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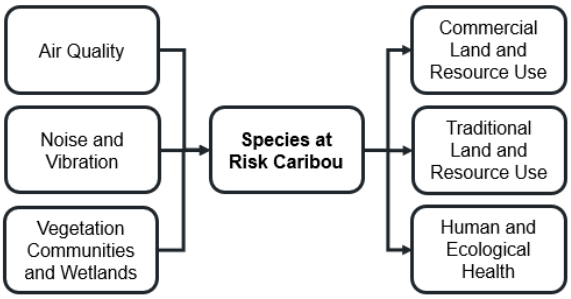
6.13 Boreal Caribou

The Project is located within the northern portion of the Churchill range and adjacent to the Berens and Kinloch ranges for Boreal Caribou. Boreal Caribou are a valued species classified as Threatened under the provincial *Endangered Species Act (ESA)* and the federal *Species at Risk Act (SARA)*. Several complex factors contribute to the abundance and distribution of caribou across the landscape and ultimately drive population status and trends over time. These factors are described and considered in the Boreal Caribou VC section towards informing potential Project-related effects on population status and trends in the future. This work intends to inform both Project-specific mitigation and monitoring to achieve an overall benefit for the species, and to support information sharing for the overall Boreal Caribou range management responsibilities of government.

In the absence of mitigation, the assessment of potential changes on Caribou are directly linked to other VCs and is informed by the following sections:

- **Air Quality (Section 6.2):** the assessment of the potential effects on air quality includes changes in dust deposition during construction and operation of the Project that may have indirect effects on habitat for Boreal Caribou.
- **Noise and Vibration (Section 6.3):** the assessment of potential effects from noise and vibration includes changes in sound levels during construction and operation of the Project which may have indirect effects on habitat due to sensory disturbance.
- **Vegetation Communities and Wetlands (Section 6.11):** the assessment of potential effects on vegetation communities and wetlands includes changes in abundance and function of vegetation communities during construction and operation of the Project, which may affect habitat for Boreal Caribou.



In addition, the assessment of potential changes on Boreal Caribou is also directly linked to other VCs, and informs the analysis of the following sections:

- **Commercial Land and Resource Use (Section 6.17):** the assessment of potential effects on commercial land and resources is informed by changes in habitat for Boreal Caribou during construction of the Project, which may affect wildlife resources used by local users for trapping.
- **Traditional Land and Resource Use (Section 6.21):** the assessment of potential effects on traditional land and resource use is informed by changes in habitat for Boreal Caribou during construction of the Project, which may affect traditionally harvested wildlife species like Boreal Caribou used by Indigenous people.
- **Human and Ecological Health (Section 6.24):** the assessment of potential effects on human and ecological health is informed by changes in the function of habitat for Boreal Caribou from dust deposition during construction and operation of the Project, which may affect potential contaminants that could be ingested by humans.

The assessment of the potential changes on Boreal Caribou from the Project are compared to relevant provincial and federal criteria (Section 6.13.1.4) and existing conditions (Section 6.13.2). The terrestrial

resources technical support documentation is included in Appendix P, which includes the Baseline Terrestrial Report (Appendix P-3).

6.13.1 Assessment Approach

The approach to the assessment of potential effects on Boreal Caribou includes a description of the relevant regulatory and policy setting, a description of the input obtained through consultation specific to this VC, the identification of criteria along with the associated rationale, a description of the spatial and temporal boundaries used for this VC, and a description of the attributes used to determine the significance of any residual adverse effects. The assessment of potential effects is supported by a description of the existing conditions for the VC (Section 6.13.2), the identification and description of applicable pathways of potential effects on the VC (Section 6.13.3) and a description of applicable mitigation measures for the VC (Section 6.13.4). An outline of the analytical methodology conducted for the assessment and the key assumptions and/or conservative approach is found in Section 6.13.5.7. With the application of mitigation measures to the potential effects on the VC, the residual effects are then characterized in Section 6.13.5.7 and the significance of the residual effects is determined in Section 6.13.6.

6.13.1.1 Regulatory and Policy Setting

The effects assessment for Caribou has been prepared in accordance with the requirements of the federal Environmental Impact Statement (EIS) Guidelines (Appendix B-1 and the provincial approved Amended Terms of Reference (ToR; Appendix B-3). Concordance tables, indicating where EIS Guidelines and ToR requirements have been addressed, are provided in Appendix B-2 and B-5, respectively. Government policies, objectives, standards or guidelines most relevant to the VC are summarized below.

