Throughout all project phases, the total area of projected habitat loss is 51.6 km², which is 0.3% of the suitable habitat available within the RAA at baseline.

Table 18.29 Magnitude of the Change in Suitable Wolverine Habitat due to the Project

Project Phase	Assessment Area	Effect Type	Area (km ²)	% of Suitable Habitat in RAA
Baseline	RAA	Nil	15,502.4	100.0
Construction	LAA (PDA portion)	Direct Habitat Loss	18.5	0.1
Construction and Operations and Maintenance	LAA (ZOI portion)	Indirect Habitat Loss	33.1	0.2
Total Habitat Loss			51.6	0.3

Notes:

A ZOI of 1km around the PDA was applied to capture indirect effects on wolverine habitat.

With the implementation of measures to reduce the area of disturbance and intensity of sensory disturbances to wolverine, it is anticipated that the Project will result in an adverse change of direct and indirect loss to suitable wolverine habitat within the RAA of less than 1% of the baseline amount of suitable habitat within the RAA. This amounts to a negligible change in wolverine habitat.

The direct loss of potential wolverine habitat is expected to be limited to the PDA and to activities during the Construction phase. In contrast, indirect effects on potential wolverine habitat are expected to occur within the LAA within 1 km of the PDA during each phase of the Project. Therefore, the geographic extent of the residual effect is limited to the LAA. The timing of the habitat changes is expected to overlap with the natal denning season, a critical period in their lifecycle when females may be giving birth and raising young. Therefore, the effect is predicted to have high sensitivity to timing.

The Project will result in the construction of permanent infrastructure. Thus, direct habitat loss within the PDA, as well as indirect habitat loss in the LAA, is anticipated to persist for the lifespan of the Project infrastructure, resulting in long-term residual effects. While the direct loss of potential wolverine habitat due to clearing is expected to occur once during construction, the indirect loss of potential wolverine habitat within the LAA is anticipated to be continuous throughout the Project's life. Therefore, the frequency of the change in wolverine habitat is predicted to be continuous. As the Project will result in permanent infrastructure, resultant changes in wolverine habitat will be irreversible.

18.16.2 Change in Movement

Inuit Knowledge provided input for assessing the Project's potential effects on wolverine movement by documenting their landscape-level travel patterns, seasonal behaviours, and responses to industrial disturbance (as identified by Inuit consultants in Banci and Spicker (2024)). Key Inuit Knowledge regarding wolverine movement includes:

- Landscape-Scale Travel and Habitat Selection:
 - Wolverines move extensively through rugged country, big rivers, mountains, and boulder fields.
 - Their travel is often concentrated along ocean shorelines and river banks where the terrain is gentler and easier to navigate.
 - In the Project area, they are known to move along the coast and islands, specifically on the ice and shoreline of Hepburn Island.
- Prey-Driven Movement:
 - Wolverine movement is tied to the distribution of their primary prey, caribou.
 - They also follow caribou herds during migration, with predators like wolverines noted to be "getting down there" (Victoria Island) following the recent expansion of caribou ranges.
- Sensitivity to Disturbance:
 - Project activities such as blasting and helicopter traffic are noted as disturbances that can cause animals (including wolverine) to stay away from their usual routes.
 - When threatened or disturbed, wolverines typically run toward rocky areas or crevices to escape.
- Learned Behavioural Shifts:
 - While they traditionally avoid human activity, wolverines are known to move toward human infrastructure when they become attracted to meat caches, cabins, or poorly managed waste and garbage at industrial sites.

18.16.2.1 *Analytical Assessment Techniques*

The assessment of potential project-related changes to wolverine movement patterns considers potential effects such as physical obstruction to movement, sensory disturbances (e.g., noise, light, human presence, vehicle traffic), and habitat fragmentation across project phases. Project effects on movement were qualitatively assessed using professional judgment informed by Inuit, Indigenous, and Community Knowledge, baseline conditions in the RAA, the anticipated pathways of effects, a literature review, and the availability and effectiveness of mitigation measures. The focus was on various project components or activities that could influence wolverine movement. Given the large home ranges of wolverines (females: 300 km² to 400 km², males: 1,000 km² to 1,400 km²), project effects on change in movement patterns are assessed at the RAA scale (Krebs and Lewis 1999; Lofroth 2001).

18.16.2.2 *Project Effects Pathways*

Mammal movement is a complex suite of behaviours driven by physiological, social, and reproductive needs (May et al. 2010; Vigeant-Langlois and Desrochers 2011; Feierabend and Kielland 2014; Dickie et al. 2017). Both natural and anthropogenic landscape features influence these patterns by affecting habitat connectivity, resource availability, and risk exposure (Bennett and Zurcher 2013; Starbuck et al. 2020; Seewagen and Adams 2021). Project activities and infrastructure may influence wolverine movement throughout the Project's lifespan, although some effects are expected to diminish as activity declines during the Operations and Maintenance phase.

Inuit Knowledge provides a limited description of wolverine movement patterns. It is known in the Grays Bay region that wolverine will travel across sea ice to access Hepburn Island, indicating that movement and distribution are not restricted to the mainland (Banci and Spicker 2024). Inuit Knowledge also states that wolverine often inhabit rocks and cliffs, and will run towards rocky areas when threatened, providing some insight into their small-scale movement (Banci and Spicker 2024). Use of such rugged terrain also implies that wolverine are highly agile and not restricted by most physical obstacles. Furthermore, while Inuit Knowledge does not directly link wolverine movement to food sources, it is stated that wolverine tend to occupy areas used more frequently by caribou, as carrion from caribou is a primary food source (Banci and Spicker 2024). Inuit Knowledge also states that wolverine will stash carrion during summer for winter consumption (Banci and Spicker 2024). This indicates that food drives small-scale wolverine movement to some degree, which is consistent with findings from Western Science. This suggests that wolverine could alter movements to be attracted to the road, if the road results in the mortality of other species and management efforts are not put in place to remove roadkill in a time-effective manner.

Findings from academic literature show that wolverine distribution and abundance are strongly linked to ungulate carrion, making them susceptible to indirect effects from project changes to other VCs and Indicators (e.g., caribou, muskox, and moose (Krebs et al. 2007; Glass et al. 2022). Wolverines are sensitive to human activity, including vehicle traffic on roads, infrastructure, and backcountry recreation, and are likely to alter movement patterns to avoid such activities (Stewart et al. 2016; Heinemeyer et al. 2019; Jokinen et al. 2019).

While wolverine movements are strongly influenced by food abundance and summer temperatures, disturbances from humans, such as roads, can also play a role (Ruggiero et al. 1994; Copeland et al. 2010; Fisher et al. 2013). Wolverine are known to travel great distances, and daily movements can extend up to 65 km, often in search of food (Lofroth et al. 2007). Young wolverines disperse over considerable distances, with records up to 378 km (Wilson 1982; Ruggiero et al. 1994; Lofroth et al. 2007). Anthropogenic features and activities, such as road density, logging, mining, and backcountry recreation, can alter wolverine movement (Austin et al. 2000; Lofroth 2001; Dawson et al. 2010). Roads with traffic exceeding 300 vehicles per day or densities above 0.44 km/km² may act as barriers or cause spatial avoidance (Alexander et al. 2005; Scrafford and Boyce 2015; Kortello et al. 2019). In addition, there is evidence that wolverines are more likely to select den sites more than 1 km away from roads during the denning season of February 15 to May 31 (May et al. 2012; Scrafford et al. 2018; Scrafford and Ray 2022; Aronsson et al. 2023).

Although wolverines are anticipated to avoid project infrastructure within the PDA, potentially up to 1 km from it for denning females (May et al. 2012), anticipated peak traffic volumes, which occur during the Construction phase, are not expected to create an impermeable filter to movement. Furthermore, the physical structure of the road, with a height of 1.4 m to 1.7 m and a slope ratio of 3:1, will not restrict wolverine from access or crossing, given the agile nature of the species, as stated by local Inuit Knowledge (Banci and Spicker 2024). As such, new linear features resulting from the Project are not expected to be complete obstructions to daily or seasonal movements.

Project-related activities will likely influence wolverine movement throughout the Project's lifespan. However, these effects will be concentrated in areas where construction activity is underway at any given time during the Construction phase, as construction will not occur in synchrony along the entire length of the road. Furthermore, effects are anticipated to decrease considerably during the Operations and Maintenance phase, when sensory disturbance and traffic volume will decline. During both phases, effects are more likely to occur in the northern portion of the RAA near the Grays Bay Port, due to higher traffic volume, air traffic, and overall higher levels of sensory disturbance (see Volume 15, Section 13). Effects around the port could influence wolverine movement over sea ice in winter, potentially affecting parts of their range. Effects are also likely to be greater near temporary and permanent road quarries, where blasting will occur during both project phases; however, the effects of blasting on noise and vibration are not expected to exceed recommended levels beyond 1 km from the sites, following mitigation (see Volume 15, Section 13).

18.16.2.3 Mitigation, Management, and Enhancement Measures

The Project has integrated multiple mitigation and management measures into its design and operational procedures to avoid, manage, and reduce the magnitude, duration, and extent of potential project-related effects on wolverine movement. Measures for wolverine focus on reducing physical filters to movement and sensory disturbance to the extent feasible, reducing vehicle-related mortality of caribou and other species that could attract wolverine to roads and away from their natural travel routes or patterns, and on reclamation post-disturbance. Below are proposed measures to mitigate the effects of change in movement patterns on wolverine.

- Wildlife will have the right-of-way when they occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, driver's must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Wildlife will have the right-of-way on all Project infrastructure areas as detailed in the WMMP.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers on the road.
- Aircraft will maintain a minimum cruising altitude of 610 m above ground level except during landing and take-off at the airstrip, or for safety reasons due to inclement weather or when operationally required.

18.16.2.4 Project Residual Effect

The scale of the Project relative to that of wolverine movements is relatively small, and the Project is not expected to create impermeable filters to wolverine movement after accounting for mitigation measures. Mitigation measures should greatly reduce the risk of vehicle-related mortality of all species and ensure that animal carcasses do not remain on the road. As such, wolverine movement should not be altered to be attracted to roadways. While mitigation will effectively reduce sensory disturbance during both project phases, such disturbances will not be completely eliminated, so residual effects of the Project on wolverine movement of a low magnitude are expected.

The geographic extent of the residual effect on change to wolverine movement is predicted to be limited to the LAA, as such effects are anticipated to be limited to within 1 km (i.e., distance denning females may avoid roads) of project components and activities (i.e., within PDA and LAA). Furthermore, modelled increases in noise and vibration are predicted to return to baseline (or an acceptable level) within 1 km of the PDA. The scale of noise and vibration effects will also exhibit spatiotemporal variation across the PDA, as project activities will generally be concentrated in a few locations at any given time.

The timing of changes in movement patterns will overlap with a critical period in the wolverine lifecycle, when females may be giving birth and raising young (i.e., natal and maternal denning from February 15 to May 31; Aronsson et al. 2023). Any change in movement across sea ice due to sensory disturbances at the port will only occur during months when sea ice is frozen. Therefore, the effect is predicted to have high sensitivity in timing. The frequency of changes in movement patterns is predicted to be continuous at the port and other centres of permanent activity during both project phases, and irregular along the road based on changes in traffic and localized construction/maintenance activity.

Many project-related effects on movement during construction, such as wolverine avoiding drilling and blasting sites, will diminish once the Construction phase is completed due to reduced noise and human presence. Maintenance activities such as snow plowing or grading may affect wolverine movement, though mitigation measures will reduce these effects, which will occur only at certain points in time. Effects from the presence of vehicles, people, and noise during the Operations and Maintenance phase will be continuous around the port but will be infrequent along the road, fluctuating within the presence of operational and maintenance activities. The road and port are permanent developments and will affect movement throughout the Project's life. Therefore, the Project's effect on wolverine movement is predicted to be long-term. Project effects are predicted to be irreversible, as project infrastructure will be permanent and may continuously affect wolverine local movements.

18.16.3 Change in Mortality Risk

Inuit Knowledge provided input into the assessment of wolverine mortality risk by identifying the animal's behavioural vulnerabilities, its changing ecological relationships with other species, and risks associated with the project infrastructure. Inuit consultants identified specific behaviours that increase a wolverine's risk of interacting with Project activities:

- **Learned Attraction:** While they typically avoid humans, wolverines are described as pests that are strongly attracted to meat caches, cabins, and poorly managed waste or garbage at industrial sites (Banci and Spicker 2024). This attraction increases the risk of human-wildlife conflict, often resulting in direct mortality to wolverine.
- **Escape cover:** wolverine tend to use rocky areas as escape habitat to avoid risks (Banci and Spicker 2024).

The IAG (2025b) provided specific recommendations based on this knowledge to lower wolverine mortality risk:

- **Predator Control Support:** IAG members recommended that WKR support local wolf, grizzly bear, and wolverine control programs to help manage these populations.

Comments were received during engagement with Inuit on how the Project may influence their ability to harvest wildlife (see Table 18.10).

18.16.3.1 *Analytical Assessment Techniques*

Project-related changes to wolverine mortality risk were assessed through the identification and qualitative evaluation of Inuit Knowledge and relevant literature, in relation to potential project-related factors that may affect wolverine mortality risk, and within the context of existing sources of mortality risk for wolverine in the West Kitikmeot Region. Potential sources of mortality resulting from the Project include collisions with wolverine on the road, potentially lethal interactions with specific project infrastructure or activities (e.g., airstrip, blasting), lethal control of problem animals, and increased hunting and trapping facilitated by the presence of the port and road. Project-related factors that can influence the risk of collisions (e.g., traffic, embankment characteristics, roadside attractants, speed limits, areas of the road within high-quality late winter habitat) were considered, as were the availability and anticipated effectiveness of mitigation measures. The potential increase in wolverine mortality risk from facilitated access for harvest was assessed qualitatively by considering current harvest regulations and rates, the potential for increased access into previously remote areas provided by the port and road, and the likelihood of increased harvest given facilitated access. The results of the qualitative assessment were then presented within the context of existing knowledge on wolverine population size and mortality within the RAA.

18.16.3.2 *Project Effects Pathways*

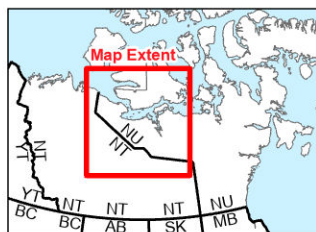
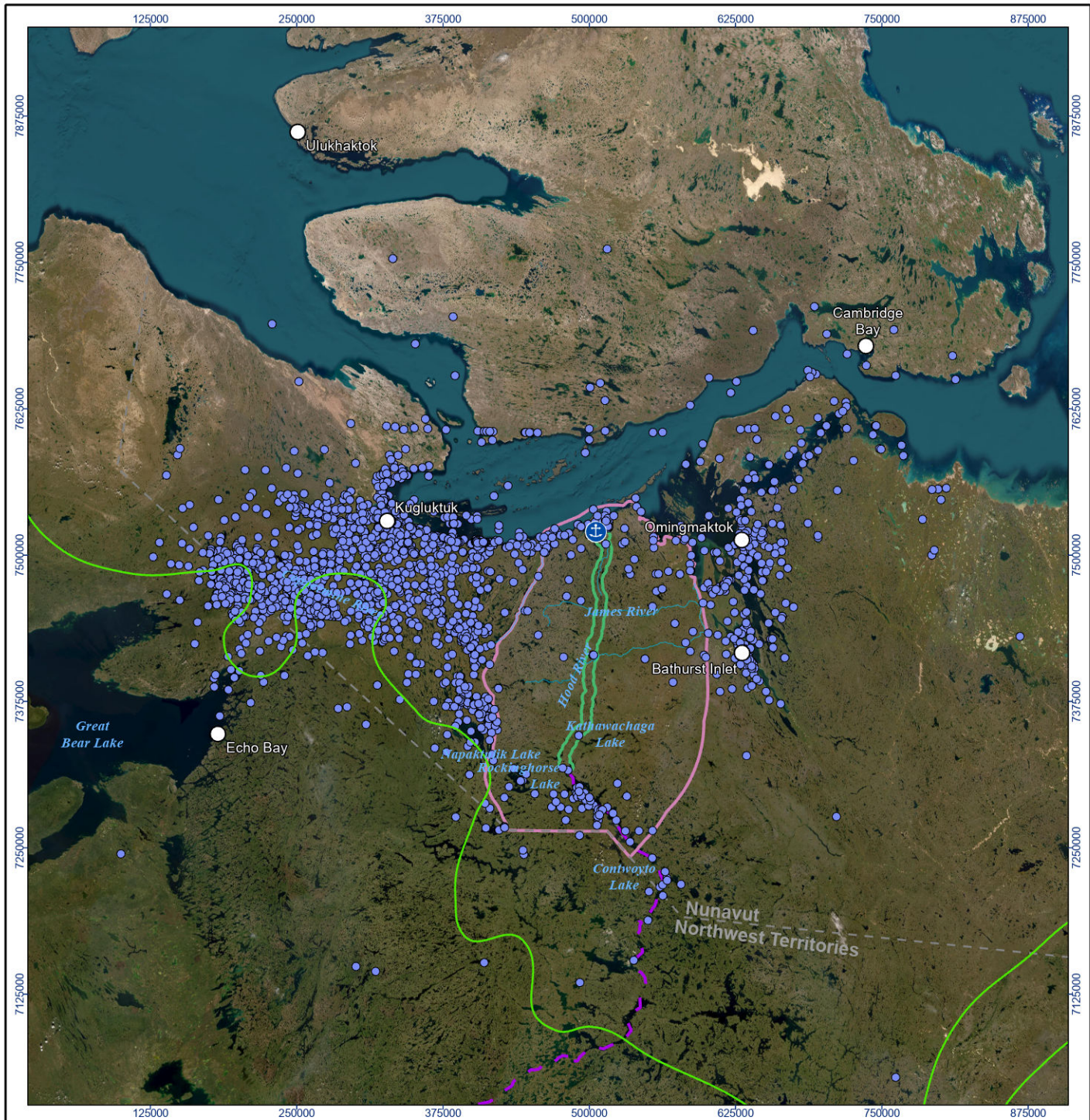
Anthropogenic factors on the landscape can influence wolverine mortality directly (e.g., vehicle collisions, lethal control of problem animals) or indirectly (e.g., facilitated access to occupied habitat (Clark and Fritzell 1992; Erb and Coy 2016; Fogarty et al. 2022). Understanding this distinction is important because anthropogenic mortality can affect species differently based on their life history. Anthropogenic mortality is more likely to be compensatory in shorter-lived species, replacing alternative sources of mortality and not causing a large increase in the overall mortality rate (Clark and Fritzell 1992). However, in longer-lived species, such as wolverine, human-caused mortality is more likely to be additive, combining with natural sources of mortality and leading to a considerable increase in total mortality (Clark and Fritzell 1992).