Federal *Species at Risk Act*

The *Species at Risk Act* (SARA; S.C. 2002, c. 29) was passed into law in 2002 and was last amended on February 2023. The SARA is administered throughout Canada by Environment and Climate Change Canada (ECCC). The purpose of the SARA is to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species, and to manage species to prevent further risk to their status. SARA provides legal protection to SAR listed in Schedule 1 if they have a designation of Extirpated, Endangered, or Threatened with respect to harming the species (Section 32 of SARA) or its residence (Section 33 of SARA). The SARA applies to federal lands (e.g., First Nations reserve lands) and outside of federal lands to Boreal Caribou.

Boreal Caribou are federally designated as Threatened, and as a result a Federal Recovery Strategy for Boreal Caribou (Environment Canada 2012) is in place that identifies their critical habitat and requirements for protection (ECCC 2020). Notably, SARA prohibitions can be applied if provincial legislation or voluntary measures do not adequately protect federally listed species and their residence. Generally, compliance with provincial legislation in Ontario does satisfy the requirements under the SARA.

In addition, a Conservation Agreement for Boreal Caribou in Ontario and Federal Action Plan for Boreal Caribou are in place to support the Federal Recovery Strategy and must also be considered.

Conservation Agreement for Boreal Caribou in Ontario

Canada and Ontario are acting on a shared commitment to Boreal Caribou conservation and recovery. The Agreement builds on Ontario's ongoing Boreal Caribou conservation program and the federal Boreal Caribou action plan but does not create or alter legal powers or duties under existing legislation. This

Agreement will support the implementation of Conservation Measures, building on the base of existing management frameworks.

Ontario's Boreal Caribou Conservation Framework includes:

- The Ontario Endangered Species Act (ESA);
- Ontario's Woodland Boreal Caribou Conservation Plan;
- The Range Management Policy in Support of Woodland Boreal Caribou Conservation and Recovery;
- The General Habitat Description for the Forest-dwelling Woodland Boreal Caribou; and
- The Forest Management Guide for Boreal Landscapes ("BLG") made under the CFSA which includes:
    - Consideration of Integrated Range Assessment Reports and range condition,
    - Use of decision support tools (e.g., Ontario Landscape Tool) for assessing and managing the amount and arrangement of Boreal Caribou habitat consistent with simulated ranges of natural variation (SRNV), and
    - Managing Boreal Caribou sub-range habitat features (i.e., biophysical attributes such as calving areas).

Canada has committed to continuing to implement the pillars of the 2018 Federal Action Plan for Boreal Caribou (ECCC 2018), including the assessment of critical habitat.

Federal Action Plan for Boreal Caribou

Building on the Federal Recovery Strategy for Boreal Caribou (Environment Canada 2012), the federal government will continue to support the recovery of Boreal Caribou. The 2018 Federal Action Plan for Boreal Caribou (ECCC 2018) to describes the federal government's contribution to the recovery efforts. As the Federal Action Plan progresses, additional measures required by the *Species at Risk Act* (SARA) will be implemented. Fulfillment of SARA requirements would be accomplished as provinces/territories complete their range plans or similar documents, which can be adopted over time as subsequent action plans for the species.

Federal Offsetting Policy for Biodiversity

The draft Offsetting Policy for Biodiversity (ECCC 2020) outlines Environment and Climate Change Canada's (ECCC) approach to the application, design, and implementation of offsets for biodiversity. Offsetting is an approach to managing residual adverse effects to biodiversity for proposed Project developments (ECCC 2020). The principles in this policy reflect international best practices which promote consistent application of offsets across regulatory and policy regimes ECCC 2020). The policy applies to residual adverse effects where it has been determined that offsetting is required, under the *Canadian Environmental Assessment Act* or the *Species at Risk Act*.

The mitigation hierarchy establishes an order of preference that promotes Project development designs with the least environmental effect (ECCC 2020). It functions to eliminate as many potential adverse effects through the impact assessment process, prioritizing measures in the following order (ECCC 2020):

- Avoidance (e.g. re-design or re-locate Project);
- Minimization (e.g. adjusting the Project construction schedule to protect critical life stages of species and implementing erosion and sediment control measures);

- On-site restoration (e.g. revegetating disturbed areas after construction); and
- Offsetting (e.g. habitat restoration, enhancement, creation or protection Projects).

Avoidance and minimization measures take priority because they address adverse effects proactively, thereby reducing environmental harm and reliance upon on-site restoration and offsetting measures (ECCC 2020). Technically feasible measures to avoid or minimize adverse effects should be considered at each step of the mitigation hierarchy.

ECCC 2020 advises that where adverse effects remain after implementation of avoidance and minimization measures, on-site restoration measures can be used to rehabilitate impacted ecosystem components and functions at Project sites once construction activities are complete (e.g. temporary work areas, laydown area, access roads). The extent to which all preceding mitigation reduces adverse effects informs the need for and extent of offsetting.

Offsets are used to address residual adverse effects, after it has been determined that options in the previous steps of the mitigation hierarchy have been considered and applied.

Provincial *Endangered Species Act*

The ESA came into effect on June 30, 2008 and is enforced by the Ministry of the Environment, Conservation and Parks (MECP), however, SAR are determined by the Committee on the Status of Species at Risk in Ontario (COSSARO). If a species is listed under the ESA as Extirpated, Endangered, or Threatened, Section 9 of the ESA prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. Similarly, Section 10 of the ESA prohibits the damage or destruction of the habitat of all Endangered and Threatened species. Protection under the ESA extends to both public and private lands. Habitat is the area prescribed by regulation as the habitat of the species or an area on which the species depends directly or indirectly to carry on its life processes, including reproduction, rearing of young, hibernation, migration or feeding. Species listed as Special Concern are not afforded protection under Sections 9 and 10 of the ESA; however, the Provincial Policy Statement provides protection through Significant Wildlife Habitat.

The MECP may authorize damage to habitat or individuals by way of registration or a permit commonly referred to as an "overall benefit permit". The requirements of the permit include:

- Demonstration that reasonable alternatives were considered;
- Documentation of steps taken to limit residual effects on the species; and
- Commitment to undertake measures that will achieve an overall benefit to the species.

Based on fieldwork and secondary sources, a SAR screening was completed, and SAR species have been confirmed or considered to have a high potential to occur at the Project, including Boreal Caribou, which are designated as Threatened under the ESA.

If impacts on Boreal Caribou or their habitat cannot be fully avoided, a permit will be required under the ESA including achieving an overall benefit for the species.

Provincial Caribou Recovery Strategy and Range Management Policy

Section 11 of the ESA requires recovery strategies and government response statements to be prepared within prescribed timelines for species listed as endangered or threatened. In 2008, the Recovery Strategy for the Woodland Boreal Caribou (Forest-dwelling, Boreal population) in Ontario (Ontario Woodland Boreal

Caribou Recovery Team 2008) was finalized. In response to the recovery strategy, Ontario released the government's response statement, known as Ontario's Woodland Boreal Caribou Conservation Plan (CCP) (MNR 2009) in October 2009. The CCP outlines the government's goal for the recovery of Boreal Caribou, provides broad policy direction and identifies actions the Ontario government intends to take to conserve and recover Boreal Caribou in Ontario. The CCP identifies ranges and prescribes the adoption of a Range Management Approach.

The Range Management Approach involves managing range-level cumulative disturbance, habitat amount and arrangement, and the ecological function of sub-range habitat features. The Range Management Policy in Support of Woodland Boreal Caribou Conservation and Recovery (MECP 2019) includes direction on the integration of range condition into activity review and assessment in the context of species and habitat protection under the ESA, which informs planning and decision-making. It supports the preliminary screening phase and other elements of the ESA Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits (MNR 2012b).

General Habitat Description

To clarify the area of habitat protected for a species at risk designated under the ESA, a general habitat description (GHD) is defined in a technical document based on the general habitat definition found in the ESA. It also indicates how the species' habitat has been categorized, as per the policy Categorizing and Protecting Habitat Under the ESA (MNR 2012a) and is based on the best scientific information available. Under the Forest-dwelling Woodland Boreal Caribou (MECP 2020) technical document, GHD is categorized as follows:

- Category 1 – Nursery areas, winter use areas;
- Category 2 – Seasonal ranges; and
- Category 3 – Remaining areas within the range.

The Project area is comprised of Category 1, Category 2 and Category 3 habitats for Boreal Caribou.

Ontario's Woodland Boreal Caribou Conservation Plan

In addition, Ontario has prepared a Woodland Boreal Caribou Conservation Plan (MNR 2009), with the purpose to:

- Provide broad policy direction regarding Woodland Boreal Caribou conservation and recovery;
- Summarize the actions the Government of Ontario intends to take in response to recommendations in the Ontario Woodland Boreal Caribou Recovery Strategy and the government's priorities in taking those actions (Government Response Statement); and
- Outline initiatives to support Woodland Boreal Caribou recovery.

6.13.1.2 Influence of Consultation with Indigenous Communities, Government, and the Public

Consultation has been ongoing for several years, prior to and throughout the environmental assessment process, and will continue with Indigenous communities, government agencies and the public through the life of the Project. Section 2 provides more detail on the consultation process. The Record of Consultation (Appendix D) includes detailed comments received, and responses provided, during the development of the final EIS/EA.