Wolverine, a long-lived furbearer with low reproductive rates, is sensitive to increased mortality due to the additive nature of anthropogenic effects (Clark and Fritzell 1992; COSEWIC 2014). While natural mortality ranges from 4% to 20%, anthropogenic mortality, primarily from regulated harvest, is typically sustainable between 4% to 8% (Krebs et al. 2004; Mowat et al. 2020). NU harvest rates are estimated to be sustainable, although explicit harvest rates are not reported (GN 2023). Because wolverine harvest for NU residents is not limited, mechanisms to control this source of mortality are not currently enacted in the region (ECCC 2024). Other anthropogenic mortality sources, like vehicle collisions, likely contribute minimally to the overall mortality rate (Krebs et al. 2004). This trend is consistent across the region; for example, the Ekati Diamond Mine in NT contains over 60 km of haul roads and approximately 220 km of total roads, and has recorded only one wolverine mortality from a vehicle collision between 1997 and 2024 (ERM Consultants Canada Ltd. 2025).

Regional Inuit Knowledge states that wolverine are a target for hunters and trappers in the Grays Bay region (Banci and Spicker 2024). Wolverine pelts are highly valued, as the fur is resistant to freezing, making it useful as trim for winter parkas (Banci and Spicker 2024). The Project could increase access to areas not previously exposed to intensive harvesting pressure (see Figure 18.15), likely leading to higher overall wolverine mortality rates in the region.

Assessing potential interactions between project-related components and wolverine mortality is important for determining the magnitude of the Project's effect on the overall wolverine mortality rate. Both the road and port components are anticipated to affect wolverine mortality. The road is anticipated to be a vector for both direct mortality from vehicle collisions and induced mortality from increased access to hunting and trapping. The port facilities, as well as worker camps and waste facilities, may be associated with increased mortality risk from euthanasia of problem animals because of food waste and other attractants. Mines in the region have generally caused greater wolverine mortality from non-vehicle-collision-related causes than from vehicle collisions (e.g., the Ekati Diamond Mine [ERM Consultants Canada Ltd. 2025]).

Facilitation of wolverine harvest, enabled by increased access from the Project, will likely increase anthropogenic mortality and, in turn, overall mortality rates in the RAA (Boer 1990; Jalkotzy et al. 1997; Krebs et al. 2004; Beazley et al. 2004; Mowat et al. 2020). The proposed road is 230 km of new all-season access into an area with no current road access. Minimal recorded wolverine harvest has occurred within the RAA relative to other areas in the region in recent years (see Figure 18.15), likely due to access challenges. Increased access may lead to changes in the distribution and seasonality of the harvest, and, in the absence of enforcement, to illegal harvest (Thomas et al. 1976; Jalkotzy et al. 1997). However, it should be noted that mining-related road construction at the Meadowbank Mine near the Hamlet of Baker Lake, in the Kivalliq region of NU has not increased the number of wolverine harvested in the area, based on results of a hunter harvest study carried out by the proponent (Agnico Eagle Mines Ltd. 2020).



Notes
 1. Coordinate System: WGS 1984 UTM Zone 12N
 2. Data Sources: Government of Canada, Stantec, Natural Resources Canada, Government of Canada (<https://www.nrcan.gc.ca/earth-sciences/geography/download-geographical-names-data/9245>)
 Publication Date: Unknown
 Downloaded: September 7, 2021
 Last Checked: September 7, 2021

- Wolverine Harvest Points (1989 - 2024)
- ⚓ Grays Bay Port
- Tibbitt to Contwoyo Winter Road
- - Territorial Boundary
- Treeline
- Watercourse
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)

0 60 120 Kilometres
 (At original document size of 8.5x11) 1:5,000,000



Project Location
 West Kitikmeot Region
 Nunavut

Prepared by OliviaLeblanc on 2026-02-05

Client/Project

West Kitikmeot Resources Corp (WKR)
 Grays Bay Road and Port

24Y0376

Figure No.

18.15

Title

**Location of Reported Wolverine Harvest
 Near the Regional Assessment Area in
 the West Kitikmeot Region**

18.16.3.3 *Mitigation, Management, and Enhancement Measures*

The Project has integrated multiple mitigation and management measures into its design and operational procedures to prevent, manage, and reduce the magnitude, duration, and extent of potential effects on wolverine mortality. Measures for reducing the mortality risk of wolverine focus on minimizing the potential for vehicle collisions, controlling potential wolverine attractants associated with project activities, monitoring wolverine activity in proximity to project activities, and harvest management. Below are proposed measures to mitigate the effects of the change in mortality.

Mitigation Measures to Reduce Vehicle Collisions

- Wildlife will have the right-of-way when the
 - occur on or immediately adjacent to the roadway.
 - All vehicles and equipment must slow down to 30 km/h when caribou or other wildlife occur within line of sight of the driver and must stop for 20 minutes when wildlife are within 100 m of the road and show intent to cross; vehicles may proceed after 20 minutes or wildlife no longer show intent to cross.
 - When animals are on the road, drivers must stop and wait for them to leave the area. If caribou and/or other wildlife do not leave the road after 20 minutes since stopping, vehicles are to move forward no faster than a walking pace until the individuals leave the road and may resume the posted speed limit once the vehicle has driven past the animals.
- Any dead wildlife on or immediately adjacent to the roadway will be moved at least 100 m away from the road to reduce the potential for wildlife-vehicle collisions with scavengers.
- Drivers must call out on the radio for wildlife observed on or immediately adjacent to the road (i.e., the nearest kilometre marker).
- Wildlife 'hotspots' will be discussed daily during tailgate meetings with drivers on the road.
- Site-wide notifications of wildlife will occur during construction and operations and maintenance activities.

Mitigation Measures to Control Wolverine Attractants

- Raised, heated buildings will be skirted to prevent wildlife access under the buildings for use as shelters, dens or building entry points; skirting should use wire mesh, sheet metal sheathing, or other chew-resistant material.
- A policy of no littering throughout the Project's life will be implemented to limit wildlife attraction.
- Personnel will dispose of garbage and food waste in appropriate dumpsters and trash bins.
- Personnel will not feed, harass, or hunt wildlife while working on the Project.
- Food wastes will be stored in wildlife proof bins and will be incinerated daily to avoid attracting wildlife.

18.16.3.4 *Project Residual Effect*

The direct effects of the Project on changes in wolverine mortality risk (i.e., vehicle collisions and euthanasia of problem animals) during all project phases are expected to be mitigated through effective management measures, such that they are not anticipated to result in a residual effect on wolverine mortality risk. However, the potential for induced effects resulting from increased harvest rates, facilitated by the Project's access, is beyond WKR's authority and obligation to mitigate, as sustainable harvest management is ultimately a territorial responsibility. While use of the road and port will be managed, local residents will be allowed access to the road during the Operations and Maintenance phase. As a result, the Project may cause a measurable increase in wolverine mortality from harvest. However, even with the road present, the RAA remains highly remote, and legislation is in place to limit non-resident harvest. Accordingly, the facilitated access provided by the road is expected to be limited. Furthermore, mining-related road construction in more populated parts of the territory has not affected wolverine harvest rates (Agnico Eagle Mines Ltd. 2020). Thus, there is potential for measurable changes in mortality from project effects, but the effect is predicted to be of low magnitude.

The geographic extent of the induced increase in harvest rates will likely extend beyond the 4 km buffer of the LAA into the RAA, as hunters/trappers with snowmachines can travel farther than this distance. The timing of induced effects on mortality is expected to be highly sensitive. Though there is no set hunting season for wolverine for NU residents, harvest is more likely to occur during winter when snowmachines allow for travel at greater velocity and distance across the rugged landscape (Scrafford et al. 2025). In NU, most reported wolverine harvest occurs between November and April (Awan 2025).

Induced effects of increased harvest are expected to begin at the end of the Construction phase and persist throughout the Project's lifespan. Therefore, the Project's effects on mortality are expected to be long-term. Any increase in mortality risk from facilitated hunting access will be mostly continuous when assessed over multiple years, but will show seasonal intra-annual fluctuations, as most harvest occurs from November to April (Awan 2025). Project infrastructure will be permanent, so the effect is likely to be irreversible.

18.16.4 *Summary of Project Residual Effects*

During all project phases, effects of change in habitat, movement, and mortality risk are all expected to have moderate sensitivity to timing, as wolverine movement will be more sensitive to disturbance during the natal denning period. The overall duration of the residual effects will be long-term because the Project is permanent. However, effects on movement are expected to decrease in magnitude once the Construction phase concludes, as sensory disturbance, project personnel, traffic, and the presence of temporary infrastructure (e.g., temporary work camps) will decline. The frequency of project residual effects will be continuous during the Construction phase. During the Operations and Maintenance phase, effects will be continuous around the port, but changes in movement from the Project will occur as irregular events, fluctuating with the presence of operational traffic and maintenance activities. Mortality on the road will remain continuous during the Operations and Maintenance phase, as increased access for harvesting will persist as long as the port and road remain in place. All project effects are likely to be irreversible, as the Project will be permanent.

Table 18.30 summarizes project residual effects on wolverine. Following the implementation of mitigation and management measures, the Project is projected to result in adverse residual effects on wolverine habitat, movement, and mortality risk in both the Construction and Operations and Maintenance phases. Changes in habitat, movement, and mortality risk are predicted to be negligible or low in magnitude, causing a minor change (habitat) or a detectable change from baseline conditions but within the range of natural variation and/or accepted standards (movement and mortality), once mitigation measures have been implemented. The Project's effects on habitat change and movement during both project phases will be restricted to the LAA, mainly due to the range within which sensory disturbance from Project activities (e.g., noise and vibration) can extend. However, the Project's effect on mortality risk could extend into the RAA, as the road could facilitate harvest beyond 4 km from the PDA.

Table 18.30 Project Residual Effects on Wolverine

Residual Effect	Residual Effects Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	C, O	A	N	LAA	HS	LT	C	I
Change in Movement	C, O	A	L	LAA	HS	LT	C, IR	I
Change in Mortality Risk	C, O	A	L	RAA	HS	LT	C	I
Key: See Table 18.4 for detailed definitions Project Phase: C: Construction O: Operations and Maintenance Direction: P: Positive A: Adverse N: Neutral Magnitude: N: Negligible L: Low M: Moderate H: High Geographic Extent: PDA: Project Development Area LAA: Local Assessment Area RAA: Regional Assessment Area Timing: NS: No sensitivity MS: Moderate sensitivity HS: High sensitivity Duration: ST: Short-term MT: Medium-term LT: Long-term Frequency: S: Single event IR: Irregular event R: Regular event C: Continuous Reversibility: R: Reversible I: Irreversible N/A: Not applicable								

During all project phases, effects of change in habitat, movement, and mortality risk are all expected to have high sensitivity to timing, as wolverine will be more sensitive to disturbance during the natal denning period. The residual effects will be long-term because the Project is permanent. However, effects on movement are expected to decrease in magnitude once the Construction phase concludes, as sensory disturbance, project personnel, traffic, and the presence of temporary infrastructure (e.g., temporary work camps) will decline. The frequency of project residual effects will be continuous during the Construction phase. During the Operations and Maintenance phase, effects will be continuous around the port, but changes in movement from the Project will occur as irregular events, fluctuating with the presence of operational traffic and maintenance activities. Mortality on the road will remain continuous during the Operations and Maintenance phase, as increased access for harvesting will persist as long as the port and road remain in place. All project effects are likely to be irreversible, as the Project will be permanent.

18.16.5 Effects of Climate Change on Wolverine

The future influence of climate change on Arctic wolverine populations remains uncertain, and the species may experience both positive and negative effects (Glass et al. 2022). Arctic wolverine populations are thought to be increasing in size, consistent with some Inuit Knowledge accounts of population size changes in Bathurst Inlet/Grays Bay (Tomasik and Cook 2005; Glass et al. 2022; Banci and Spicker 2024). Projected climatic changes for the RAA are consistent with much of the Canadian Arctic, with temperatures projected to increase by 4°C to 8°C (depending on emission scenario) by 2080 (see Volume 5, Appendix 12A). Accordingly, the region is expected to experience greater growing degree days during this time frame, while precipitation is also projected to increase. Altogether, these changes are likely to increase vegetation productivity in the region. This is consistent with current trends such as a northward shift in the treeline and increased range and abundance of many shrub species (Holtmeier and Broll 2005; Myers-Smith et al. 2015). This increase in net primary productivity could be favourable for some wolverine prey species that are experiencing northward range expansions (e.g., snowshoe hare, moose), thereby increasing wolverine prey availability in the RAA (Tape et al. 2016a, 2016b, 2018).

While climate change could yield positive outcomes for wolverine in the Arctic, it is also likely to have negative effects. Wolverine in the Arctic often rely on food caching to store prey caught during summer for future consumption during the food-scarce winter (Inman et al. 2012; van der Veen et al. 2020). Climate warming is likely to reduce the effectiveness of caching by increasing spoilage rates, which could lead to starvation or disease in animals (Glass et al. 2022). Climate change is predicted to negatively affect caribou, which are the main dietary item for wolverine in the RAA as carrion (Mallory and Boyce 2018). It remains unclear whether a reduction in wolverine food availability from caribou and/or reduced caching effectiveness would be offset by increased prey availability from species undergoing northward range expansions.

Facilitation of movement along the project road for wildlife and humans, combined with the range expansion of southern species, could create new disease transmission vectors in the RAA. Novel diseases or parasites may become more viable with warming temperatures, which could increase the susceptibility of wolverine to such pathogens. Warmer, longer summers could increase parasite development rates and alter disease transmission pathways, potentially negatively affecting wolverine populations in the Arctic (Bradley et al. 2005).

The projected effects of climate change on wolverine in the RAA do not affect the project's effects assessment conclusion. Climatic changes within the region are unlikely to result in conditions outside of the range of physiological tolerance for wolverine. While food availability may be affected, it remains unclear whether changes would result in a net positive or net negative outcome, and a reduction in some prey would likely be offset by increased availability of others. Given the high degree of uncertainty in climate projections and in the ecological effects of climate change on wolverine in the RAA, monitoring and adaptive management by regulators in response to climate-driven changes in wolverine habitat, movement, or mortality will be important.

18.17 Assessment of Cumulative Effects on Wolverine

18.17.1 Project Residual Effects Likely to Interact Cumulatively

Table 1 in Appendix 9A (Volume 4) presents the project inclusion list, which identifies other projects and physical activities that may cumulatively act with the Project. Where residual effects from the Project act cumulatively with residual effects from other projects and physical activities (see Table 18.31), a CEA is carried out.

During engagement sessions, comments were received on concerns about how the combination of exploration activities and other human developments in the area may cumulatively influence wildlife (see Table 18.10). These concerns were taken into consideration in the CEA.

Table 18.31 Interactions with the Potential to Contribute to Cumulative Effects on Wolverine

Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
Past			
Bathurst Inlet	–	–	–
Snap Lake Mine	–	–	–
Omingmaktok	–	–	–
Present			
Arcadia Bay Project	–	✓	–
B2Gold George Property	–	–	–
B2Gold Marine Laydown Area	–	–	–
Bulk Carriers	–	–	–
Cambridge Bay	–	–	–
Chuk and Fire Shear Blocks	–	✓	–
Commercial Cargo	–	–	–
Commercial and Domestic Harvesting	–	–	✓
Coppermine Project	–	–	–
Coppermine River Project	–	–	–

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
Diavik Diamond Mine	–	–	–
Ekati Diamond Mine	–	–	–
Epworth Project	–	–	–
Fishing Vessels	–	–	–
Gahcho Kué Diamond Mine	–	–	–
Goose Mine	–	–	–
Hackett River Project	✓	✓	✓
High Lake (Izok Corridor Project)	✓	✓	✓
High Lake East	–	✓	–
Hood River Gold Project	–	✓	–
Hope Bay Project	–	–	–
Hydroelectric	–	–	–
Icebreakers	–	–	–
Itchen Lake Property	–	✓	–
Izok Lake (Izok Corridor Project)	✓	✓	✓
Jericho Mine	✓	✓	✓
Kennady North - Exploration	–	–	–
Kugluktuk	–	–	–
Lupin Mine	✓	✓	✓
Muskox Nickel Property	–	–	–
Nunavut Community Infrastructure	–	–	–
Northwest Territories Community Infrastructure	–	–	–
Overflights	–	✓	–
Passenger Ships and Pleasure Craft	–	–	–
Pistol Lake Project	–	✓	–
Rae Copper Exploration Project	–	–	–
Rockinghorse (Koamaogaktok) Project	–	✓	–
Roma Project	–	✓	–
Scientific Research	–	✓	–
South Kitikmeot Gold Project	–	–	–
Tanker Ships	–	–	–
Tibbitt to Contwoyto Winter Road	✓	✓	✓
Tourism	–	✓	–
Tree River Lodge	✓	✓	✓

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Physical Activities	Effects		
	Change in Habitat	Change in Movement	Change in Mortality
TTMG Project	–	–	–
Tugs/Barges	–	–	–
Ulu Gold Project	✓	✓	✓
Wolf/Mistake Lake Property	–	✓	–
Yellowknife City Gold Project	–	–	–
Past and Reasonably Foreseeable			
Indin Lake Gold Project	–	–	–
Mon Mine	–	–	–
Yellowknife Gold Project	–	–	–
Project-Related Physical Activities			
Reasonably Foreseeable			
Arctic Economic and Security Corridor	–	–	–
Courageous Lake Mine	–	–	–
NICO	–	–	–
Reasonably Foreseeable Induced			
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port	–	✓	–
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho	–	✓	–
Grays Bay Road and Port: Airstrip Expansion	–	✓	–
Grays Bay Road and Port: Road Traffic	✓	✓	✓
Grays Bay Road and Port: Port Traffic	–	–	–
Grays Bay Road and Port: Air Traffic	✓	✓	–
Grays Bay Road and Port Phase 2 –Jericho Mine to NT Border	✓	✓	✓
Hackett River Project	–	–	–
Hackett and Back River Access Road	✓	✓	✓
High Lake Mine (Izok Corridor Project)	✓	✓	✓
Izok Lake Mine (Izok Corridor Project)	–	–	–
Izok Lake Access Road	✓	✓	✓

Notes:

- ✓ = Other projects and physical activities whose residual effects are likely to interact cumulatively with the Project residual effects.
- = Interactions between the residual effects of other projects and the residual effects of the Project are not expected.

Most physical activities listed in Table 18.31 were determined not to contribute to cumulative effects on wolverine habitat, movement, or mortality, and were characterized as such due to their location outside of the RAA (see Figure 18.14) or because they relate to marine activities during open water conditions. Of the RFI physical activities within the RAA, those related to expansion of the Project within the existing PDA (e.g., fuel storage, airstrip) will not result in effects on wolverine habitat beyond those already considered in the assessment of project effects. Increased air traffic at the port is unlikely to cause a cumulative effect on change in wolverine mortality, as collisions between aircraft and wolverine are improbable regardless of air traffic volume.

The effects of past and present physical activities within the RAA have been captured in the baseline conditions for wolverine and have already been considered in the assessment of project effects; therefore, they are not included in the CEA. No reasonably foreseeable activities occur within the RAA. The assessment of cumulative effects likely to result from the Project, in combination with RFI physical activities, is discussed in subsequent sections.

18.17.2 Change in Habitat

18.17.2.1 Cumulative Effect Pathways

RFI physical activities with the potential to act cumulatively with the Project to affect wolverine habitat include the extension of the Grays Bay Road (Phase 2 – Jericho Mine to the NT border), 117 km of the Hackett and Back River access road, 89 km of the Izok Lake access road, and the High Lake Mine. The three RFI roads are in the southern portion of the RAA, while the High Lake Mine is in the central northern portion of the RAA. The distribution of these RFI activities in relation to the Project is displayed in Figure 18.14. Changes to wolverine habitat as a result of these RFI activities are expected to follow similar pathways to those described for the Project's effects (see Section 18.16.1.2).