Feedback received through consultation has been addressed through direct responses (in writing and follow up meetings) and incorporated in the final EIS/EA, as appropriate. The key comments that influenced the assessment for noise and vibration between the draft and final EIS/EA is provided below:

Baseline

The IAAC identified several gaps in the draft EIS/EA baseline information regarding Boreal Caribou and their habitat, including a lack of comprehensive information on seasonal movements and habitats such as overwintering and calving areas as well movement behaviours and landscape connectivity. IAAC had uncertainty in the 2021 survey data due to snow cover, requiring more data for reliable conclusions. Three additional aerial surveys with expanded geographic coverage have been carried out since 2021, as described in Section 6.13.2.2 and the Terrestrial Baseline Report (Appendix P1). A comprehensive satellite telemetry program was also initiated in February 2023 to provide baseline information pertaining to seasonal habitat use, movement dynamics and demography.

IAAC raised concerns about the Boreal Caribou habitat, particularly range disturbance levels in Churchill Range caused by historical and recent forestry operations as well as fires. The 2021 forest fire increased habitat disturbance, which may impact calving and nursery areas, prompting plans for updated surveys and technical meetings. They note that the Churchill population's habitat disturbance has increased due to combination of factors including forestry, necessitating a range-scale assessment and mitigation strategy. The spatial disturbance data with recent fire and forestry-related disturbances was updated, and the percent of total disturbance for the Churchill range was updated, including both federal and provincial calculation methods for disturbances.

Traditional Knowledge

The NWOMC, CLFN, LSFN, MOFN and SFN emphasize the cultural and spiritual significance of Boreal Caribou, and their priority for Boreal Caribou conservation, especially protecting calving areas. FMG acknowledges this and has integrated these values into the final EIS/EA. The draft EIS/EA was updated to include details from the community-led studies, Know History TKLUS (2022), and other Indigenous Knowledge and Use and Socio-Economic Studies (NDMNRF 2019, Kunicky 2021, ArrowBlade 2014, Slate Falls Nation and Odonaterra, 2024). The communities expressed concern about noise and traffic impacts on wildlife and hunting.

NWOMC and the nations expect the cumulative effects on Boreal Caribou to include traditional knowledge of local herds. FMG commits to ongoing collaboration, including workshops and feedback on mitigation measures. FMG has integrated information from these into the final EIS/EA, provided support to fill outstanding information gaps, and shared baseline data on Boreal Caribou habitat use and distribution with CLFN and LSFN.

MOFN's concerns include the need for improved measurement of identified indicators and variables, an expanded regional scale of analysis, and temporal boundaries that align with the Boreal Caribou's generation time. They also highlight the importance of clarifying assumptions and strengthening the linkage of mitigation measures to effects. Additionally, MOFN emphasizes the need to address time lags in habitat restoration, characterize the magnitude of residual effects on movement behaviour and sensory disturbance, and improve the assessment of population demography changes. They also stress the importance of providing context on total natural disturbance to ensure the Project does not reduce the likelihood of self-sustainability in the range.

Assessment Methods

The EIS/EA was requested to include additional details about the study methodology, including the determination of the EA's spatial and temporal boundaries, inclusion of additional baseline studies, and background data (e.g., incorporation of available updated land cover classification) for a thorough understanding of the environmental impact. Study areas are defined by potential Project effects and zones of influence, refined based on ecological boundaries and government guidance. MOFN's concerns include the need for improved measurement of identified indicators and variables, an expanded regional scale of analysis, and temporal boundaries that align with the Boreal Caribou's generation time.

Potential Effects

MECP and MNR requested the evaluation of impacts, mitigation, and residual effects for all feasible alternatives for roads, transmission line corridors, and aggregate pits, not just the preferred ones. An assessment of potential effects on SAR (including Boreal Caribou) for all alternative routes for the mine access road, transmission line routes, and locations for the aggregate sources are described in Section 4 of the EIS/EA and supported with a detailed analysis in Appendix T using the criteria and indicators recommended by MECP.

The IAAC also noted that the EIS/EA does not differentiate between various Boreal Caribou habitat components in evaluating residual effects, and cumulative effects and long-term impacts on Boreal Caribou recruitment and habitat use need to be considered.

Analytical Methods

MOFN highlights the importance of clarifying assumptions and strengthening the linkage of mitigation measures to effects. Additionally, MOFN emphasizes the need to address time lags in habitat restoration, characterize the magnitude of residual effects on movement behaviour and sensory disturbance, and improve the assessment of population demography changes. The spatial disturbance data with recent fire and forestry-related disturbances was updated between EIS/EA revisions, and the percent of total disturbance for the Churchill range was updated, including both federal and provincial calculation methods for disturbances.

Mitigation

MNR found the proposed mitigation measures for habitat loss and mortality insufficient, calling for more definition. MNR emphasized that post-closure mitigation should include decommissioning and revegetation of roads, barriers to restrict predator and vehicle access, and measures to favour Boreal Caribou habitat development. The Closure Plan includes Boreal Caribou habitat features, with measures like scarifying roads, restricting vehicle access, appropriate revegetation, and progressive rehabilitation.

Monitoring

Consultation highlighted the importance of detailed, seasonal monitoring, especially during critical periods like calving.

6.13.1.3 Spatial and Temporal Boundaries

The Project Development Area (PDA) is defined as the footprint of the Project including the mine site, mine site access road, and the transmission line corridor, as well as a buffer to allow for flexibility for design optimizations during Project permitting. The buffer includes approximately 250 metres (m) around the mine site area. The buffer is included within the 40 m wide corridor for the transmission line and within in the

30 m wide corridor for the mine access road. Where the mine access road and transmission line are aligned together, the buffer is included within a 60 m wide corridor.

The spatial boundaries used for the assessment are shown in Figure 6.13-3 and Figure 6.13-4 and defined as follows:

- PDA (see above).
- **PDA + 500m Buffer:** Buffer applied as per the ECCC disturbance management threshold and per Ontario's Range Management Policy for Caribou.
- **Local Study Area (LSA):** The LSA was defined by applying a 10 km buffer around the mine site area and the centreline of the mine site access road of the PDA, and a 1 km buffer from the centreline of the transmission line to reflect the primary area of expected effects. The size of the LSA is intended to capture anticipated direct effects from the Project (such as habitat loss) and indirect effects resulting from the Project (such as sensory disturbance from noise and dust).
- **Habitat Regional Study Area (RSHA):** The regional study area for habitat effects assessment is the Churchill Range. The RSHA is used to comply with Ontario's Range Management policy, provide context for the assessment of potential Project effects, the assessment of cumulative effects and is the maximum geographical extent (or zone of influence) to which effects from the Project may be identifiable to Churchill Range.
- **Population Regional Study Area (RSPA):** The regional study area for population effects assessment encompassing the Churchill, Berens, and Kinloch Range boundaries. The Population RSA has evolved to the current delineation as determined through landscape analysis of MECP telemetry data (2010-2013), MECP General Habitat Description (GHD) data and Project-specific datasets (i.e., satellite telemetry data, winter aerial survey data). The Population RSA is used to provide context for the assessment of potential Project effects and the assessment of cumulative effects and is the maximum geographical extent (or zone of influence) in which effects from the Project may be identifiable to the regional Boreal Caribou population.

The temporal boundaries for the assessment of Boreal Caribou are defined as:

- **Construction Phase:** Years -3 to -1, representing the construction period for the Project;
- **Operations Phase:** Years 1 to 10, with the first year potentially representing a partial year as the Project transitions from construction into operations. Mining of the ore from the open pit will end in Year 10, at which time the pit will begin refilling with water; and
- **Decommissioning and Closure Phase:**
    - Active Closure: Years 11 to 15, when final decommissioning and the majority of active reclamation activities are carried out; and
    - Post-Closure: Years 16+, corresponding to the post-closure monitoring period when the filled open pit basin will be reconnected to Springpole Lake.

Effects on each VC are assessed for each Project phase (i.e., construction, operations, and closure).

6.13.1.4 Criteria and Indicators

In undertaking the assessment of effects on Boreal Caribou, the following criteria were used:

- Direct Habitat Changes;
- Indirect Habitat Changes;
- Change in Range Condition;
- Change in Population Demography; and
- Change in Community Dynamics via Predator – Prey Dynamics

The specific criteria, measurable indicators and the rationale for the selection of criteria are described in Table 6.13-14.

6.13.1.5 Description of Residual Effect Attributes

The residual environmental effects for Boreal Caribou are characterized in terms of the following:

- Magnitude;
- Geographic Extent;
- Duration;
- Frequency;
- Reversibility; and
- Timing.

These attributes along with the rankings are further described in Table 6.13-2.