Direct habitat loss will occur where the footprints of these RFI activities overlap with suitable wolverine habitat from earthworks and vegetation clearing, while indirect habitat loss or alteration within a ZOI surrounding the footprints can be expected due to sensory disturbance (e.g., blasting and vehicle traffic) or dust deposition. The ZOI used for the assessment of project effects on wolverine habitat is considered adequate to capture indirect effects associated with the RFI road activities; however, to account for increased levels of sensory disturbance and dust deposition associated with mining activities, a ZOI of 4 km around the footprint was used to assess indirect effects of the High Lake Mine.

18.17.2.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

Given that all current and proposed projects in NU are obligated by laws and regulations to implement appropriate environmental safeguards and project-specific mitigation plans (e.g., sediment and erosion control), no additional mitigation measures beyond those committed to in the Project's effects assessment are proposed. Wildlife monitoring and adaptive management measures will be critical to continuously evaluate the Project's contribution to cumulative effects on wolverine habitat in the RAA.

18.17.2.3 Cumulative Effects

The CEA evaluated both direct habitat loss and indirect loss or alteration of suitable wolverine habitat, focusing on potential additive effects of the Project's residual effects and those of RFI activities within the RAA. A quantitative assessment of the cumulative effects of change in wolverine habitat was primarily conducted in accordance with the methods described in Section 18.16.1.1, except for the use of a larger ZOI around the RFI mine to assess indirect effects.

The cumulative effects of the Project and RFI activities on the amount of suitable wolverine habitat within the RAA are presented in Table 18.32. Cumulatively, these future physical activities are predicted to result in the direct loss of 22.1 km² and indirect loss of 58.3 km² of suitable wolverine habitat, for a total loss of 80.4 km². The Project is the major contributor to these losses, accounting for almost two-thirds of the total. The total loss of suitable habitat amounts to 0.5% of the potentially suitable habitat in the RAA at baseline, representing a negligible change (<1%). An additional 349.8 km², including 148.0 km² due to the Project, is predicted to experience indirect alteration, but remain suitable wolverine habitat.

Table 18.32 Cumulative Effects on Wolverine Habitat

Physical Activity	Direct Habitat Loss (km ²)	Indirect Habitat Loss (km ²)	Total Habitat Loss (km ²)	% Suitable Habitat in RAA
Grays Bay Road and Port Phase 1	18.5	33.1	51.6	0.3
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Grays Bay Port*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Bulk Fuel Storage Expansion, Jericho*	0.0	0.0	0.0	0.0
Grays Bay Road and Port: Airstrip Expansion*	0.0	0.0	0.0	0.0
Grays Bay Road and Port Phase 2 – Jericho Mine to NT Border	0.8	6.5	7.2	0.1
Hackett and Back River Access Road	1.4	14.4	15.7	0.1
High Lake Mine (Izok Corridor Project)	0.2	1.6	1.9	0.0
Izok Lake Access Road	1.3	2.7	4.0	0.0
Total	22.1	58.3	80.4	0.5

Notes:

* Activity occurs within the Project Phase 1 PDA.

A ZOI of 1 km was applied around RFI roads and 4 km around RFI mines.

The Project's residual effect of habitat loss, which is expected to be limited to the LAA, is anticipated to interact with the residual effects of RFI activities that extend into the RAA. Therefore, the cumulative effect of habitat loss is predicted to have a regional geographic extent. The timing of habitat loss due to future activities is uncertain, but some activities are anticipated to occur continuously and may overlap with sensitive periods for wolverine. Consequently, the timing of the cumulative effect is predicted to have high sensitivity. Construction of the Project and other RFI projects and activities that require ground disturbance are anticipated to occur as one-time events at specific locations. However, ongoing sensory

disturbances (e.g., vehicle traffic, human presence) associated with current and likely future projects and activities (e.g., roads) may result in continuous habitat alteration. Therefore, the cumulative effect is predicted to be continuous. Most portions of the Project and other activities in the RAA will be permanent, given that not all disturbed areas will be reclaimed or revegetated. As a result, most of the cumulative effect of habitat change is considered long-term and irreversible.

18.17.3 Change in Movement

18.17.3.1 Cumulative Effect Pathways

The potential effects pathways for change in wolverine movement identified in Section 18.12.2.2 for the Project are expected to be similar for the RFI projects or activities and are primarily associated with sensory disturbances. Cumulative effects on changes in wolverine movement patterns are likely to occur as a result of sensory disturbances associated with the construction and operation of the three RFI roads, the construction and operation of the High Lake Mine, and increased port, road, and aircraft traffic and human activity at the Project. As operations and maintenance activities at the Project were predicted to have a low effect on wolverine movement, increased activity on the road and at the port and airstrip due to RFI activities is expected to be additive to the Project's effects. New access roads create additional linear features that may alter crossing behaviour, whereas airstrip and port activity add episodic overflight/berth noise that can widen short-duration sensory zones. Cumulatively, impacts on permeability may increase where several corridors converge, sightlines are constrained, or activity is frequent. As there is limited spatial overlap between the Project, the new RFI road network, and the mine, the effects of these RFI activities on wolverine movements within the RAA are also expected to be largely additive to those of the Project.

18.17.3.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

Given that all current and proposed projects in NU are legally and regulatorily obligated to implement appropriate environmental safeguards and project-specific mitigation plans (e.g., WMMP), no additional mitigation measures beyond those committed to in the Project's effects assessment are proposed. Wildlife monitoring and adaptive management measures will be necessary to continuously evaluate the Project's contribution to cumulative effects on wolverine movement.

18.17.3.3 Cumulative Effects

Construction and operation of the three RFI roads, third-party use of the project road, and increased activity at the port and airstrip are expected to be the primary contributors to future changes in wolverine movement in the RAA. Studies of the effects of road networks on wolverine habitats show displacement distances vary widely with traffic and context, but population-level movement constraints are unlikely where permeability and crossings at watercourses are maintained and traffic is controlled (Scrafford et al. 2018). Large home ranges further buffer regional-scale movement effects, although females, potentially with dependent young, can be more risk-averse near busy segments (Krebs et al. 2007; Scrafford et al. 2017, 2025). As a result, the magnitude of cumulative change in movement patterns is expected to be low.

While the Project's residual effect on movement was predicted to be limited to the LAA, the residual effects of RFI activities will extend into the RAA. Therefore, the cumulative effect of the change in movement is predicted to have a regional geographic extent. The timing of residual effects associated with RFI activities is unknown, but some of these effects may overlap with sensitive periods for wolverine (e.g., maternal and natal denning); therefore, the timing of the residual cumulative effects is expected to be highly sensitive. The cumulative effects on wolverine movement will be long-term and irreversible, as the RFI activities involve the construction and use of permanent road infrastructure. The cumulative effect on movement is expected to be continuous due to persistent sensory disturbances, primarily associated with third-party use of the road networks.

18.17.4 Change in Mortality Risk

18.17.4.1 Cumulative Effect Pathways

Wolverine are culturally and ecologically important in NU, and changes in mortality risk require management attention. Roads associated with mining projects, along with third-party use of Project infrastructure, represent the primary pathways through which cumulative mortality effects are expected to occur.

Additional roads and increased traffic from RFI activities could increase the risk of vehicle collisions with wolverine and provide greater opportunities for hunter access. These influences would add to existing pressures already reflected in baseline conditions. While the Project's residual effects on mortality were expected to occur primarily within the LAA, they would contribute cumulatively to broader mortality risk across the RAA.

18.17.4.2 Mitigation, Management, and Enhancement Measures for Cumulative Effects

The mitigation, management and enhancement measures identified in Section 18.12.3.3 are also expected to apply to RFI projects and activities. Measures such as awareness training and speed limits are anticipated to help keep wolverine-vehicle collisions low across all RFI project-related road use. However, an increase in road length or traffic within the RAA could elevate mortality risk by increasing collision potential and increasing human access for hunting. The cumulative presence of additional human activity and infrastructure could therefore increase overall mortality pressure on the population, particularly where new access routes improve hunting opportunities. There are no project-specific mitigation measures to reduce wolverine mortality risk from increased hunting, but harvest in the RAA will occur within the current regulatory and management framework for wolverine in NU. Wildlife monitoring and adaptive management measures at the Project will be necessary to evaluate the Project's contribution to cumulative effects on wolverine mortality within the RAA.

18.17.4.3 Cumulative Effects

This assessment considered Project-related mortality of wolverine in the context of projected future regional stressors, focusing on the types and general intensities of other activities, their spatial and temporal overlap with wolverine distribution, and the overarching regulatory frameworks. The Project's residual effect on change in mortality is predicted to interact with the residual effects of RFI activities that extend across the RAA. Therefore, the cumulative effect of the change in mortality is predicted to have a regional geographic extent. While cumulative mortality risk increases qualitatively with added roads and traffic, its magnitude is directly related to the effectiveness of mitigation, management and enhancement measures. Additional road use by RFI projects or activities will increase encounter frequency and collision probability, while localized growth at mines, ports, airstrips can raise the risk of lethal control measures if attractants are not rigorously managed. Improved access may also lead to additional induced harvest pressures, complicating attribution and monitoring. However, even when considering cumulative effects, it is unlikely that harvest will increase to a level which puts the viability of wolverine populations at risk, as the RAA will remain highly remote and challenging to access. As a result, the magnitude of the cumulative effects of mortality change is predicted to be low.

The timing of residual effects from RFI projects and activities is variable, but some are expected to overlap continuously with seasonally sensitive periods for wolverine (e.g., maternal and natal denning). Therefore, the effect is expected to be high sensitivity in timing. Harvesting activity is likely to occur as irregular events in the RAA. Increased access for harvest will result from the development of permanent road infrastructure; therefore, cumulative effects on wolverine movement are predicted to be long-term and irreversible.

18.17.5 Summary of Cumulative Effects

The Project's residual effects, combined with RFI physical activities, are likely to have cumulative effects on wolverine, specifically regarding habitat (direct and indirect loss), movement, and mortality. These cumulative effects are generally assessed as low in magnitude, regional in extent, irreversible, and long-term in duration, as well as highly sensitive in timing due to potential overlap with critical wolverine life stages. Table 18.33 summarizes the cumulative effects on wolverine.

The Project contributes 0.3% of wolverine habitat loss in the RAA, with a cumulative alteration from all the Project and RFI projects or activities projected to be 0.5% of the amount of suitable wolverine habitat available in the RAA at baseline. This effect is considered irreversible due to the permanent nature of the Project and the RFI projects in the RAA.

Table 18.33 Residual Cumulative Effects on Wolverine

Residual Cumulative Effect	Residual Cumulative Effects Characterization						
	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
Change in Habitat	A	N	RAA	HS	LT	C	I
Contribution from the Project to Change in Habitat	The Project will be the major contributor to the loss of suitable wolverine habitat in the RAA, accounting for 51.6 km ² of the total estimated cumulative loss of 80.4 km ² (or 64% of the cumulative loss). The cumulative loss from all future activities, including the Project, is estimated at less than 1% of suitable wolverine habitat in the RAA.						
Change in Movement	A	L	RAA	HS	LT	C	I
Contribution from the Project to Change in Movement	Once operational, the Project's contribution to changes in movement was determined to be negligible. RFI activities are expected to be the major contributors to sensory disturbances that may have localized, temporary effects on wolverine movement, primarily due to considerable increases in port, road, and aircraft activity associated with third-party users of the Project, and the development of three new all-season roads and a mine within the RAA.						
Change in Mortality Risk	A	L	RAA	HS	LT	R, IR	I
Contribution from the Project to Change in Mortality	Both the Project and RFI activities are expected to result in a low-magnitude increase in wolverine mortality risk. RFI activities are expected to be the greater contributor to increased mortality risk due to increased traffic volumes and associated collision risk, increased human activity and potential for human-wolverine conflict, and facilitated hunter access to a wider portion of the RAA than generated by the Project alone.						
Key: See Table 18.5 for detailed definitions							
Direction: <i>P</i> : Positive <i>A</i> : Adverse <i>N</i> : Neutral		Timing: <i>NS</i> : No sensitivity <i>MS</i> : Moderate sensitivity <i>HS</i> : High sensitivity		Frequency: <i>S</i> : Single event <i>IR</i> : Irregular event <i>R</i> : Regular event <i>C</i> : Continuous			
Magnitude: <i>NMC</i> : No Measurable Change <i>L</i> : Low <i>M</i> : Moderate <i>H</i> : High		Duration: <i>ST</i> : Short-term <i>MT</i> : Medium-term <i>LT</i> : Long-term		Reversibility: <i>R</i> : Reversible <i>I</i> : Irreversible <i>N/A</i> : Not applicable			
Geographic Extent: <i>PDA</i> : Project Development Area <i>LAA</i> : Local Assessment Area <i>RAA</i> : Regional Assessment Area							

Cumulative effects on wolverine movement, primarily due to sensory disturbance from future activities, are also expected to be of a low magnitude. The effect is considered irreversible, as future activities will continue, except for the High Lake mine, where the effects will cease following mine closure and reclamation. Other future activities are expected to be the greatest contributors to changes in wolverine movement in the RAA due to increased levels of sensory disturbance associated with RFI activities compared to operations and maintenance activities at the Project. These activities are expected to be a relatively consistent source of sensory disturbance for wolverine.

Project effects on changes in wolverine mortality are predicted to be of low magnitude, with the primary pathway being a redistribution of harvest opportunities from the wider region to the RAA, as residents gain seasonal access to a network of all-season roads. Although access may change where harvesting occurs, NU's existing harvest-management framework, including territorial wildlife legislation, the NWMB Regional Wildlife Organizations, and local HTOs, provides tools to monitor harvest outcomes and respond adaptively if sustainability concerns arise. Because the Project and RFI roads will be permanent, this redistribution of access is considered irreversible.

18.18 Transboundary Effects on Wolverine

An assessment of the potential for transboundary effects on wolverine is provided in Volume 10, Section 33 Transboundary Effects Assessment.

18.19 Significance of Effects on Wolverine

18.19.1 Significance of Project Residual Effects

After applying mitigation, management and enhancement measures, the residual effects of the Project on changes in wolverine habitat, movement, and mortality are predicted to be not significant. The Project is not expected to cause population-level changes that would affect the long-term viability, persistence, or sustainability of wolverine populations that interact with the RAA, because the residual effects represent small changes to baseline conditions and are highly localized. This conclusion reflects the limited magnitude and spatial extent of habitat loss (<1% of available suitable habitat within the RAA), the localized and low-magnitude nature of movement effects, and the low predicted increase in mortality risk following implementation of the WMMP and other management measures. Implementation of the WMMP, adaptive management, and ongoing engagement with communities and co-management partners will facilitate early detection of project-related mortalities or behavioural changes, which can be addressed through corrective measures.

18.19.2 Significance of Cumulative Effects

The cumulative effects of the Project and RFI activities are predicted to be not significant since they are not expected to alter the population viability or persistence of wolverine within the RAA. Future RFI physical activities are anticipated to result in relatively small incremental increases in magnitude across all three assessed effects, assuming implementation of comparable mitigation, management and enhancement measures to those of the Project.

18.19.3 Summary of Mitigation, Management, and Enhancement Measures

Mitigation, management and enhancement measures are designed to mitigate the Project's influence on wolverine, including risks to habitat, movement, and mortality. Changes in wolverine habitat can result from vegetation clearing, sensory disturbance, and infrastructure construction, potentially leading to measurable habitat loss or degradation. Mitigation and management measures reduce this risk by minimizing clearing footprints, planning infrastructure to avoid sensitive landforms, and applying dust suppression and noise controls. As a result, total direct and indirect habitat change remains <1% of available suitable habitat in the RAA, a negligible magnitude that does not limit habitat availability or function. Through the implementation of targeted measures, residual habitat effects are not significant.

Construction activities can temporarily disrupt local movements, but by applying applicable measures, such as timing restrictions near denning habitat, speed limits, wildlife monitors, and permeable designs at key habitat features, changes to wolverine movement will be minimized. These measures limit displacement to short-duration, localized avoidance, with no indication of population-level movement restriction. Since movement effects only become significant if wolverines lose access to key resources across broader areas, which mitigation and management measures prevent, residual movement effects are not significant.

Changes in wolverine mortality was the project effect with the greatest potential to become significant without mitigation. Mitigation and management measures target vehicle collisions, attractants, human-wolverine conflict, and access-related harvest risk. Speed limits, mandatory wildlife reporting, attractant-proof storage, daily waste incineration, wildlife safety training, and controlled road access all reduce opportunities for wolverines to be killed or habituated. These measures help prevent mortality from reaching levels that could affect adult female survival, the key demographic driver of population stability. Because population-level impacts are expected in the absence of harvest management, the residual mortality risk is deemed not significant.

18.20 Effects Assessment Summary for Other Terrestrial Wildlife

The assessment of other terrestrial wildlife considered three pathways for potential effects: Change in Habitat, Change in Movement, and Change in Mortality Risk. For each indicator species, the predicted residual effects of the Project, after implementing mitigation measures, and the cumulative effects with other existing and future activities, were determined to be not significant. Individual summaries are provided below.

Muskox

The muskox population in the RAA is considered secure and currently has a TAH that is generally not met.

- **Project Residual Effects on Muskox:**
 - **Change in Habitat:** Direct and indirect loss of suitable summer habitat is predicted to be 2.4% and late winter habitat is 2.7% of the total suitable habitat in the RAA, resulting in a low magnitude effect confined to the LAA.

- **Change in Movement:** Project components will not create an impermeable filter to movement. Displacement from sensory disturbance will be mitigated through measures like traffic speed limits and road design, resulting in a low magnitude effect restricted to the LAA.
- **Change in Mortality Risk:** Direct mortality from vehicle collisions is predicted to be rare. The greatest effect will be the indirect increase in harvest due to hunter access, but this will remain within the regulated TAH framework, resulting in a low magnitude effect extending into the RAA.
- **Cumulative Effects on Muskox:** The cumulative loss of suitable habitat (Project and reasonably foreseeable induced activities) is projected to be 3.3% to 3.8% (low magnitude). Cumulative effects on movement and mortality risk are also assessed as low magnitude, primarily due to increased road traffic and facilitated hunter access, but managed by the regulatory framework.

Moose

Moose populations are naturally sparse in the RAA, and habitat is primarily confined to river valleys and high shrub cover.

- **Project Residual Effects on Moose:**
 - **Change in Habitat:** Total direct and indirect habitat change is predicted to be 0.8% of the potentially suitable habitat in the RAA, a negligible magnitude effect.
 - **Change in Movement:** Movement changes are expected to be low magnitude during construction and negligible during operations and maintenance, as moose are expected to eventually habituate to human activity, keeping effects within the LAA.
 - **Change in Mortality Risk:** Mortality risk from vehicle collisions is low due to sparse moose density. Increased harvest risk due to enhanced access is the main indirect effect, but the effect is deemed low magnitude given existing regulatory management.
- **Cumulative Effects on Moose:** The cumulative effect on habitat change is quantitatively assessed as a low magnitude loss of 1.6% of suitable habitat. Cumulative effects on movement and mortality risk are also predicted to be low magnitude, with effects primarily stemming from increased traffic on the expanded road network.