In addition, the residual effects for Boreal Caribou are characterized according to the ecological and/or social context within which the VC is found. This is a qualitative measure of the sensitivity and/or resilience of the VC is to potential change. The following ranking is applicable:

- **Level I:** The VC may or may not be sensitive, but the predicted change can be managed with typical mitigation measures of avoidance or minimization.
- **Level II:** The VC is sensitive and requires special measures to support the predicted change.
- **Level III:** The VC is sensitive and unable to support the predicted change even with special measures.

As noted in Section 6.1, a residual effect is defined as significant if both of the following criteria are satisfied:

- A Level II or III rating is attained for all of the attributes involving magnitude, extent, duration, frequency, timing and reversibility; and
- A Level II or III rating is attained for ecological and/or social context.

Conversely, if a Level I rating is achieved for any of the attributes involving magnitude, extent, duration, frequency, timing or reversibility; or, if a Level I rating is achieved for the ecological and/or social context, then the residual effect is not significant.

In the event there is a significant adverse effect, the likelihood of occurrence is further described.

6.13.2 Existing Conditions

A description of the baseline conditions is presented below to characterize the existing conditions for Boreal Caribou and is based on several years of study that has resulted in a comprehensive dataset for this stage of Project planning. The existing conditions are used to support the assessment of potential effects from the Project on Boreal Caribou and will support long-term monitoring for the Project. Further baseline information on terrestrial resources can be found in the technical support documentation (Appendix P) includes baseline data on Boreal Caribou and their habitat. Detail on baseline habitat and population models used to quantify the baseline distribution of habitat, range disturbance and populations are found in Sections 6.13.5.

The Project is situated on the Precambrian Shield within the boundaries of the Lake Wabigoon Ecoregion in the Northern Coniferous Forest Section of the Boreal Forest Region, the Trout Lake Forest Management Unit (TLFMU) and the Red Lake District (ArrowBlade 2014). The Project occurs in an area of the boreal forest in northwest Ontario known as the Northern Coniferous Region, a region where climatic conditions allow reasonable tree growth and the development of closed forests wherever soil depth is adequate (Rowe 1972). Black Spruce is the predominant tree, forming stands on the thin soil of the uplands with Jack Pine and in the poorly drained lowlands with Tamarack. Frequent fires favour the spread of Jack Pine and likely encourage the spread of White Birch. Where favourable local soil conditions and climate occur, typically in river valleys and around some lakes, White Spruce, Balsam Fir, Trembling Aspen and Balsam Poplar form mixed stands (Rowe 1972).

Boreal Caribou naturally occur at low spatial density (typically 0.02 to 0.03 Boreal Caribou per square kilometre) but have large spatial home range requirements for contiguous old-growth boreal forest and lichen-rich peatlands which allows them to spatially separate from predators, alternative prey and avoid disturbance (ECCC 2020).

There are three Boreal Caribou ranges that interact with the Project:

1) Berens Range (ON2) is located west of the Project and has a range area of 27,948 km^2.
2) Churchill Range area encompasses the majority of the Project and has a range area of 21,505 km^2
3) Kinloch Range is located northeast of the Project and has a range area of 26,700 km^2.

6.13.2.1 Traditional Knowledge

Boreal Caribou hold important cultural and spiritual significance for Indigenous people. The local Indigenous communities have shared traditional land use information through engagement activities and from their Traditional Knowledge and Land Use Studies (TKLUS; Kunicky 2021, ArrowBlade 2014, Slate Falls Nation and Odonaterra, 2024). Available traditional knowledge, traditional land use studies and land use plans were reviewed for information related to Boreal Caribou.

Traditional knowledge and land use information from Slate Falls Nation (SFN), Lac Seul First Nation, Cat Lake First Nation, notes that members hunt various animals, including Boreal Caribou, for sustenance, tools (e.g., femurs used to scrape hides) and fur (Slate Falls Nation and Odonaterra 2024, Firelight Research and Lac Seul First Nation, 2024 and Firelight Research and Cat Lake First Nation, 2024). Boreal Caribou meat is shared within the community, especially for elders during special occasions. SFN notes that Boreal Caribou populations have moved northward, likely due to forestry, development and climate change.

Although the Project is outside the boundaries of the Cat Lake – Slate Falls Community Based Land Use Plan (NDMNRF 2019), the Plan's objectives include providing strategic direction to sustain biological

diversity and abundance, including support for the needs of wildlife species at risk such as Boreal Caribou. The importance of this document and its guiding principles is recognized (NDMNRF 2019). This land use plan, a joint effort between Cat Lake First Nation and Slate Falls Nation, acknowledges the many shared interests and values, close family ties, and historical occupancy and traditional use along the Cat River system. Lands and resources in the Cat Lake-Slate Falls planning area have been managed and protected by Indigenous people for centuries for subsistence (food, clothing), traditional livelihood activities (fur harvesting), and spiritual and cultural practices. Substantial quantities of country food, meat, and fish are harvested for consumption in the communities and for family and community members in Sioux Lookout and beyond.