Grizzly Bear

Grizzly bears are federally listed as a species of special concern and are sensitive to human disturbance.

- **Project Residual Effects on Grizzly Bear:**
 - **Change in Habitat:** Total projected suitable habitat loss (direct and indirect) is 0.6% of the RAA's baseline suitable habitat, resulting in a negligible magnitude effect confined to the LAA.
 - **Change in Movement:** Movement change is low magnitude during construction and negligible during operations and maintenance, as road design will permit permeability and large home ranges buffer population-level movement constraints.

- **Change in Mortality Risk:** Mortality risk from collisions and human-bear conflicts is reduced by mitigation (e.g., attractant control). Induced harvest risk remains, but regulatory oversight limits this effect to a low magnitude.
- **Cumulative Effects on Grizzly Bear:** Cumulative suitable habitat loss is projected to be low magnitude (1.2%). Cumulative effects on movement and mortality risk are also anticipated to be low magnitude due to the effectiveness of required mitigation and the regulatory framework controlling harvest.

Wolverine

Wolverine occupy large home ranges and are sensitive to increased mortality due to low reproductive rates.

- **Project Residual Effects on Wolverine:**
 - **Change in Habitat:** Total direct and indirect habitat loss is 0.3% of suitable habitat in the RAA, a negligible magnitude effect within the LAA.
 - **Change in Movement:** Project activities are not expected to create impermeable filters to movement. Sensory disturbance will be minimized, resulting in a low magnitude effect within the LAA, though the timing of effects is highly sensitive due to overlap with natal denning.
 - **Change in Mortality Risk:** Direct mortality risk from collisions and lethal control is mitigated to be negligible. Induced harvest risk from increased access is the primary remaining effect but is predicted to be low magnitude.
- **Cumulative Effects on Wolverine:** Cumulative suitable habitat loss is projected to be negligible magnitude (0.5%). Cumulative effects on movement and mortality risk are predicted to be low magnitude, assuming regulatory management maintains sustainable harvest levels and mitigation is successful.

18.21 Prediction Confidence and Uncertainty for Other Terrestrial Wildlife

Confidence in the conclusions of the Project's residual effects on other terrestrial wildlife is moderate to high that the Project will result in not significant residual effects on changes to each indicator species' habitat, movement, or mortality risk. This level of confidence is based on several factors:

- **Concordance between Inuit Knowledge and Western Science:** There was generally agreement between Inuit Knowledge and western science on the indicator species' distribution, habitat use, and movement patterns within the RAA.
- **Assumptions:** A key assumption is that standard mitigation, management and enhancement measures, which have been successfully applied on comparable northern mine and road projects, will be similarly effective for the Project. It is also assumed the mitigation measures and management strategies will be consistently implemented throughout construction and operation.

- **Baseline Data:** Baseline data for the indicator species in the RAA is robust relative to most Arctic regions. This includes the DNA-based population estimates and mark–recapture survival rates for grizzly bear and wolverine. The baseline studies provide a reasonable understanding of each indicator species' distribution and habitat use in the vicinity of the Project. Inuit Knowledge aligns with the findings from the baseline studies, providing robust confidence in understanding each species' regional distribution and habitat use. Uncertainty remains regarding harvest-related mortalities because subsistence harvest reporting is voluntary and therefore incomplete.
- **Measurements and Analytical Techniques:** The effects assessment relies on well-established techniques to predict habitat loss/disturbance in the RAA and to understand potential changes in mortality and movement related to infrastructure and activities, based on Inuit Knowledge and relevant academic literature. Habitat suitability mapping inherently entails uncertainty related to spatial information, ecological complexities of habitat use, and the nature of interactions between human disturbance and habitat quality.
- **Success of Mitigation, Management and Enhancement Measures:** There is high confidence in the effectiveness of standard mitigation and management measures based on their effectiveness in past projects (Golder Associates Ltd. 2020; Agnico Eagle Mines Ltd. 2020, Arctic Canadian Diamond Company 2022). However, the specific responses of the indicator species to the measures are uncertain due to the limited human activity in the area; the indicator species may exhibit increased risk avoidance of areas used by humans. Additionally, confidence is slightly lower for mortality outcomes linked to increased hunter access because the Project cannot compel reporting of resident subsistence harvests, and future harvest levels cannot be fully predicted.
- **Future Environmental Conditions (Climate Change):** Uncertainty exists regarding the long-term accuracy of habitat suitability predictions due to potential limitations in spatial information and the influence of future projects, climate change, and natural disturbances (e.g., insect outbreaks, fires), which are beyond the direct control of the Project. Climate projections were qualitatively evaluated under high- and intermediate-emissions scenarios, but uncertainty remains about the predictive capacity of climate change models. However, while climate-driven ecological shifts may alter baseline conditions over decades, they are unlikely to change the conclusions of the current effects assessment.
- **Conservative Measures:** The conclusion of not significant effects incorporates a degree of conservatism. It acknowledges the potential for some level of effect and determines that it remains within acceptable limits based on current knowledge and the implementation of the proposed mitigation, management, and enhancement measures.

Confidence in the CEA is low to moderate due to uncertainty in predicting future regional developments, voluntary harvest reporting, and long-term climate-driven changes that could influence prey or food availability, habitat suitability and distribution, and future mortality risk. However, the implementation of adaptive management, ongoing community engagement, and annual reporting increases confidence that emerging cumulative risks can be detected and addressed.

18.22 Follow-up and Monitoring for Other Terrestrial Wildlife

Project activities will result in residual effects on habitat, movement, and mortality risk for other terrestrial wildlife. The predicted effects can be verified through a monitoring program designed to:

- Verify the accuracy of predicted residual and cumulative effects
- Assess the effectiveness of mitigation measures and strategies
- Identify unanticipated environmental constraints
- Support updates to mitigation and monitoring strategies, as needed

Further details on the monitoring program and its objectives can be found in the WMMP. The mitigation and monitoring strategies identified in the WMMP will be updated to remain consistent with new best management practices introduced during the Project's lifecycle and input received during the review process. Updates will also consider management reviews, incident investigations, shared Inuit, Indigenous, and Community Knowledge, new or improved scientific methods, regulatory changes, or other changes related to the Project.

WKR will continue to respond to questions and concerns from Kitikmiut, other Indigenous groups, and other potentially affected communities through its ongoing engagement efforts. Information provided following submission of the IS will be reviewed in the context of the IS and for incorporation into Project planning, including adaptive management and monitoring, as appropriate.

18.23 Knowledge and Literature Cited

18.23.1 References

- Agnico Eagle Mines Ltd. 2020. Meadowbank Gold Mine Project 2019 Wildlife Monitoring Summary Report. NIRB File No. 03MN017, 16MN056 NIRB Registry No. 330229.
- Albon, S.D., Clutton-Brock, T.H., and Guinness, F.E. 1987. Early Development and Population Dynamics in Red Deer. II. Density-Independent Effects and Cohort Variation. *Journal of Animal Ecology* 56(1):69–81.
- Alexander, S.M., Waters, N.M., and Paquet, P.C. 2005. Traffic volume and highway permeability for a mammalian community in the Canadian Rocky Mountains. *The Canadian Geographer* 49(4):321–331. DOI: 10.1111/j.0008-3658.2005.00099.x
- Andersen, R., Linnell, J.D.C., and Langvatn, R. 1996. Short term behavioural and physiological response of moose *Alces alces* to military disturbance in Norway. *Biological Conservation* 77(2–3):169–176.
- Andrén, H. 1994. Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review. *Oikos* 71(3):355–366. Nordic Society Oikos, Wiley. DOI: 10.2307/3545823

- Apps, C.D., McLellan, B.N., Woods, J.G., and Proctor, M.F. 2004. Estimating Grizzly Bear Distribution and Abundance Relative to Habitat and Human Influence. *The Journal of Wildlife Management* 68(1):138–152. [Wiley, Wildlife Society].
- Arctic Canadian Diamond Company. 2022. Ekati Diamond Mine 2022 Wildlife Management and Monitoring Plan.
- Aronsson, M., Andrén, H., Low, M., and Persson, J. 2023. Wolverine denning behaviour and its implications for monitoring reproductive females. *Wildlife Biology* 2023(4):e01079. DOI: 10.1002/wlb3.01079
- Austin, M., Herrero, S., and Paquet, P. 2000. Wolverine winter travel routes and response to transportation corridors in Kicking Horse Pass between Yoho and Banff National Parks, Conference on the biology and management of species and habitats at risk. British Columbia Ministry of Environment, Lands and Parks. University College of the Caribou, Kamloops, British Columbia.
- Awan, M. 2021. Grizzly Bear (*Ursus arctos*) Harvest Monitoring in Nunavut: Summary Report. Department of Environment, Government of Nunavut, Igloolik, Nunavut, Canada. 14 pp.
- Awan, M. 2025. Wolverine (*Gulo gulo*) Harvest Monitoring in Nunavut. Summary report. Department of Environment, Government of Nunavut, Arviat, Nunavut, Canada. 16 pp.
- Awan, M., Efford, M., and Boulanger, J. 2020. Estimates of wolverine density from mark-recapture DNA sampling. Napaktulik Lake, Kitikmeot Region, Nunavut 2018-2019. Final report. Government of Nunavut. 51 pp.
- Awan, M., Boulanger, J., Efford, M., and Poole, K.G. 2025. Grizzly bear DNA mark–recapture sampling in the western Kitikmeot region of Nunavut, 2022–2023. Government of Nunavut, Department of Environment, Igloolik, Nunavut.
- AXYS Environmental Consulting Ltd. 2001. Thresholds for Addressing Cumulative Effects on Terrestrial and Avian Wildlife in the Yukon. AECL CP502. Department of Indian and Northern Affairs, Environmental Directorate and Environment Yukon, Whitehorse, Canada. 92 pp.
- Ballard, W.B., Whitman, J.S., and Reed, D.J. 1991. Population Dynamics of Moose in South-Central Alaska. *Wildlife Monographs* (114):3–49.
- Banci, V. 1987. Ecology and Behaviour of Wolverine in Yukon. M.Sc. Thesis. Simon Fraser University, Burnaby, British Columbia. 178 pp.
- Banci, V., Demarchi, D.A., and Archibald, W.R. 1994. Evaluation of the Population Status of Grizzly Bears in Canada. *Bears: Their Biology and Management* 9:129–142. International Association for Bear Research and Management. DOI: 10.2307/3872692

- Banci, V. and Spicker, R. 2024. Kitikmiut Knowledge of the Proposed Kogloktokyo (Grays Bay) Port and Road Project. Naonaiyaotit Inuit Knowledge Project (NTKP). Kitikmeot Inuit Association, Lands & Environment Department. West Kitikmeot Resources Corp., Kugluktuk, Nunavut. 150 pp. (Report on file.)
- Banfield, A.W.F. 1974. The mammals of Canada. University of Toronto Press for the National Museum of Natural Sciences, Toronto, Ontario, Canada. 438 pp.
- Barker, O.E. 2011. Foraging ecology of brown bears in the Mackenzie Delta region, NWT. MSc thesis. University of Alberta, Edmonton, AB.
- Barrueto, M., Jessen, T.D., Diepstraten, R., and Musiani, M. 2023. Density and genetic diversity of grizzly bears at the northern edge of their distribution. *Ecosphere* 14(6): e4523. DOI: 10.1002/ecs2.4523
- Baskin, L., Ball, J.P., and Danell, K. 2004. Moose escape behaviour in areas of high hunting pressure. *Alces* 40.
- BC Ministry of Environment and Climate Change Strategy. 2019. Wildlife Habitat Features Field Guide (Kootenay Boundary Region). 112 pp. Available at:
https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/legislation-regulation/frpa-pac/wildlife-habitat-features/whf_field_guide_kootenay_boundary.pdf
- Beazley, K.F., Snaith, T.V., MacKinnon, F., and Colville, D. 2004. Road Density and Potential Impacts on Wildlife Species Such as American Moose in Mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science (NSIS)* 42(2).
- Belant, J.L. 1995. Moose collisions with vehicles and trains in northeastern Minnesota. *Alces* 31:45–52.
- Belant, J.L., Paynter, J.A., Stahlnecker, K.E., and Ballenberghe, V.V. 2006. Moose distribution relative to human development in a national park. *Alces* 42:33–39.
- Benn, B. 1998. Grizzly bear mortality in the central rockies ecosystem, Canada. Unpublished master's thesis. University of Calgary, Calgary, AB. Available at:
<https://prism.ucalgary.ca/handle/1880/26290>
- Bennett, V. and Zurcher, A. 2013. When Corridors Collide: Road-Related Disturbance in Commuting Bats. *The Journal of Wildlife Management* 77(1):93–101.
- Benson, K. 2014. Gwich'in Knowledge of Grizzly Bears. Gwich'in Social and Cultural Institute and Gwich'in Renewable Resources Board. 75 pp. Available at:
https://gwichin.ca/sites/default/files/gsci_benson_2014_gwichin_tk_grizzly.pdf
- Berg, J.E., Hebblewhite, M., St. Clair, C.C., and Merrill, E.H. 2019. Prevalence and Mechanisms of Partial Migration in Ungulates. *Frontiers in Ecology and Evolution* 7:325. DOI: 10.3389/fevo.2019.00325
- Berger, J., Hartway, C., Gruzdev, A., and Johnson, M. 2018. Climate Degradation and Extreme Icing Events Constrain Life in Cold-Adapted Mammals. *Scientific Reports* 8:1156. DOI: 10.1038/s41598-018-19416-9

- Berland, A., Nelson, T., Stenhouse, G., Graham, K., and Cranston, J. 2008. The impact of landscape disturbance on grizzly bear habitat use in the Foothills Model Forest, Alberta, Canada. *Forest Ecology and Management* 256(11):1875–1883. DOI: 10.1016/j.foreco.2008.07.019
- Bertram, M.R. and Vivion, M.T. 2002. Moose Mortality in Eastern Interior Alaska. *The Journal of Wildlife Management* 66(3):747–756.
- Beyer, H.L., Gurarie, E., Börger, L., Panzacchi, M., Basille, M., Herfindal, I., Van Moorter, B., R. Lele, S., and Matthiopoulos, J. 2016. ‘You shall not pass!’: quantifying barrier permeability and proximity avoidance by animals. *Journal of Animal Ecology* 85(1):43–53. DOI: 10.1111/1365-2656.12275
- Bjorge, R.R., Anderson, D., Herdman, E., and Stevens, S. 2018. Status and management of moose in the parkland and grassland natural regions of Alberta. *ALCES* 54:71–84.
- Bjørneraas, K., Solberg, E.J., Herfindal, I., Moorter, B.V., Rolandsen, C.M., Tremblay, J.-P., Skarpe, C., Sæther, B.-E., Eriksen, R., and Astrup, R. 2011. Moose *Alces alces* habitat use at multiple temporal scales in a human-altered landscape. *Wildlife Biology* 17(1):44–54. DOI: 10.2981/10-073
- Boer, A.H. 1990. Spatial Distribution of Moose Kills in New Brunswick. *Wildlife Society Bulletin* 18(4):431–434.
- Boertje, R.D., Gasaway, W.C., Grangaard, D.V., and Kelleyhouse, D.G. 1988. Predation on moose and caribou by radio-collared grizzly bears in east central Alaska. *Canadian Journal of Zoology* 66(11):2492–2499. DOI: 10.1139/z88-369
- Boulanger, J. 2013. An analysis of the High Lake and Izok wolverine DNA mark-recapture data sets. DRAFT. Prepared by Integrated Ecological Research for MMG’s Izok Corridor Project. 17 pp.
- Boulanger, J. and Mulders, R. 2013. Analysis of wolverine DNA mark-recapture sampling at Daring Lake from 2004 to 2011. Environment and Natural Resources, Government of Northwest Territories.
- Boulanger, J. and Stenhouse, G.B. 2014. The Impact of Roads on the Demography of Grizzly Bears in Alberta. *PLoS ONE* 9(12). DOI: 10.1371/journal.pone.0115535. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4274100/>
- Boulanger, J., Adamczewski, J., Williams, J., Clark, K., and Abernethy, R. 2024. June 2023 Calving Ground Surveys: Bluenose-East and Bathurst Barren-ground Caribou Herds. No. 319. Government of Northwest Territories. 171 pp.
- Bowyer, R.T., Van Ballenberghe, V., and Kie, J.G. 2003. Moose *Alces alces*. pp. 931–964. *Wild Mammals of North America - Biology, Management, and Conservation*. Second Edition. Edited by George A. Feldhamer, Bruce C. Feldhamer, and Joseph A. Chapman, Second Edition. The Johns Hopkins University Press. Available at: https://www.researchgate.net/publication/272818592_Moose_Alces_alces

- Bradley, M.J., Kutz, S.J., Jenkins, E., and O'Hara, T.M. 2005. The potential impact of climate change on infectious diseases of Arctic fauna. *International Journal of Circumpolar Health* 64(5):468–477. DOI: 10.3402/ijch.v64i5.18028
- Bunnell, F.L. and Hamilton, T. 1983. Forage Digestibility and Fitness in Grizzly Bears. *Bears: Their Biology and Management* 5:179–185. International Association for Bear Research and Management. DOI: 10.2307/3872536
- Burson, S.L., Belant, J.L., Fortier, K.A., and Tomkiewicz, W.C. 2000. The effect of vehicle traffic on wildlife in Denali National Park. *Arctic* 53(2):146–151.
- Canadian Endangered Species Conservation Council. 2022. Wild Species 2020: The General Status of Species in Canada. Canadian Endangered Species Conservation Council National General Status Working Group. 172 pp. Available at: www.wildspecies.ca
- Canteri, E., Brown, S., Schmidt, N., Heller, R., Nogués-Bravo, D., and Fordham, D. 2022. Spatiotemporal influences of climate and humans on muskox range dynamics over multiple millennia. *Global Change Biology* 28:6602–6617. DOI: 10.1111/gcb.16375
- Case, R.L. and Buckland, L. 1998. Reproductive Characteristics of Grizzly Bears in the Kugluktuk Area, Northwest Territories, Canada. *Ursus* 10:41–47. International Association for Bear Research and Management.
- Chapin, T.G., Harrison, D.J., and Katnik, D.D. 1998. Influence of Landscape Pattern on Habitat Use by American Marten in An Industrial Forest. *Conservation Biology* 12(6):1327–1337. [Wiley, Society for Conservation Biology].
- Child, K., Barry, S., and Aitken, D. 1991. Moose mortality on highways and railways in British Columbia. *Alces* 27:41–49.
- Chruszcz, B., Clevenger, A.P., Gunson, K.E., and Gibeau, M.L. 2003. Relationships among grizzly bears, highways, and habitat in the Banff-Bow Valley, Alberta, Canada. *Canadian Journal of Zoology* 81(8):1378–1391. DOI: 10.1139/z03-123
- Ciarniello, L.M., Heard, D.C., Seip, D.R., and Boyce, M.S. 2004. Grizzly Bears and Forestry: Increased Mortality Leading to Lower Abundance in Heavily-roaded Landscapes.
- Ciarniello, L.M., Boyce, M.S., Heard, D.C., and Seip, D.R. 2007. Components of Grizzly Bear Habitat Selection: Density, Habitats, Roads, and Mortality Risk. *The Journal of Wildlife Management* 71(5):1446–1457.
- Clark, D.A. and Slocombe, S. 2011. Adaptive co-management and grizzly bear human conflicts in two northern Canadian Aboriginal communities. *Human Ecology* 39:627–640.
- Clark, W.R. and Fritzell, E.K. 1992. A Review of Population Dynamics of Furbearers. pp. 899–910. In D.R. McCullough, R.H. Barrett (eds.) *Wildlife 2001: Populations*. Springer Netherlands, Dordrecht. DOI: 10.1007/978-94-011-2868-1_68. Available at: https://doi.org/10.1007/978-94-011-2868-1_68

- Cleary, E.C., Dolbeer, R., A., and Wright, S. 2004. Wildlife Strikes to Civil Aircraft in the United States 1990-2003. Federal Aviation Administration National Wildlife Strike Database 10. Washington DC. 72 pp.
- Cluff, H.D. 2005. Survey of moose abundance in the boreal forest around Yellowknife, Northwest Territories. Final Report to the West Kitikmeot / Slave Study Society. Government of Northwest Territories Department of Resources, Wildlife, and Economic Development, Yellowknife, NWT.
- Coffin, A.W. 2007. From roadkill to road ecology: A review of the ecological effects of roads. *Journal of Transport Geography* 15(5):396–406. DOI: 10.1016/j.jtrangeo.2006.11.006
- Copeland, J.P., McKelvey, K.S., Aubry, K.B., Landa, A., Persson, J., Inman, R.M., Krebs, J., Lofroth, E.C., Golden, H., Squires, J.R., Magoun, A.J., Schawartz, M.K., Wilmot, J., Copeland, C.L., Yates, R.E., Kojola, I., and May, R. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? *Canadian Journal of Zoology* 88(3):233–246.
- COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012. COSEWIC assessment and status report on the Grizzly Bear *Ursus arctos* in Canada. Ottawa, ON. 84 pp. Available at: https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_ours_grizz_bear_1012_e.pdf
- COSEWIC. 2014. COSEWIC assessment and status report on the Wolverine *Gulo gulo* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 76 pp.
- Craighead, F.C. and Craighead, J.J. 1972. Data on Grizzly Bear Denning Activities and Behavior Obtained by Using Wildlife Telemetry. *Bears: Their Biology and Management* 2:84–106. DOI: 10.2307/3872573
- Cumberland Resources Ltd. 2005. Meadowbank Gold Project Terrestrial Ecosystem Management Plan. 116 pp.
- Cunningham, C.X., Liston, G.E., Reinking, A.K., Boelman, N.T., Brinkman, T.J., Joly, K., Hebblewhite, M., Boutin, S., Czetwertynski, S., Sielecki, L.E., and Prugh, L.R. 2022. Human and animal movements combine with snow to increase moose-vehicle collisions in winter. *Environmental Research Letters* 17(12):125007. IOP Publishing. DOI: 10.1088/1748-9326/aca8bf
- Dalerum, F., Loxterman, J., Shults, B., Kunkel, K., and Cook, J.A. 2007. Sex-Specific Dispersal Patterns of Wolverines: Insights from Microsatellite Markers. *Journal of Mammalogy* 88(3):793–800. DOI: 10.1644/05-MAMM-A-427R1.1
- Danks, Z. 2007. Spatial, temporal, and landscape characteristics of moose-vehicle collisions in Maine. MSc. State University of New York College of Environmental Science and Forestry, Syracuse, New York. 84 pp.

- Danks, F.S. and Klein, D.R. 2002. Using GIS to predict potential wildlife habitat: A case study of muskoxen in northern Alaska. *International Journal of Remote Sensing* 23(21):4611–4632. DOI: 10.1080/01431160110113890
- Dawson, F.N., Magoun, A.J., Bowman, J., and Ray, J.C. 2010. Wolverine, *Gulo gulo*, Home Range Size and Denning Habitat in Lowland Boreal Forest in Ontario. *The Canadian Field-Naturalist* 124(2):139–144. DOI: 10.22621/cfn.v124i2.1052
- De Beers Canada Inc. 2010. Gahcho Kué Project Environmental Impact Statement, Section 7 - Key Line of Inquiry: Caribou. Prepared by Golder Associates Ltd. 09-1365–1004. Submitted to Mackenzie Valley Environmental Impact Review Board, December 2010. 320 pp. Available at: http://reviewboard.ca/upload/project_document/EIR0607-001_EIS_Section_7_Caribou.PDF
- De Beers Canada Inc. 2013. Wildlife effects monitoring program v1. Prepared by Golder Associates Ltd., Yellowknife, NWT. iii + 52 pp.
- Deb, J.C., Forbes, G., and MacLean, D.A. 2020. Modelling the spatial distribution of selected North American woodland mammals under future climate scenarios. *Mammal Review* 50(4):440–452. DOI: 10.1111/mam.12210
- Del Frate, G.G. and Spraker, T.H. 1991. Moose vehicle interactions and an associated public awareness program on the Kenai Peninsula, Alaska. *Alces* 27:1–7.
- Diavik Diamond Mines Inc. 2006. A comparison of methods for monitoring abundance and distribution of wolverine at the Diavik diamond mine. Prepared by Golder Associates Ltd. for Diavik Diamond Mines Inc., Yellowknife, NWT.
- Díaz, S., Settele, J., Brondízio, E.S., Ngo, H.T., Agard, J., Arneth, A., Balvanera, P., Brauman, K.A., Butchart, S.H.M., Chan, K.M.A., Garibaldi, L.A., Ichii, K., Liu, J., Subramanian, S.M., Midgley, G.F., Miloslavich, P., Molnár, Z., Obura, D., Pfaff, A., Polasky, S., Purvis, A., Razzaque, J., Reyers, B., Chowdhury, R.R., Shin, Y.-J., Visseren-Hamakers, I., Willis, K.J., and Zayas, C.N. 2019. Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* 366(6471):eaax3100. American Association for the Advancement of Science. DOI: 10.1126/science.aax3100
- Dickie, M., Serrouya, R., DeMars, C., Cranston, J., and Boutin, S. 2017. Evaluating functional recovery of habitat for threatened woodland caribou. *Ecosphere* 8(9):e01936. DOI: 10.1002/ecs2.1936
- Dumond, M., Boulanger, J., and Paetkau, D. 2015. The estimation of grizzly bear density through hair-snagging techniques above the tree line. *Wildlife Society Bulletin* 39(2):390–402. DOI: 10.1002/wsb.520
- Dussault, C., Poulin, M., Courtois, R., and Ouellet, J.-P. 2006. Temporal and spatial distribution of moose-vehicle accidents in the Laurentides Wildlife Reserve, Quebec, Canada. *Wildlife Biology* 12(4):415–425. Nordic Board for Wildlife Research. DOI: 10.2981/0909-6396(2006)12[415:TASDOM]2.0.CO;2

- Dyer, S.J., O'Neill, J.P., Wasel, S.M., and Boutin, S. 2002. Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. *Canadian Journal of Zoology* 80(5):839–845. DOI: 10.1139/z02-060
- EBA Engineering Consultants Ltd. 2001. Tibbitt to Contwoyto winter road environmental setting report. Contwoyto Winter Road Joint Venture, Yellowknife, NWT.
- Eberhardt, L.L., Blanchard, B.M., and Knight, R.R. 1994. Population trend of the Yellowstone grizzly bear as estimated from reproductive and survival rates. *Canadian Journal of Zoology* 72(2):360–363. DOI: 10.1139/z94-049
- Edwards, M.A., Derocher, A.E., Hobson, K.A., Branigan, M., and Nagy, J.A. 2011. Fast carnivores and slow herbivores: Differential foraging strategies among grizzly bears in the Canadian Arctic. *Oecologia* 165(4):877–889. DOI: 10.1007/s00442-010-1869-9
- Elmqvist, T., Folke, C., Nyström, M., Peterson, G., Bengtsson, J., Walker, B., and Norberg, J. 2003. Response diversity, ecosystem change, and resilience. *Frontiers in Ecology and the Environment* 1(9):488–494. DOI: 10.1890/1540-9295(2003)001[0488:RDECAR]2.0.CO;2
- ECCC (Environment and Climate Change Canada). 2023. Guidance Regarding Information Needed to Support Assessment of Project Effects on Birds: Presentation to National Industry Associations. Environment and Climate Change Canada. February 1, 2023 presentation.
- ECCC. 2024. Management Plan for the Wolverine (*Gulo gulo*) in Canada [DRAFT]. Species at Risk Act Management Plan Series.
- Erb, J. and Coy, P. 2016. Survival and causes of mortality for fishers and martens in Minnesota. Minnesota Department of Natural Resources, Grand Rapids, Minnesota. Available at: https://www.researchgate.net/profile/John-Erb/publication/314207205_SURVIVAL_AND_CAUSES_OF_MORTALITY_FOR_FISHERS_AND_MARTENS_IN_MINNESOTA/links/58b9b1bda6fdcc2d14ddcf34/SURVIVAL-AND-CAUSES-OF-MORTALITY-FOR-FISHERS-AND-MARTENS-IN-MINNESOTA.pdf
- ERM Consultants Canada Ltd. 2025a. Bathurst Caribou Zone of Influence Literature Review. Prepared for the Government of Northwest Territories. 18 pp.
- ERM Consultants Canada Ltd. 2025b. Etaki Diamond Mine: 2024 Wildlife Effects Monitoring Program. Prepared for Dominion Diamond Ekati Corporation by ERM Consultants Canada Ltd., Yellowknife, NWT.
- Feierabend, D. and Kielland, K. 2014. Movements, activity patterns, and habitat use of snowshoe hares (*Lepus americanus*) in interior Alaska. *Journal of Mammalogy* 95(3):525–533. DOI: 10.1644/13-MAMM-A-199
- Ferguson, R.S. 1991. Detection and classification of muskox habitat on Banks Island, Northwest Territories, Canada, using Landsat Thematic Mapper data. *Arctic* 44(1):66–74.

- Finnerty, P.B., McArthur, C., Banks, P.B., Price, C., and Shrader, A.M. 2022. The Olfactory Landscape Concept: A Key Source of Past, Present, and Future Information Driving Animal Movement and Decision-making. *BioScience* 72(8):745–752.
- Fisher, J.T., Bradbury, S., Anholt, B., Nolan, L., Roy, L., Volpe, J.P., and Wheatley, M. 2013. Wolverines (*Gulo gulo luscus*) on the Rocky Mountain slopes: natural heterogeneity and landscape alteration as predictors of distribution. *Canadian Journal of Zoology* 91(10):706–716. NRC Research Press. DOI: 10.1139/cjz-2013-0022
- Fogarty, R.D., Weir, R.D., Lofroth, E.C., and Larsen, K.W. 2022. Trapping mortality accelerates the decline of the fisher, an endangered mesocarnivore, in British Columbia, Canada. *Endangered Species Research* 49:1–12. DOI: 10.3354/esr01200
- Forchhammer, M.C., Stenseth, N.C., Post, E., and Landvatn, R. 1998. Population dynamics of Norwegian red deer: density–dependence and climatic variation. *Proceedings: Biological Sciences* 265(1393):341–350. DOI: <https://doi.org/10.1098/rspb.1998.0301>
- Forman, R.T.T. and Alexander, L.E. 1998. Roads and their major ecological effects. *Annual Review of Ecology and Systematics* 29(1):207–231. DOI: 10.1146/annurev.ecolsys.29.1.207
- Frair, J.L., Merrill, E.H., Beyer, H.L., and Morales, J.M. 2008. Thresholds in landscape connectivity and mortality risks in response to growing road networks. *Journal of Applied Ecology* 45(5):1504–1513. DOI: 10.1111/j.1365-2664.2008.01526.x
- Francis, A.L., Procter, C., Kuzyk, G., and Fisher, J.T. 2021. Female Moose Prioritize Forage Over Mortality Risk in Harvested Landscapes. *The Journal of Wildlife Management* 85(1):156–168. DOI: 10.1002/jwmg.21963
- Freeman, M.M.R. 1976. Inuit Land Use and Occupancy Project, of 3. Department of Indian and Northern Affairs, Ottawa, Ontario. 287 pp.
- Frid, A. and Dill, L.M. 2002. Human-caused Disturbance Stimuli as a Form of Predation Risk. *Conservation Ecology* 6(1):11.
- Garshelis, D.L., Gibeau, M.L., and Herrero, S. 2005. Grizzly Bear Demographics in and around Banff National Park and Kananaskis Country, Alberta. *The Journal of Wildlife Management* 69(1):277–297. [Wiley, Wildlife Society].
- Gau, R.J., Case, R., Penner, D.F., and McLoughlin, P.D. 2002. Feeding Patterns of Barren-ground Grizzly Bears in the Central Canadian Arctic. *Arctic* 55(4):339–344.
- Gau, R., J., McLoughlin, P.D., Case, R., Cluff, H.D., Mulders, R., and Messier, F. 2004. Movements of Subadult Male Grizzly Bears, *Ursus arctos*, in the Central Canadian Arctic. *Canadian Field-Naturalist* 118(2):239–242. DOI: <https://doi.org/10.22621/cfn.v118i2.920>
- GBRP. 2025. Grays Bay Road and Port Project Records of Engagement. Records on file.

- Gibeau, M.L., Clevenger, A.P., Herrero, S., and Wierzchowski, J. 2002. Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. *Biological Conservation* 103(2):227–236. DOI: 10.1016/S0006-3207(01)00131-8
- Glass, T.W., Magoun, A.J., Robards, M.D., and Kielland, K. 2022. Wolverines (*Gulo gulo*) in the Arctic: Revisiting distribution and identifying research and conservation priorities amid rapid environmental change. *Polar Biology* 45(9):1465–1482. DOI: 10.1007/s00300-022-03079-4
- Gleason, S.M., Faucette, D.T., Toyofuku, M.M., Torres, C.A., and Bagley, C.F. 2007. Assessing and mitigating the effects of windblown soil on rare and common vegetation. *Environmental Management* 40(6):1016–1024. DOI: 10.1007/s00267-007-9004-3
- Golder Associates Ltd. 2003. Report on Inuit Qaujimajatuqangit literature review, gap analysis and workshop results related to the Doris North Project. Prepared for Miramar Mining Ltd .
- Golder Associates Ltd. 2010. Effects of development on barren-ground caribou: Insight from Inuit Qaujimajatuqangit and an ecological model. 2010 presentation.
- Golder Associates Ltd. 2020. 2019 Wildlife Monitoring Report. 19115664-1897-R-Rev0-10000. Submitted to Diavik Diamond Mines (2012) Inc., Vancouver, British Columbia. 571 pp. Available at: https://www.emab.ca/sites/default/files/ddmi_cover_ltr_and_2019_wmp_report.pdf
- GNWT (Government of Northwest Territories). 2015. Northern Land Use Guidelines: Northwest Territories Seismic Operations.
- GN (Government of Nunavut). 1999. Wildlife Act - Consolidation of Trapping Regulations. R-023-92.
- GN. 2014. Environmental Guideline for Dust Suppression on Unpaved Roads. Department of Environment, Government of Nunavut.
- GN. 2022. Wildlife Fact Sheets — Moose. Wildlife Fact Sheets. Available at: <https://www.gov.nu.ca/sites/default/files/publications/2022-01/Moose.pdf>
- GN. 2023. Statutory Report on Wildlife to the Nunavut Legislative Assembly: Section 176 of the Wildlife Act. Government of Nunavut.
- GN. 2024. Summary of the Nunavut Hunting Regulations 2024|2025. 15 pp. Available at: https://www.gov.nu.ca/sites/default/files/documents/2024-12/Nunavut_Hunting_Regulations_Guide_2024-25.pdf
- GN-DOE (Government of Nunavut - Department of Environment). 2017. Nunavut Grizzly Bear Co-Management Plan. Government of Nunavut, Department of Environment, Iqaluit, Nunavut, Canada. 15 pp.
- Graf, R.P. 1992. Status and management of moose in the Northwest Territories, Canada. *Alces Supplement* 1:22–28.

- Graham, K., Boulanger, J., Duval, J., and Stenhouse, G. 2010. Spatial and temporal use of roads by grizzly bears in west-central Alberta. *Ursus* 21(1):43–56. DOI: 10.2192/09GR010.1
- Gray, D.R. 1973. Social organization and behaviour of muskoxen (*Ovibos moschatus*) on Bathurst Island. Unpublished Ph.D. dissert University Alberta, Edmonton.
- Gunn, A. and Case, R. 1984. Numbers and Distribution of Muskoxen in the Queen Maud Gulf Area, July, 1982. File Report No. 39. Government of Northwest Territories Department of Resources, Wildlife, and Economic Development, Yellowknife, NWT.
- Gunn, A. 1990. Distribution and abundance of muskoxen between Bathurst Inlet and Contwoyto Lake, NWT, 1986. File Report. 100. Government of Northwest Territories Department of Renewable Resources, Coppermine, NWT.
- Gunn, A. 1991. Denning surveys for barren-ground grizzly bears, Coppermine, October 1984 and implications for a commercial quota on the Coronation Gulf mainland. Manuscript Report 46. Government of Northwest Territories Department of Resources. 29 pp.
- Gunn, A. and Fournier, B. 2000. Calf Survival and Seasonal Migrations of Mainland Muskox Population. File Report No. 124. Department of Resources, Wildlife and Economic Development, Government of Northwest Territories, Yellowknife, NWT. 126 pp.
- Gunn, A. and Sutherland, M. 1997. Muskox diet and sex-age composition in the Central Arctic coastal mainland (Queen Maud Gulf area) 1988-1991. Manuscript Report. 95. Government of Northwest Territories Department of Resources, Wildlife, and Economic Development, Yellowknife, NWT. 67 pp.
- Gunn, A. and Adamczewski, J.Z. 2003. Muskox. pp. 1076–1091. In G.A. Feldhamer, B. Thompson, J. Chapman (eds.) *Wild animals of North America: biology, management and conservation*, 2nd Edition. The John Hopkins University Press, Baltimore, Maryland, USA.
- Gunn, A., Antoine, J., Boulanger, J., Bartlett, J., Croft, B., and D'Hont, A. 2004. Boreal Caribou Habitat and Land Use Planning in the Deh Cho Region, Northwest Territories. Manuscript Report 153. Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories, Yellowknife, NWT. 47 pp.
- Gunn, A., Fournier, B., Williams, J., and Adamczewski, J. 2024. Technical Status Report for Muskoxen (*Ovibos moschatus*) in the Northwest Territories. Manuscript 315. Government of the Northwest Territories. 109 pp.
- Gunther, K.A., Biel, M.J., and Robison, H.L. 1998. Factors influencing the frequency of road-killed wildlife in Yellowstone National Park. *Proceedings of the International Conference on Wildlife Ecology and Transportation*, Florida Department of Transportation, Tallahassee, Florida.
- Harding, L. and Nagy, J.A. 1980. Responses of grizzly bears to hydrocarbon exploration on Richards Island, Northwest Territories, Canada. *Bears: Their Biology and Management* :277–280.