Wabauskang First Nation (WFN) members historically hunted Boreal Caribou. Further, WFN members noted seasonal movements by Caribou, including an area between Trout Lake and Parker Lake, and a major crossing at Woodland Caribou Provincial Park, west of Red Lake (ArrowBlade 2014). Boreal Caribou hides were traditionally processed and tanned for clothing and other items (Kunicky 2021), and leather remains preferred for its superior quality, and continue to be used for traditional crafting methods.

6.13.2.2 Field Studies

Historical data compilation and supplementary field studies were undertaken to acquire current baseline data with respect to the Boreal Caribou population and supporting habitat across the population and habitat RSPA and RSHA.

Landscape Scale Surveys

Systematic annual winter aerial surveys were undertaken between 2021 and 2024 to document Boreal Caribou winter use across the study area (Churchill range and adjacent portions of Berens and Kinloch ranges) relative to known wintering areas based on data from the province (Figure 6.13-1). The following is a summary of survey results by year:

- **2021 Winter Aerial Survey:** A winter aerial survey was undertaken between February 27 and March 5, 2021. Challenging survey conditions and size of the preliminary survey area resulted in additional efforts to sample areas adjacent to the periphery of the survey area to locate additional groups of Boreal Caribou to improve sample size for demographic analyses. The additional effort also included revisiting several locations of concentrated activity within the survey area for intensive search (100% systematic local grid search pattern) to locate and classify Boreal Caribou groups not found during the first attempt. The 2021 winter aerial survey detected 10 Boreal Caribou groups for a total of 92 Boreal Caribou classified, which consisted of 22 bulls, 60 cows, and 10 calves. The mean group size was 9.2 ±2.10 caribou. Signs of an additional 16 groups (104 caribou) were not directly observed and had a mean group size of 6.5 ±1.27 caribou. The proportion of calves (10.9%) in the population suggests lower-than-average calf recruitment. The calf-cow ratio was 16.7 calves/100 cows, which is lower than the 28.9 calves/100 cow's threshold typically used to assess population growth trajectory (ECCC 2020). Calf production was 12.2 calves/100 adults, suggesting a population decline in 2021. The Minimum Animal Count (MAC) was 196 Caribou. The mean population density in the survey area was 0.0293 Boreal Caribou /km^2±0.0047 (95% Confidence Limits [CL]).

MECP classified Category 1 wintering areas are not adjacent to the Project (Figure 6.1.3-1). Vegetation cover in areas directly adjacent to the Project primarily consists of early successional conifer-dominated stands from recent disturbance by wildfire and forestry activity, which provides poor habitat suitability for Boreal Caribou. However, south, southeast, and northwest of the Project is high-quality habitat comprised of mature coniferous forest and classified by MECP as Category 1 wintering areas. These Category 1 wintering

areas had confirmed use by Boreal Caribou during the 2021 survey (Figure 6.13-1). In addition, the 2021 survey identified potential new wintering areas south and southeast of the Project (Figure 6.13-1). In general, Boreal Caribou were typically observed in areas with contiguous mature coniferous forest blocks; activity was rarely associated with disturbed areas. Boreal Caribou foraging activity was, however, observed along the occasional edge of existing linear corridors.

Incidental signs of Boreal Caribou were frequently documented during summer and fall fieldwork for other terrestrial studies. Two Boreal Caribou were seen swimming across Birch Lake north of the Project in July 2021 and one Boreal Caribou was seen east of the Project in August 2021.

2022 Winter Aerial Survey: A second winter aerial survey was conducted between February 24 and March 5, 2022. This survey area was expanded based on the results of the 2021 survey. It detected 26 groups for a total of 161 Boreal Caribou, of which 135 were classified and consisted of 40 bulls, 74 cows and 21 calves. The mean group size was 6.2 ±1.24 (95% CL). An additional 29 groups (159 caribou) were detected but not observed to classify, with a mean group size of 5.5 ±0.69 (95% CL). The proportion of calves (15.6%) suggests good recruitment, indicating population growth. The calf-cow ratio of 28.4 calves/100 cows was similar to the 28.9 calves/100 cow(s) threshold that is typically used to assess population growth trajectory (ECCC 2020). Calf production was 18.4 calves/100 adults, suggesting population growth in 2022. All groups (n=55) were again associated with known wintering areas and no groups were detected near the Project during the winter survey (Figure 6.13-1). The MAC was 320 Boreal Caribou. The mean population density for the survey area was 0.0261 Boreal Caribou /km^2±0.0031 (95% CL).