- Hargis, C.D., Bissonette, J.A., and Turner, D.L. 1999. The influence of forest fragmentation and landscape pattern on American martens. *Journal of Applied Ecology* 36(1):157–172. DOI: 10.1046/j.1365-2664.1999.00377.x
- Harris, G., Nielson, R.M., Rinaldi, T., and Lohuis, T. 2014. Effects of winter recreation on northern ungulates with focus on moose (*Alces alces*) and snowmobiles. *European Journal of Wildlife Research* 60(1):45–58. DOI: 10.1007/s10344-013-0749-0
- Harsch, M.A., Hulme, P.E., McGlone, M.S., and Duncan, R.P. 2009. Are treelines advancing? A global meta-analysis of treeline response to climate warming. *Ecology Letters* 12(10):1040–1049. DOI: 10.1111/j.1461-0248.2009.01355.x
- Hausleitner, D., Kortello, A., Barrueto, M., Harrower, W., and Krebs, J. 2024. Guidelines for Winter Recreation near Wolverine Dens in Montane Western North America. *Journal of Ecosystems and Management* 24(1):20 pp-20 pp. DOI: 10.22230/jem.2024v24n1a631
- Heard, D.C. and Williams, T.M. 1992. Distribution of wolf dens on migratory caribou ranges in the Northwest Territories. *Canadian Journal of Zoology* 70(8):1504–1510.
- Heinemeyer, K., Squires, J., Hebblewhite, M., O’Keefe, J.J., Holbrook, J.D., and Copeland, J. 2019. Wolverines in winter: indirect habitat loss and functional responses to backcountry recreation. *Ecosphere* 10(2):e02611. DOI: 10.1002/ecs2.2611
- Henriksson, L.-H. 2007. Movement pattern of Moose (*Alces alces*) in southwestern Sweden in relation to highway traffic intensity. Biology D-level thesis. Karlstads University, Sweden. 20 pp. Available at: <https://pdfs.semanticscholar.org/8936/f355336902479b36588591b6e632c7872e55.pdf>
- Hetta, E.S. 2025. Factors predicting migration patterns in the world’s northernmost moose population in Finnmark. The Arctic University of Norway. Available at: <https://munin.uit.no/handle/10037/37505>
- Holtmeier, F. and Broll, G. 2005. Sensitivity and response of northern hemisphere altitudinal and polar treelines to environmental change at landscape and local scales. *Global Ecology and Biogeography* 14(5):395–410. DOI: 10.1111/j.1466-822X.2005.00168.x
- Horejsi, B.L. 1979. Seismic Operations and their impact on Large Mammals: Results of a Monitoring Program. Western Wildlife Environments, Calgary, AB. 96 pp.
- Huijser, M.P., Paul, K.J.S., Oechsli, L., Ament, R., Clevenger, A.P., and Ford, A. 2008. Wildlife-Vehicle Collision and Crossing Mitigation Plan for Hwy 93S in Kootenay and Banff National Park and the Roads in and Around Radium Hot Springs. Montana State University, Parks Canada.
- Hundertmark, K.J. 1998. Home Range, Dispersal and Migration. Chapter 9. pp. 303–335. *Ecology and management of the North American moose*. Smithsonian Institution Press, Washington DC. Available at: <http://rgdoi.net/10.13140/2.1.4757.9843>
- Hundertmark, Kris.J., Schwartz, C.C., and Shuey, C.C. 1994. Moose Research Center Reports - Federal Aid in Wildlife Restoration, Research Progress Report. Alaska Department of Fish and Game, Division of Wildlife Conservation.

- Hurley M A, Hebblewhite M, Gaillard J M, Dray S, Taylor K A, Smith W K, Zager P and Bonenfant C. 2014. Functional analysis of normalized difference vegetation index curves reveals overwinter mule deer survival is driven by both spring and autumn phenology *Philosophical Transactions of The Royal Society B* **369**
- Inman, R.M., Magoun, A.J., Persson, J., and Mattisson, J. 2012. The wolverine's niche: linking reproductive chronology, caching, competition, and climate. *Journal of Mammalogy* 93(3):634–644. DOI: 10.1644/11-MAMM-A-319.1
- IPCC (Intergovernmental Panel on Climate Change). 2021. Climate change 2021: the physical science basis : summary for policymakers : working group I contribution to the sixth Assessment report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.
- IAG (Inuit Advisory Group). 2025a. Grays Bay Road and Port Project What We Heard Report - Inuit Advisory Group Workshop Summary 1. Inuit Knowledge Integration Methods and Mitigation Strategies. Prepared for West Kitikmeot Resources Corp. by Nunami Stantec Ltd., Kugluktuk, Nunavut. 85 pp.
- IAG. 2025b. Grays Bay Road and Port Project What We Heard Report - Inuit Advisory Group Workshop Summary 2. Understanding and Protecting Caribou. Prepared by West Kitikmeot Resources Corp., Kugluktuk, Nunavut. 113 pp.
- Inuvik Community Corporation, Tuktoyaktuk Community Corporation, and Aklavik Community Corporation. 2006. Inuvialuit Settlement Region Traditional Knowledge Report. Mackenzie Gas Project, Inuvik, NWT.
- IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services Secretariat, Bonn, Germany. DOI: 10.5281/zenodo.3553579. Available at: <https://zenodo.org/records/3553579>
- Jalkotzy, M.G., Ross, P.I., and Nasserden, M.D. 1997. The Effects of Linear Developments on Wildlife: A review of selected scientific literature. Report: 1-354. Prepared for the Canadian Association of Petroleum Producers by Arc Wildlife Services, Calgary, Alberta, Canada.
- Jingfors, K.T. 1982. Seasonal activity budgets and movements of a reintroduced Alaskan muskox herd. *The Journal of Wildlife Management* 46(2):344–350.
- Johnson, C.J., Boyce, M.S., Schwartz, C.C., and Haroldson, M.A. 2004. Modeling Survival: Application of the Andersen-Gill Model to Yellowstone Grizzly Bears. *The Journal of Wildlife Management* 68(4):966–978. [Wiley, Wildlife Society].
- Johnson, C.J., Boyce, M.S., Case, R.L., Cluff, H.D., Gau, R.J., Gunn, A., and Mulders, R. 2005. Cumulative effects of human developments on arctic wildlife. *Wildlife Monographs* 160:1–36.

- Jokinen, M.E., Webb, S.M., Manzer, D.L., and Anderson, R.B. 2019. Characteristics of Wolverine (*Gulo gulo*) dens in the lowland boreal forest of north-central Alberta. *The Canadian Field-Naturalist* 133(1):1–15. DOI: 10.22621/cfn.v133i1.2083
- Joly, K., Duffy, P.A., and Rupp, T.S. 2012. Simulating the effects of climate change on fire regimes in Arctic biomes: implications for caribou and moose habitat. *Ecosphere* 3(5):1–18. DOI: 10.1890/ES12-00012.1
- Joly, K., Craig, T., Sorum, M.S., McMillan, J.S., and Spindler, M.A. 2015. Moose Movement Patterns in the Upper Koyukuk River Drainage, Northcentral Alaska. *ALCES VOL.* 51.
- Joyce, T. and Mahoney, S. 2001. Spatial and Temporal Distributions of Moose-Vehicle Collisions in Newfoundland. *Wildlife Society Bulletin* 29(1):281–291.
- Kafle, P., Peller, P., Massolo, A., Hoberg, E., Leclerc, L.-M., Tomaselli, M., and Kutz, S. 2020. Range expansion of muskox lungworms track rapid arctic warming: implications for geographic colonization under climate forcing. *Scientific Reports* 10(1):17323. DOI: 10.1038/s41598-020-74358-5
- Karns, P.D. 1997. Population distribution, density and trends. In A.W. Franzmann, C.C. Schwartz (eds.) *Ecology and management of the North American moose*. Smithsonian Institution Press, Washington.
- Kelly, T. and Allan, J. 2006. Chapter 1: Ecological effects of aviation. pp. 5–24. In J. Davenport, J.L. Davenport (eds.) *The Ecology of Transportation: Managing Mobility for the Environment*. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7120303/>
- Kelsall, J.P. 1972. The Northern Limits of Moose (*Alces alces*) in Western Canada. *Journal of Mammalogy* 53(1):129–138.
- KIA (Kitikmeot Inuit Association). 2024. Letter to NIRB RE: Screening of West Kitikmeot Resources Corp.'s (WKRC) Gray's Bay Road and Port Project. Kitikmeot Inuit Association, Cambridge Bay, Nunavut, Canada. Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=351931&applicationid=125987
- Klein, D.R., Yakushkin, G.D., and Pospelova, E.B. 1993. Comparative habitat selection by muskoxen introduced to northeastern Alaska and the Taimyr Peninsula, Russia. *Rangifer* 13(1):21–25.
- Kneeshaw, Larouche, M., Asselin, H., Adam, M.C., Saint-Arnaud, M., and Reyes, G. 2010. Road Rash: Ecological and Social Impacts of Road Networks on First Nations. pp. 169–184. *Planning Co-existence: Aboriginal considerations and approaches in land use planning*. Canadian Circumpolar Institute Press, Edmonton, AB.
- Kortello, A., Hausleitner, D., and Mowat, G. 2019. Mechanisms influencing the winter distribution of wolverine *Gulo gulo luscus* in the southern Columbia Mountains, Canada. *Wildlife Biology* 2019(1):1–13. Nordic Board for Wildlife Research. DOI: 10.2981/wlb.00480

- Kowalchuk, K. 2011. Inuit knowledge of mammal distribution in Nunavut: applications in wildlife management and risk assessment. Masters Thesis. University of Guelph, Ottawa.
- Krebs, J., Lofroth, E., Copeland, J., Banci, V., Cooley, D., Golden, H., Magoun, A., Mulders, R., and Shults, B. 2004. Synthesis of survival rates and causes of mortality in North American wolverines. *Journal of Wildlife Management* 68(3):493–502.
- Krebs, J., Lofroth, E.C., and Parfitt, I. 2007. Multiscale Habitat Use by Wolverines in British Columbia, Canada. *The Journal of Wildlife Management* 71(7):2180–2192. DOI: 10.2193/2007-099
- Krebs, J.A. and Lewis, D. 1999. Wolverine ecology and habitat use in the North Columbia Mountains: progress report, Proceedings of a Conference on the biology and management of species and habitats at risk, Volume 2, 695–703 pp. University College of the Cariboo, Kamloops, British Columbia. Available at: <http://www.env.gov.bc.ca/wld/documents/ca08krebs.pdf>
- Kuliktana, M. 2020. Embracing Moose in Kugluktuk. (<https://www.itk.ca/embracing-moose-in-kugluktuk/>)
- Kutz, S., Bollinger, T., Branigan, M., Checkley, S., Davison, T., Dumond, M., Elkin, B., Forde, T., Hutchins, W., Niptanatiak, A., and Orsel, K. 2015. *Erysipelothrix rhusiopathiae* associated with recent widespread muskox mortalities in the Canadian Arctic. *The Canadian Veterinary Journal* 56(6):560–563.
- Kutz, S.J., Veitch, A.M., Hoberg, E.P., Elkin, B.T., Jenkins, E.J., and Polley, L. 2001. New host and geographic records for two protostrongylids in Dall's sheep. *Journal of Wildlife Diseases* 37(4):761–774.
- Kutz, S.J., Checkley, S., Verocai, G.G., Dumond, M., Hoberg, E.P., Peacock, R., Wu, J.P., Orsel, K., Seegers, K., Warren, A.L., and Abrams, A. 2013. Invasion, establishment, and range expansion of two parasitic nematodes in the Canadian Arctic. *Global Change Biology* :n/a-n/a. DOI: 10.1111/gcb.12315
- Kuyt, E. 1972. Food habits and ecology of wolves on barren-ground caribou range in the Northwest Territories. Report Series. 21. Environment Canada Wildlife Service.
- Lackner, G., Domine, F., Nadeau, D.F., Lafaysse, M., and Dumont, M. 2022. Snow properties at the forest–tundra ecotone: predominance of water vapor fluxes even in deep, moderately cold snowpacks. *The Cryosphere* 16(8):3357–3373. DOI: 10.5194/tc-16-3357-2022
- Lamb, C.T., Mowat, G., McLellan, B.N., Nielsen, S.E., and Boutin, S. 2017. Forbidden fruit: human settlement and abundant fruit create an ecological trap for an apex omnivore. *Journal of Animal Ecology* 86(1):55–65. DOI: 10.1111/1365-2656.12589
- Lamb, C.T., Mowat, G., Reid, A., Smit, L., Proctor, M., McLellan, B.N., Nielsen, S.E., and Boutin, S. 2018. Effects of habitat quality and access management on the density of a recovering grizzly bear population. *Journal of Applied Ecology* 55(3):1406–1417. DOI: 10.1111/1365-2664.13056

- Langley, R.L., Higgins, S.A., and Herrin, K.B. 2006. Risk Factors Associated with Fatal Animal-Vehicle Collisions in the United States, 1995–2004. *Wilderness & Environmental Medicine* 17(4):229–239. SAGE Publications. DOI: 10.1580/06-WEME-OR-001R1.1
- Larter, N.C. and Nagy, J.A. 2004. Seasonal changes in the composition of the diets of Peary caribou and muskoxen on Banks Island. *Polar Research*.
- Laugrand, F. 2019. La perception du carcajou/glouton par les Inuit du Nord canadien : Du passé au présent. *Études Inuit Studies* 41(1–2):243–263. DOI: 10.7202/1061440ar
- Laurian, C., Dussault, C., Ouellet, J.-P., Courtois, R., Poulin, M., and Breton, L. 2008. Behavior of Moose Relative to a Road Network. *The Journal of Wildlife Management* 72(7):1550–1557.
- Laurian, C., Dussault, C., Ouellet, J.-P., Courtois, R., and Poulin, M. 2012. Interactions between a large herbivore and a road network. *Écoscience* 19(1):69–79. DOI: 10.2980/19-1-3461
- Leblond, M., Dussault, C., and Ouellet, J.P. 2013. Avoidance of roads by large herbivores and its relation to disturbance intensity. *Journal of Zoology* 289(1):32–40. DOI: 10.1111/j.1469-7998.2012.00959.x
- Leclerc, L.-M. 2015. Muskox (*Ovibos moschatus*) distribution and abundance, muskox management units MX-11 subdivision, Kugluktuk, September 2013. Status Report. 2016–XX. Government of Nunavut Department of Environment, Kugluktuk, Nunavut. 16 pp.
- Leclerc, L.-M. 2025. Nunavut MX11 Moose and Muskoxen Harvest Data 2005 and 2022.
- Leclerc, L.-M., Awan, M., Roberto-Charron, A., Campbell, M., and Boulanger, J. 2024. Muskox (*Ovibos moschatus*) distribution and abundance of Central Kitikmeot Group, MX-11 - March 2022. GN Technical Report. Government of Nunavut Department of Environment. 36 pp.
- Lee, J. and Niptanatiak, A. 1996. Observation of repeated use of a wolverine, *Gulo gulo*, den on the tundra of the Northwest Territories. *Canadian Field Naturalist* 110(2):349–350.
- Lievense, S. 2024. Unexpected Wildlife Strikes: Beyond Birds in Aviation. Available at: <https://www.airportbiologist.com/post/unexpected-wildlife-strikes-beyond-birds-in-aviation>. Accessed March 26, 2025.
- Lister, A.M. 1993. Evolution of mammoths and moose: the Holarctic perspective. pp. 178–204. In R.A. Martin, A.D. Barnosky (eds.) *Morphological Change in Quaternary Mammals of North America*, 1 Edition. Cambridge University Press. DOI: 10.1017/CBO9780511565052.009. Available at: https://www.cambridge.org/core/product/identifier/CBO9780511565052A016/type/book_part
- Lofroth, E. 2001. Wolverine ecology in plateau and foothill landscapes. 1996–2001. Northern Wolverine Project 2000/01 Year End Report. British Columbia Ministry of Environment, Victoria, British Columbia. 99 pp.
- Lofroth, E.C., Krebs, J.A., Harrower, W.L., and Lewis, D. 2007. Food habits of wolverine *Gulo gulo* in montane ecosystems of British Columbia, Canada. *Wildlife Biology* 13(2):31–37.

- Lykkja, O.N., Solberg, E.J., Herfindal, I., Wright, J., Rolandsen, C.M., and Hanssen, M.G. 2009. The effects of human activity on summer habitat use by moose. *Alces: A Journal Devoted to the Biology and Management of Moose* 45(0):109–124.
- Mace, R.D., Waller, J.S., Manley, T.L., Lyon, L.J., and Zuuring, H. 1996. Relationships Among Grizzly Bears, Roads and Habitat in the Swan Mountains Montana. *Journal of Applied Ecology* 33(6):1395–1404. [British Ecological Society, Wiley]. DOI: 10.2307/2404779
- MacHutchon, G. 2025. Casino Project: Grizzly Bear Habitat Modelling and Project Effects Assessment. Appendix 14A, Attachment 3. Prepared for EDI Environmental Dynamics Inc, Whitehorse YT. 88 pp.
- MacHutchon, A.G. and Mahon, T. 2003. Habitat use by grizzly bears and implications for forest development activities in the Kispiox Forest District final report. Skeena Cellulose Incorporated, Hazelton and B.C. Ministries of Water, Land, and Air Protection, and Sustainable Resource Management, Smithers, British Columbia. 66 pp.
- MacHutchon, A.G. and Wellwood, D.W. 2003. Grizzly bear food habits in the northern Yukon, Canada. *Ursus* 14(2):225–235.
- MacNearney, D., Pigeon, K., Stenhouse, G., Nijland, W., Coops, N.C., and Finnegan, L. 2016. Heading for the hills? Evaluating spatial distribution of woodland caribou in response to a growing anthropogenic disturbance footprint. *Ecology and Evolution* 6(18):6484–6509. DOI: 10.1002/ece3.2362
- Magoun, A.J. 1985. Population Characteristics, Ecology, and Management of Wolverines in Northwestern Alaska (*Gulo gulo*). Thesis. Available at: <https://scholarworks.alaska.edu/handle/11122/9294>
- Magoun, A.J. 1987. Summer and winter diets of Wolverines, *Gulo gulo*, in arctic Alaska. *The Canadian field-naturalist* 101(3):392–397. DOI: 10.5962/p.355938
- Magoun, A.J. and Copeland, J.P. 1998. Characteristics of Wolverine Reproductive Den Sites. *The Journal of Wildlife Management* 62(4):1313–1320. [Wiley, Wildlife Society]. DOI: 10.2307/3801996
- Mallory, C.D. and Boyce, M.S. 2018. Observed and predicted effects of climate change on Arctic caribou and reindeer. *Environmental Reviews* 26(1):13–25.
- Maraj, R. 2007. Evaluating the ecological consequences of human land-use on grizzly bears in southwest Yukon, Canada. Doctor of Philosophy. University of Calgary, Calgary, AB. 259 pp.
- Mattson, D.J. and Merrill, T. 2002. Extirpations of Grizzly Bears in the Contiguous United States, 1850–2000. *Conservation Biology* 16(4):1123–1136. DOI: 10.1046/j.1523-1739.2002.00414.x
- Mattson, D.J., Herrero, S., Wright, R.G., and Pease, C.M. 1996. Science and Management of Rocky Mountain Grizzly Bears. *Conservation Biology* 10(4):1013–1025. DOI: 10.1046/j.1523-1739.1996.10041013.x

- May, R., van Dijk, J., Landa, A., Andersen, Roy, and Andersen, Reidar. 2010. Spatio-temporal ranging behaviour and its relevance to foraging strategies in wide-ranging wolverines. *Ecological Modelling* 221(6):936–943. DOI: 10.1016/j.ecolmodel.2009.12.024
- May, R., Gorini, L., van Dijk, J., Brøseth, H., Linnell, J.D.C., and Landa, A. 2012. Habitat characteristics associated with wolverine den sites in Norwegian multiple-use landscapes. *Journal of Zoology* 287(3):195–204. DOI: 10.1111/j.1469-7998.2012.00907.x
- McLaren, M. and Green, J.E. 1985. The Reactions of Muskoxen to Snowmobile Harassment. *ARCTIC* 38(3):186–193.
- McLaren, M.A. and Green, J.E. 1985. The reactions of muskoxen to snowmobile harassment. *Arctic* 38(3):188–193.
- McLellan, B.N. 1989. Dynamics of a grizzly bear population during a period of industrial resource extraction. II. Mortality rates and causes of death. *Canadian Journal of Zoology* 67(8):1861–1864. DOI: 10.1139/z89-265
- McLellan, B.N. 1990. Relationships between Human Industrial Activity and Grizzly Bears. *Bears: Their Biology and Management* 8:57–64. International Association for Bear Research and Management. DOI: 10.2307/3872902
- McLellan, B.N. 2015. Some mechanisms underlying variation in vital rates of grizzly bears on a multiple use landscape. *The Journal of Wildlife Management* 79(5):749–765. DOI: 10.1002/jwmg.896
- McLellan, B.N. and Hovey, F.W. 1995. The diet of grizzly bears in the Flathead River drainage of southeastern British Columbia. *Canadian Journal of Zoology* 73(4):704–712. DOI: 10.1139/z95-082
- McLellan, B.N., Hovey, F.W., Mace, R.D., Woods, J.G., Carney, D.W., Gibeau, M.L., Wakkinen, W.L., and Kasworm, W.F. 1999. Rates and Causes of Grizzly Bear Mortality in the Interior Mountains of British Columbia, Alberta, Montana, Washington, and Idaho. *The Journal of Wildlife Management* 63(3):911–920. [Wiley, Wildlife Society]. DOI: 10.2307/3802805
- McLellan, M.L. and McLellan, B. 2015. Effect of Season and High Ambient Temperature on Activity Levels and Patterns of Grizzly Bears (*Ursus arctos*). *PLoS ONE* 10(2). DOI: doi:10.1371/journal.pone.0117734
- McLennan, D., Brown, K., Scharien, R., Else, R., Wilson, K., Humpheries, E., Marsh, P., Ullulaq, J., Park, B., Cockney-Goose, T., Aipellie, G., and Qillaq, N. 2022. Environmental change in the Kitikmeot Region of western Nunavut and Ulukhaktok region of eastern Northwest Territories. Aqhaliat Report. Polar Knowledge 4. Available at: <https://www.canada.ca/content/dam/polar-polaire/documents/publications/aqhaliat/volume-4/aqhaliat-volume-4-english.pdf>
- McLoughlin, P.D., Ferguson, S.H., and Messier, F. 2000. Intraspecific Variation in Home Range Overlap with Habitat Quality: A Comparison among Brown Bear Populations. *Evolutionary Ecology* 14(1):39–60.

- McLoughlin, P.D., Case, R.L., Gau, R.J., Cluff, D.H., Mulders, R., and Messier, F. 2002a. Hierarchical habitat selection by barren-ground grizzly bears in the central Canadian Arctic. *Oecologia* 132(1):102–108. DOI: 10.1007/s00442-002-0941-5
- McLoughlin, P.D., Cluff, H.D., and Messier, F. 2002b. Denning Ecology of Barren-Ground Grizzly Bears in the Central Arctic. *Journal of Mammalogy* 83(1):188–198.
- McLoughlin, P.D., Cluff, H.D., Gau, R.J., Mulders, R.J., Case, R.Y., and Messier, F. 2003a. Effect of spatial differences in habitat on home ranges of grizzly bears. *Écoscience* 10(1):11–16. DOI: 10.1080/11956860.2003.11682744
- McLoughlin, P.D., Taylor, M.K., Cluff, H.D., Gau, R.J., Mulders, R., Case, R.L., and Messier, F. 2003b. Population viability of barren-ground grizzly bears in Nunavut and the Northwest Territories. *Arctic* :185–190.
- Miller, F.L. and Gunn, A. 1979. Responses of Peary caribou and muskoxen to turbo-helicopter harassment, Prince of Wales Island, Northwest Territories, 1976–77. Canadian Wildlife Service, Ottawa.
- Miller, F.L., Gunn, A., and Barry, S.J. 1988. Nursing by Muskox Calves before, during, and after Helicopter Overflights. *ARCTIC* 41:231–235.
- Miller, J.M., Malenfant, R.M., Rivkin, L.R., and et al. 2024. Development of an 8K SNP chip to assess adaptive diversity and hybridization in polar bear. *Conservation Genetics Resources* (16):237–249. DOI: <https://doi.org/10.1007/s12686-024-01359-1>
- Miller, S.J., Barichello, N., and Tait, D. 1982. The grizzly bears of the Mackenzie Mountains, Northwest Territories. Completion Rep. No. 3. NWT Wildlife Service, Yellowknife, NWT. 118 pp.
- Mining and Petroleum Environment Research Group. 2008. Guidelines for Industrial Activity in Bear Country for the Mineral Exploration, Placer Mining, and Oil & Gas Industries. MPERG Report 2008–2. Yukon Environment, Mining and Petroleum Environment Research Group, Whitehorse, Yukon. 21 pp.
- Morgantini, L. 1985. Ungulate encounters with construction materials (pipe, berms, etc) during the building of an underground gas pipeline in western Alberta, Canada. *Alces* 21:215–230.
- Mowat, G., Clevenger, A.P., Kortello, A.D., Hausleitner, D., Barrueto, M., Smit, L., Lamb, C., Dorsey, B., and Ott, P.K. 2020. The Sustainability of Wolverine Trapping Mortality in Southern Canada. *The Journal of Wildlife Management* 84(2):213–226. John Wiley & Sons, Ltd. DOI: 10.1002/jwmg.21787
- Mowat, G. and Heard, D.C. 2006. Major components of grizzly bear diet across North America. *Canadian Journal of Zoology* 84(3):473–489. DOI: 10.1139/z06-016

- Mueller, F.P. 1995. Tundra esker systems and denning by grizzly bears, wolves, foxes, and ground squirrels in the Central Arctic, Northwest Territories. Northwest Territories Department of Renewable Resources, Yellowknife, Northwest Territories. 68 pp. Available at: <https://www.enr.gov.nt.ca/sites/enr/files/115.pdf>
- Muhly, T., Serrouya, R., Neilson, E., Li, H., and Boutin, S. 2015. Influence of In-Situ Oil Sands Development on Caribou (*Rangifer tarandus*) Movement. PLOS ONE 10(9):e0136933. DOI: 10.1371/journal.pone.0136933
- Mulders, R. 2000. Wolverine ecology, distribution, and productivity in the Slave Geological Province. Final Report. West Kitikmeot/Slave Study Society, Yellowknife, NWT.
- Mulders, R., Boulanger, J., and Paetkau, D. 2007. Estimation of population size for wolverines *Gulo gulo* at Daring Lake, Northwest Territories, using DNA based mark-recapture methods. *Wildlife Biology* 13(2):38–51.
- Musante, A.R., Pekins, P.J., and Scarpitti, D.L. 2010. Characteristics and dynamics of a regional moose *Alces alces* population in the northeastern United States. *Wildlife Biology* 16(2):185–204.
- Myers-Smith, I.H., Elmendorf, S.C., Beck, P.S.A., Wilmking, M., Hallinger, M., Blok, D., Tape, K.D., Rayback, S.A., Macias-Fauria, M., Forbes, B.C., Speed, J.D.M., Boulanger-Lapointe, N., Rixen, C., Lévesque, E., Schmidt, N.M., Baittinger, C., Trant, A.J., Hermanutz, L., Collier, L.S., Dawes, M.A., Lantz, T.C., Weijers, S., Jørgensen, R.H., Buchwal, A., Buras, A., Naito, A.T., Ravolainen, V., Schaepman-Strub, G., Wheeler, J.A., Wipf, S., Guay, K.C., Hik, D.S., and Vellend, M. 2015. Climate sensitivity of shrub growth across the tundra biome. *Nature Climate Change* 5(9):887–891. DOI: 10.1038/nclimate2697
- Nagy, J.A. 1990. Biology and Management of Grizzly Bear on the Yukon North Slope. Yukon Fish and Wildlife Branch, Whitehorse, Yukon. 82 pp. Available at: <https://emrlibrary.gov.yk.ca/environment/biology-and-management-of-grizzly-bear-on-the-yukon-north-slope.pdf>
- Nagy, J.A. and Russell, R.H. 1978. Ecological studies of the boreal forest grizzly bear (*Ursus arctos* L.) - annual report for 1977. Canadian Wildlife Service, Edmonton, AB. 85 pp.
- Natural Resources Canada. 2013. EOSD Forest cover map. Natural Resources Canada. Available at: <https://natural-resources.canada.ca/our-natural-resources/forests/sustainable-forest-management/measuring-and-reporting/remote-sensing-forestry/forest-cover-map/13433>. Accessed December 9, 2024.
- Neumann, W. 2009. Moose (*Alces alces*) behaviour related to human activity. Swedish University of Agricultural Sciences. Available at: <https://pub.epsilon.slu.se/id/eprint/2102/contents>
- Neumann, W., Ericsson, G., Dettki, H., and Radeloff, V.C. 2013. Behavioural response to infrastructure of wildlife adapted to natural disturbances. *Landscape and Urban Planning* 114:9–27. DOI: 10.1016/j.landurbplan.2013.02.002

- Nielsen, S.E., Boyce, M.S., and Stenhouse, G.B. 2004. Grizzly bears and forestry I. Selection of clearcuts by grizzly bears in west-central Alberta, Canada. *Forest Ecology and Management* 199(1):51–65. DOI: 10.1016/j.foreco.2004.04.014
- Northrup, J.M., Pitt, J., Muhly, T.B., Stenhouse, G.B., Musiani, M., and Boyce, M.S. 2012. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. *Journal of Applied Ecology* 49(5):1159–1167. DOI: 10.1111/j.1365-2664.2012.02180.x
- NTKP (Naonaiyaotit Traditional Knowledge Project). 2018. Naonaiyaotit Traditional Knowledge Project. Cartographic material, transcripts, quotes, placenames and photos. Proprietary ArcGIS 10.5 Geodatabase and associated textual and photographic databases. Kitikmeot Inuit Association, Kugluktuk NU. Available at: <https://www.ntkp.ca/>
- NIRB. 2024a. Back River Energy Centre Project Proposal. Hearing Volume 3. Nunavut Impact Review Board, Cambridge Bay, Nunavut, Canada. Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=349113&applicationid=125740&sessionid=i39d16tnqcc0ltouqf96fqvos3
- NIRB 2024b. Public Registry. Comment Submissions. NIRB File No. 24XN038. Available at <https://www.nirb.ca/application/>. Accessed January 2026.
- NIRB. 2025a. Revised Draft Guidelines for the Preparation of an Impact Statement For West Kitikmeot Resources Corp's Grays Bay Road and Port Proposal (NIRB File No. 24XN038), September 12, 2025, pursuant to ss. 26 and 101 of the Nunavut Planning and Project Assessment Act, S.C. 2013, C. 14. 107 + app pp.
- NIRB. 2025b. Public Scoping and Impact Statement Guidelines Meetings Summary Report, April 22 to May 05, 2025, and May 13 and 15, 2025, for the Nunavut Impact Review Board's Review of West Kitikmeot God "Gray's Bay Port and Road" Project proposal, NIRB File No.: 24XN038. Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=357317&applicationid=125987&sessionid=3q7m406ln2ogakjpub8j9udck0. Accessed January 2026.
- NIRB. 2026. Guidelines for the Preparation of an Impact Statement for West Kitikmeot Resources Corp's Grays Bay Road and Port Proposal (NIRB File No. 24XN038). Available at: https://www.nirb.ca/portal/dms/script/dms_download.php?fileid=359293&applicationid=125987&sessionid=73ij15k8f2m2n5hsla0cdlsr07
- NWMB (Nunavut Wildlife Management Board). 2023. Government of Nunavut's Proposal to Increase the Total Allowable Harvest for Muskoxen in the MX-11 Management Unit from 225 to 300.
- NWMB. 2024. NWMB Strategic Plan 2024-2029.
- NWMB and GN-DOE (Nunavut Wildlife Management Board and Government of Nunavut - Department of Environment). 2019. Non-Inuit Grizzly Bear Sport Hunt Quota. Iqaluit, Nunavut, Canada. Available at: <https://www.nwmb.com/en/list-all-site-files/decision-documents/terrestrial-mammals/grizzly-bear-2>

- O'Keefe, S. and Rea, R.V. 2012. Evaluating ICBC Animal–Vehicle Crash Statistics (2006-2010) for purposes of collision mitigation in northern British Columbia. Prepared for the Insurance Corporation of British Columbia. 94 pp.
- Olthof, I., Latifovic, R., and Pouliot, D. 2009. Development of a circa 2000 land cover map of northern Canada at 30 m resolution from Landsat. *Canadian Journal of Remote Sensing* 35(2):152–165. DOI: 10.5589/m09-007
- Olthof, I., Latifovic, R., and Pouliot, D. 2015. Northern Land Cover of Canada – Circa 2000. Accessed March 17, 2017.
- Palm, E.C., Apps, C., Avgar, T., and Dickie, M. 2025. Changing grizzly bear space use and functional connectivity in response to human disturbance in the southern Canadian Rocky Mountains. *Conservation Science and Practice* 7(8):e70088. DOI: 10.1111/csp2.70088
- Parmesan, C. 2006. Ecological and Evolutionary Responses to Recent Climate Change. *Annual Review of Ecology, Evolution, and Systematics* 37(1):637–669. DOI: 10.1146/annurev.ecolsys.37.091305.110100
- Pearce-Higgins, J.W., Eglinton, S.M., Martay, B., and Chamberlain, D.E. 2015. Drivers of climate change impacts on bird communities. *Journal of Animal Ecology* 84(4):943–954. DOI: 10.1111/1365-2656.12364
- Persson, J., Wedholm, P., and Segerström, P. 2010. Space use and territoriality of wolverines (*Gulo gulo*) in northern Scandinavia. *European Journal of Wildlife Research* 56(1):49–57. DOI: 10.1007/s10344-009-0290-3
- Plante, S., Dussault, C., Richard, J.H., and Côté, S.D. 2018. Human Disturbance Effects and Cumulative Habitat Loss in Endangered Migratory Caribou. *Biological Conservation* 224:129–143. DOI: 10.1016/j.biocon.2018.05.022
- Polfus, J.L., Hebblewhite, M., and Heinemeyer, K. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. *Biological Conservation* 144(11):2637–2646. DOI: 10.1016/j.biocon.2011.07.023
- Pongracz, J., Paetkau, D., Branigan, M., and Richardson, E. 2017. Recent Hybridization between a Polar Bear and Grizzly Bears in the Canadian Arctic. *ARTIC* 70(2):151–160. DOI: 10.14430/arctic4643
- Prichard, A.K., Lawhead, B.E., Lenart, E.A., and Welch, J.H. 2020. Caribou Distribution and Movements in a Northern Alaska Oilfield. *The Journal of Wildlife Management* 84(8):1483–1499. DOI: 10.1002/jwmg.21932
- Prichard, A.K., Welch, J.H., and Lawhead, B.E. 2022. The Effect of Traffic Levels on the Distribution and Behaviour of Calving Caribou in an Arctic Oilfield. *ARCTIC* 75(1):1–19. DOI: 10.14430/arctic74609

- Priest, H. and Usher, P.J. 2004. Nunavut Wildlife Harvest Study. Nunavut Wildlife Management Board, Iqaluit, Nunavut. 822 pp. Available at: <http://www.nwmb.com/inu/publications/harvest-study/1824-156-nwhs-report-2004-156-0003/file>
- Prno, J., Bradshaw, B., Wandel, J., Pearce, T., Smit, B., and Tozer, L. 2011. Community vulnerability to climate change in the context of other exposure-sensitivities in Kugluktuk, Nunavut. *Polar Research* 30(1):7363. Norwegian Polar Institute. DOI: 10.3402/polar.v30i0.7363
- Putkonen, J., Grenfell, T., Rennert, K., Bitz, C., Jacobson, P., and Russell, D. 2009. Rain on Snow: Little Understood Killer in the North. *Eos, Transactions, American Geophysical Union* 90(26):221–222.
- Remm, K. and Luud, A. 2003. Regression and point pattern models of moose distribution in relation to habitat distribution and human influence in Ida-Viru county, Estonia. *Journal for Nature Conservation* 11(3):197–211. DOI: 10.1078/1617-1381-00046
- Rempel, R.S., Carlson, M., Rodgers, A.R., Shuter, J.L., Farrell, C.E., Cairns, D., Stelfox, B., Hunt, L.M., Mackereth, R.W., and Jackson, J.M. 2021. Modeling Cumulative Effects of Climate and Development on Moose, Wolf, and Caribou Populations. *The Journal of Wildlife Management* 85(7):1355–1376. DOI: 10.1002/jwmg.22094
- Reynolds, P.E., Wilson, K.J., Klein, D.R., 2002, Muskoxen: Biological Science Report 2002-0001, 11 p.
- Reynolds, P.E. 1998. Dynamics and range expansion of a reestablished muskox population. *The Journal of wildlife management* 62(2):734–744. DOI: <https://doi.org/10.2307/3802350>
- Reynolds, H.V., Curatolo, J.A., and Quimby, R. 1976. Denning Ecology of Grizzly Bears in Northeastern Alaska. *Bears: Their Biology and Management* 3:403–409. International Association for Bear Research and Management. DOI: 10.2307/3872790
- Reynolds, P.E., Reynolds, H.V., and Follmann, E.H. 1986. Responses of Grizzly Bears to Seismic Surveys in Northern Alaska. *Bears: Their Biology and Management* 6:169–175. DOI: 10.2307/3872821
- Roberts, D.R., Nielsen, S.E., and Stenhouse, G., B. 2014. Idiosyncratic responses of grizzly bear habitat to climate change based on projected food resource change. *Ecological Applications* 24(5):1144–1154.
- Roever, C.L., Boyce, M., and Stenhouse, G. 2008. Grizzly bears and forestry: I: Road vegetation and placement as an attractant to grizzly bears. *Forest Ecology and Management* 256. DOI: 10.1016/j.foreco.2008.06.040
- Roever, C.L., Boyce, M.S., and Stenhouse, G.B. 2010. Grizzly bear movements relative to roads: application of step selection functions. *Ecography* 33(6):1113–1122. DOI: 10.1111/j.1600-0587.2010.06077.x
- Rolandsen, C.M., Solberg, E.J., Sæther, B.-E., Moorter, B.V., Herfindal, I., and Bjørneraas, K. 2017. On fitness and partial migration in a large herbivore – migratory moose have higher reproductive performance than residents. *Oikos* 126(4):547–555. DOI: 10.1111/oik.02996

- Rolley, R. and Keith, L. 1980. Moose Population Dynamics and Winter Habitat Use at Rochester, Alberta, 1965-1979. *Canadian Field-Naturalist* 94(1):9–18.
- Rosa, K. 2020. Managing through change: Indigenous knowledge, climate change and the case of moose in Nunatsiavut. Trent University, Peterborough, ON. 231 pp. Available at: https://digitalcollections.trentu.ca/flysystem/fedora/2022-04/Managing_Through_Change_Indigenous_knowledge_climate_change_and_the_case_of_moose_in_Nunatsiavut.pdf
- Rowland, M.M., Wisdom, M.J., Johnson, D.H., Wales, B.C., Copeland, J.P., and Edelmann, F.B. 2003. Evaluation of Landscape Models for Wolverines in the Interior Northwest, United States of America. *Journal of Mammalogy* 84(1):92–105. DOI: 10.1644/1545-1542(2003)084<0092:EOLMFW>2.0.CO;2. Available at: [https://doi.org/10.1644/1545-1542\(2003\)084<0092:EOLMFW>2.0.CO;2](https://doi.org/10.1644/1545-1542(2003)084<0092:EOLMFW>2.0.CO;2)
- Rudd, L.T. and Irwin, L.L. 1985. Winter moose VS. oil/gas activity in western Wyoming. *Alces* 21:279–298.
- Ruggiero, L.F., Aubry, K.B., Buskirk, S.W., Lyon, L.J., and Zielinski, W.J. 1994. The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States. General Technical Report RM-254. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station. 198 pp.
- Russell, D.E., White, R.G., and Daniel, C.J. 2005. Energetics of the Porcupine caribou herd: A computer simulation model. Tech. Rep. Series 431.
- Russell, J. 1979. Some overt responses of muskox and caribou to seismic activities, northeastern Banks Island March and April 1977. Report to Northwest Territories Fish and Wildlife Service. Yellowknife, NWT, Canada. 85 pp.
- Scheffers, B.R., De Meester, L., Bridge, T.C.L., Hoffmann, A.A., Pandolfi, J.M., Corlett, R.T., Butchart, S.H.M., Pearce-Kelly, P., Kovacs, K.M., Dudgeon, D., Pacifici, M., Rondinini, C., Foden, W.B., Martin, T.G., Mora, C., Bickford, D., and Watson, J.E.M. 2016. The broad footprint of climate change from genes to biomes to people. *Science* 354(6313):aaf7671. DOI: 10.1126/science.aaf7671
- Schmidt, N.M., Van Beest, F.M., Mosbacher, J.B., Stelvig, M., Hansen, L.H., Nabe-Nielsen, J., and Grøndahl, C. 2016. Ungulate movement in an extreme seasonal environment: year-round movement patterns of high-arctic muskoxen. *Wildlife Biology* 22:253–267. DOI: doi: 10.2981/wlb.00219
- Schoen, J.W. 1990. Bear Habitat Management: A Review and Future Perspective. *Bears: Their Biology and Management* 8:143–154. International Association for Bear Research and Management. DOI: 10.2307/3872914

- Schoen, J.W., Beier, L.R., Lentfer, J.W., and Johnson, L.J. 1987. Denning Ecology of Brown Bears on Admiralty and Chichagof Islands. *Bears: Their Biology and Management* 7:293–304. DOI: 10.2307/3872636
- Schwartz, C.C., Haroldson, M.A., and White, G.C. 2010. Hazards Affecting Grizzly Bear Survival in the Greater Yellowstone Ecosystem. *The Journal of Wildlife Management* 74(4):654–667. [Wiley, Wildlife Society].
- Scrafford, M. and Boyce, M. 2015. Effects of industrial development on wolverine (*Gulo gulo*) ecology in the boreal forest of northern Alberta. *Wolverine Project Progress Report – Winter 2014/2015*. University of Alberta.
- Scrafford, M. and Ray, J. 2022. Wolverine denning ecology and Ontario’s Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales: FAQ and Recommendations. Wildlife Conservation Society Canada. Available at: <https://library.wcs.org/DesktopModules/Bring2mind/DMX/API/Entries/Download?EntryId=44360&PortalId=96&DownloadMethod=attachment>
- Scrafford, M.A., Avgar, T., Abercrombie, B., Tigner, J., and Boyce, M.S. 2017. Wolverine habitat selection in response to anthropogenic disturbance in the western Canadian boreal forest. *Forest Ecology and Management* 395:27–36. DOI: 10.1016/j.foreco.2017.03.029
- Scrafford, M.A., Avgar, T., Heeres, R., and Boyce, M.S. 2018. Roads elicit negative movement and habitat-selection responses by wolverines (*Gulo gulo luscus*). *Behavioral Ecology* 29(3):534–542. DOI: 10.1093/beheco/arx182
- Scrafford, M.A., Copeland, J., McCaw, L.K., Sawaya, M.A., and Boyce, M. 2025. Wolverines and wilderness: a review of wolverine response to human disturbance. *Environmental Reviews* 33:1–15. DOI: 10.1139/er-2024-0125
- Seewagen, C.L. and Adams, A.M. 2021. Turning to the dark side: LED light at night alters the activity and species composition of a foraging bat assemblage in the northeastern United States. *Ecology and Evolution* 11(10):5635–5645. John Wiley & Sons, Ltd. DOI: 10.1002/ece3.7466
- Seiler, A. 2005. Predicting locations of moose–vehicle collisions in Sweden. *Journal of Applied Ecology* 42(2):371–382. DOI: 10.1111/j.1365-2664.2005.01013.x
- Seiler, A., Helldin, J.O. 2006. Chapter 8: Mortality in Wildlife Due to Transportation. *The Ecology of Transportation: Managing Mobility for the Environment*. 2006. pp 165-189
- Sevelka, T. 2022. Blasting quarry operations: land use compatibility issues and potential property value impacts. *Journal of Environmental Law & Policy* 2(3):1–78. DOI: 10.33002
- Shannon, G., McKenna, M.F., Angeloni, L.M., Crooks, K.R., Fristrup, K.M., Brown, E., Warner, K.A., Nelson, M.D., White, C., Briggs, J., McFarland, S., and Wittemyer, G. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife: effects of anthropogenic noise on wildlife. *Biological Reviews* 91(4):982–1005. DOI: 10.1111/brv.12207

- Sharma, R., Harms, N.J., Kukka, P.M., Jung, T.S., Parker, S.E., Ross, S., Thompson, P., Rosenthal, B., Hoberg, E.P., and Jenkins, E.J. 2021. High prevalence, intensity, and genetic diversity of *Trichinella* spp. in wolverine (*Gulo gulo*) from Yukon, Canada. *Parasites & Vectors* 14(1):146. DOI: 10.1186/s13071-021-04636-2
- Singer, F.J. and Beattie, J.B. 1986. The controlled traffic system and associated wildlife responses in Denali National Park. *Arctic* 39(3):195–203.
- Slavik, D. 2010. Inuvialuit Knowledge of Nanuq: Community and Traditional Knowledge of Polar Bears in the Inuvialuit Settlement Region. Wildlife Management Advisory Council (NWT), Wildlife Management Advisory Council North Slope, and Inuvialuit Game Council. 68 pp.
- Smereka, C.A., Edwards, M.A., Pongracz, J., Branigan, M., Pilfold, N.W., and Derocher, A.E. 2017. Den selection by barren-ground grizzly bears, Mackenzie Delta, Northwest Territories. *Polar Biology* 40(3):503–516. DOI: 10.1007/s00300-016-1974-2
- Species at Risk Committee. 2014. Species Status Report for Wolverine (*Gulo gulo*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. 146 pp.
- Stankowich, T. 2008. Ungulate flight responses to human disturbance: A review and meta-analysis. *Biological Conservation* 141(9):2159–2173.
- Starbuck, C.A., Considine, E.S., and Chambers, C.L. 2020. Water and elevation are more important than burn severity in predicting bat activity at multiple scales in a post-wildfire landscape. *PLOS ONE* 15(4):e0231170. Public Library of Science. DOI: 10.1371/journal.pone.0231170
- Stenhouse, G.B., Latour, P.B., Kutny, L., MacLean, N., and Glover, G. 1995. Productivity, Survival, and Movements of Female Moose in a Low-Density Population, Northwest Territories, Canada. *Arctic* 48(1):57–62.
- Stewart, F.E.C., Heim, N.A., Clevenger, A.P., Paczkowski, J., Volpe, J.P., and Fisher, J.T. 2016. Wolverine behavior varies spatially with anthropogenic footprint: implications for conservation and inferences about declines. *Ecology and Evolution* 6(5):1493–1503. DOI: 10.1002/ece3.1921
- Stuart, K. 1984. Wildlife-vehicle accidents in British Columbia, April 1982 - March 1983. BC Ministry of Environment.
- Sweanor, P.Y. and Sandegren, F. 1989. Winter-range philopatry of seasonally migratory moose. *Journal of Applied Ecology* 26(1):25–33.
- Swift, T.L. and Hannon, S.J. 2010. Critical thresholds associated with habitat loss: a review of the concepts, evidence, and applications. *Biological Reviews* 85(1):35–53. DOI: 10.1111/j.1469-185X.2009.00093.x
- Tape, K.D., Christie, K., Carroll, G., and O'Donnell, J.A. 2016a. Novel wildlife in the Arctic: the influence of changing riparian ecosystems and shrub habitat expansion on snowshoe hares. *Global Change Biology* 22(1):208–219. DOI: 10.1111/gcb.13058

- Tape, K.D., Gustine, D.D., Ruess, R.W., Adams, L.G., and Clark, J.A. 2016b. Range Expansion of Moose in Arctic Alaska Linked to Warming and Increased Shrub Habitat. PLOS ONE 11(4):e0152636. DOI: 10.1371/journal.pone.0152636
- Tape, K.D., Jones, B.M., Arp, C.D., Nitze, I., and Grosse, G. 2018. Tundra be dammed: Beaver colonization of the Arctic. Global Change Biology 24(10):4478–4488. DOI: 10.1111/gcb.14332
- Tener, J.S. 1965. Muskoxen in Canada, a biological and taxonomic review. Monograph Series No. 2. Canadian Wildlife Service, Ottawa. Available at: https://publications.gc.ca/collections/collection_2018/ecccc/CW69-4-51-1990-eng.pdf
- Thomas, J.W., Gill, J.D., Pack, J.C., Healy, W.M., and Sanderson, H.R. 1976. Influence of Forestland Characteristics on Spatial Distribution of Hunters. The Journal of Wildlife Management 40(3):500–506. [Wiley, Wildlife Society]. DOI: 10.2307/3799954
- Thorpe Consulting Services Ltd. 2014a. The Caribou is the Boss of the Mine: Izok Corridor Project Caribou Inuit Qaujimajatuqangit Report. Results from Interviews and a Workshop carried out in Qurluqtuq (Kugluktuk) in 2012. Prepared by N. Thorpe and K. Scott with contributions from M. Kakkianun and G. Angulalik for MMG Ltd. Vancouver, BC.
- Thorpe Consulting Services Ltd. 2014b. We are Saying Something Everybody can Understand: Marine and Land Inuit Qaujimajatuqangit Report for the Izok Corridor Project (Inuit Version). Results from a Workshop carried out with Inuit and Inuvialuit in Iqaluktuuttiaq (Cambridge Bay) in March 2013. Prepared by N. Thorpe and K. Scott with contributions from M. Kakkianun and G. Angulalik for MMG Ltd., Vancouver, BC.
- Tomasik, E. and Cook, J.A. 2005. Mitochondrial Phylogeography and Conservation Genetics of Wolverine (*Gulo gulo*) of Northwestern North America. Journal of Mammalogy 86(2):386–396. DOI: 10.1644/BER-121.1
- Treseder, L. and Graf, R. 1985. Moose in the Northwest Territories - A Discussion Paper. Manuscript Report 13. NWT Wildlife Service, Renewable Resources, Government of Northwest Territories, Yellowknife, NWT. 39 pp.
- US EPA (United States Environmental Protection Agency). 1995. Compilation of air pollutant emission factors. Volume 1. Stationary point and area sources. Fifth edition. PB--95-196028/XAB; AP--42-ED-5. Environmental Protection Agency, Research Triangle Park, NC (United States). Office of Air Quality Planning and Standards. Available at: <https://www.epa.gov/biblio/104236>
- van Beest, F., López-Blanco, E., Hansen, L., and Schmidt, N. 2023. Extreme shifts in habitat suitability under contemporary climate change for a high-Arctic herbivore. Climatic Change 176(31). DOI: 10.1007/s10584-023-03510-7
- van der Veen, B., Mattisson, J., Zimmermann, B., Odden, J., and Persson, J. 2020. Refrigeration or anti-theft? Food-caching behavior of wolverines (*Gulo gulo*) in Scandinavia. Behavioral Ecology and Sociobiology 74(5):52. DOI: 10.1007/s00265-020-2823-4

- van Dijk, J., Gustavsen, L., Mysterud, A., May, R., Flagstad, Ø., Brøseth, H., Andersen, Roy, Andersen, Reidar, Steen, H., and Landa, A. 2008. Diet shift of a facultative scavenger, the wolverine, following recolonization of wolves. *Journal of Animal Ecology* 77(6):1183–1190. DOI: 10.1111/j.1365-2656.2008.01445.x
- Vangen, K.M., Persson, J., Landa, A., Andersen, R., and Segerström, P. 2001. Characteristics of dispersal in wolverines. *Canadian Journal of Zoology* 79(9):1641–1649. NRC Research Press. DOI: 10.1139/z01-124
- Vigeant-Langlois, C. and Desrochers, A. 2011. Movements of wintering American marten (*Martes americana*): relative influences of prey activity and forest stand age. *Canadian Journal of Forest Research* 41(11):2202–2208. DOI: 10.1139/x11-133
- Wasser, S.K., Keim, J.L., Taper, M.L., and Lele, S.R. 2011. The influences of wolf predation, habitat loss, and human activity on caribou and moose in the Alberta oil sands. *Frontiers in Ecology and the Environment* 9(10):546–551. DOI: 10.1890/100071
- Watkinson, A.D., Virgl, J., Miller, V.S., Naeth, M.A., Kim, J., Serben, K., Shapka, C., and Sinclair, S. 2021. Effects of dust deposition from diamond mining on subarctic plant communities and barren-ground caribou forage. *Journal of Environmental Quality* 50(4):990–1003. DOI: 10.1002/jeq2.20251
- Watson, S.E., Hailer, F., Lecomte, N., Kafle, P., Sharma, R., Jenkins, E.J., Awan, M., L'Hérault, V., and Perkins, S.E. 2020. Parasites of an Arctic scavenger; the wolverine (*Gulo gulo*). *International Journal for Parasitology: Parasites and Wildlife* 13:178–185. DOI: 10.1016/j.ijppaw.2020.10.004
- Wattles, D.W., Zeller, K.A., and DeStefano, S. 2018. Response of moose to a high-density road network: Road Avoidance by Moose. *The Journal of Wildlife Management* 82(5):929–939. DOI: 10.1002/jwmg.21459
- Weir, J.N., Mahoney, S.P., McLaren, B., and Ferguson, S.H. 2007. Effects of Mine Development on Woodland Caribou *Rangifer tarandus* Distribution. *Wildlife Biology* 13(1):66–74. DOI: 10.2981/0909-6396(2007)13[66:EOMDOW]2.0.CO;2
- White, R., Rowell, J.E., and Hauer, W.E. 1997. The role of nutrition, body condition and lactation on calving success in muskoxen. *Journal of Zoology* 243(1).
- White, K.S., Barten, N.L., Crouse, S., and Crouse, J. 2014. Benefits of migration in relation to nutritional condition and predation risk in a partially migratory moose population. *Ecology* 95(1):225–237. DOI: 10.1890/13-0054.1
- Whitman, J.S., Ballard, W.B., and Gardner, C.L. 1986. Home Range and Habitat Use by Wolverines in Southcentral Alaska. *The Journal of Wildlife Management* 50(3):460. DOI: 10.2307/3801105
- Wiebe, N., Samlious, G., Alisauskas, R.T., Bantle, J.L., Bergman, C., De Carle, R., Hendrickson, C.J., Lusignan, A., Phipps, K.J., and Pitt, J. 2009. Foraging behaviours and diets of wolves in the Queen Maud Gulf Bird Sanctuary Nunavut, Canada. *Arctic* 62(4):399–404.

- WMAC (Wildlife Management Advisory Council). 2018. Wildlife Management Advisory Council - North Slope, Annual Report. Annual Report. Whitehorse Yukon.
- WMAC (North Slope). 2008. Aklavik local and traditional knowledge about grizzly bears of the Yukon North Slope: Final Report. Wildlife Management Advisory Council (North Slope), Whitehorse Yukon.
- Wildlife Research Section. 2007. Recommendations of total allowable harvest (TAH) rates for the terrestrial wildlife populations in Nunavut. Final Wildlife Report. 4. Government of Nunavut Department of Environment, Iqaluit, Nunavut. 84 pp.
- Williams, T.M. 1990. Summer diet and behaviour of wolves denning on barren-ground caribou range in the Northwest Territories, Canada. M.Sc. Thesis. University of Alberta, Edmonton, Alberta.
- Wilson, D.E. 1982. Wolverine. pp. 644–652. In J.A. Chapman, G.A. Feldhammer (eds.) Wild Mammals of North America. John Hopkins University Press, Baltimore, MD.
- Winbourne, J. and Benson, K. 2021. Species Status Report (traditional and Community Knowledge Component) for Muskoxen (*Ovibos moschatus*) in the Northwest Territories. Manuscript Report No. 292. Government of Northwest Territories, Victoria, BC.; San Clara, MB.
- Wolfden (Wolfden Resources Inc.). 2006. High Lake Draft Environmental Impact Statement Volume 3, Section 4: Inuit Qaujimajatuqangit. 061127-06MN082. Thunder Bay, Ontario. 59 pp.
- Wood, J.E., Gillis, M.D., Goodenough, D.G., Hall, R.J., Leckie, D.G., Luther, J.E., and Wulder, M.A. 2002. Earth Observation for Sustainable Development of Forests (EOSD): project overview, IEEE International Geoscience and Remote Sensing Symposium, IEEE International Geoscience and Remote Sensing Symposium. IGARSS 2002, Volume 3, 1299–1302 pp. IEEE, Toronto, Ont., Canada. DOI: 10.1109/IGARSS.2002.1026097. Available at: <http://ieeexplore.ieee.org/document/1026097/>
- Woodford, R. and Beckmen, K. 2012. Rabies in Alaska: Rabid Wolverine Found on North Slope.
- Wright, S., E. and Dolbeer, R., A. 1998. Deer on airports: an accident waiting to happen. Proceedings of the Vertebrate Pest Conference 18. DOI: 10.5070/V418110127. Available at: <https://escholarship.org/uc/item/63w251jh>
- Wu, J., Checkley, S., Dumond, M., and Kutz, S. 2011. 2010 Muskox Health Survey: Victoria Island. KFL 2010. Kitikmeot Food Ltd, Calgary, AB (University of Calgary).
- Yost, A.C. and Wright, R.G. 2001. Moose, caribou, and grizzly bear distribution in relation to road traffic in Denali National Park, Alaska. Arctic 54(1):41–48.

18.23.2 Personal Communications

- Paetkau, D. 2012. Personal communication. May 7, 2012.