- **2023 Winter Aerial Survey:** A third winter aerial survey was conducted between January 26 and February 6, 2023. This survey area was slightly expanded from previous years based on knowledge gained from the previous two years of surveys and to comply with an *ESA* Permit associated with a concurrent satellite telemetry program to deploy 50 collars on adult female Boreal Caribou within a 100 km radius of the Project. A total of 364 Boreal Caribou were observed, of which 288 were classified, consisting of 85 bulls, 169 cows, and 34 calves. Forty (40) groups were observed, with a mean group size of 9.1 ±1.63 (95% CL). An additional ten groups (66 Boreal Caribou) were detected but not observed to classify, with a mean group size of 6.6 ±0.98 (95% CL). The proportion of calves (11.8%) suggests average recruitment, indicating population stability. The calf-cow ratio of 20.1 calves/100 cows was lower than the 28.9 calves/100 cow(s) threshold that is typically used to assess population growth trajectory (ECCC 2020). Calf production was 13.4 calves/100 adults, suggesting population stability in 2023. All groups (n=60) were associated with known Category 1 overwintering habitat, and no groups were near the Project during the winter survey (Figure 6.13-1, Figure 6.13-2, and Figure 6.13-3). The MAC was 430 Boreal Caribou. The survey area's mean population density was 0.0264 caribou/km^2±0.0041 (95% CL).
- **2024 Winter Aerial Survey**: A fourth winter aerial survey was conducted between February 17 and 25, 2024. As was the case in previous years, the survey focused on known wintering areas from provincial data as well as kernels from previous winter aerial surveys and recent winter telemetry locations and aided by VHF telemetry relocation of collared Boreal Caribou. A total of 313 Boreal Caribou were observed, of which 303 were classified and consisted of 66 bulls, 183 cows and 54 calves. Fifty (50) Boreal Caribou groups were observed, with a mean group size of 6.3 ±1.24 (95% CL). The mean group size of all Boreal Caribou groups (n=54) was 7.4 ±1.15 (95% CL). The proportion of calves (17.8%), calf/cow ratio (29.5 calves/100 cows) and calf production (21.7 calves/100 adults) all indicate a high calf recruitment and support increased potential for population growth in 2024. No groups were detected near the Project during the winter survey

(Figure 6.13-1, Figure 6.13-2, and Figure 6.13-3). The MAC was 401 Boreal Caribou. The mean population density for the survey area was 0.0246 caribou/km^2±0.0038 (95% CL).

Satellite Telemetry Program

A Boreal Caribou satellite telemetry study was initiated between February 3 and 6, 2023. The deployed collars consisted of 50 Telonics GPS/VHF (Model TGW-4670-4) iridium satellite collars (Figure 6.13-4). All collars have been programmed to collect three GPS fixes per day (0500, 1300 and 2100 UTC) until the programmed drop of date of March 31, 2027. All collars have been equipped with a mortality sensor and a VHF transmitter. Boreal Caribou captures, collar deployments and biological sample collections were primarily conducted by Bighorn Helicopters, supported by the WSP survey team (i.e., locating and re-locating groups for capture, and coordination of areas to focus collar deployment efforts throughout the study area). The collars were deployed within a 100 km radius of the Project (mine site area).

The capture and collar deployment complied with the *ESA*-B permit (# NR-B-005-21) conditions and the associated approved Wildlife Animal Care Committee protocol (#23-484). Biological sample collections were conducted by the capture crew which included blood samples (from the cephalic or jugular vein), hair samples (with roots from the shoulder area), and fecal samples to assess pregnancy at the time of capture and for potential DNA analysis.

- Blood samples were acquired from 49 of the 50 captured Boreal Caribou and were shipped to the University of Guelph's Animal Health Laboratory on February 13, 2023. The University of Guelph prepared the blood serum samples and shipped them to Herd Health Diagnostics Laboratory in Pullman, Washington for BioPRYN analysis. Of the 49 samples tested, one test was inconclusive, leaving 48 samples with a confirmed result. Of the 48 confirmed results, three samples indicated open cows (not pregnant) and 45 samples indicated pregnancy, yielding a pregnancy rate of 93.75%. Pregnancy rates are not related to calf recruitment into the population.
- Fecal samples (for future analyses) and hair samples with roots (for cortisol analysis) were collected from all captured Boreal Caribou and were submitted to Trent University following completion of the collaring program on February 13, 2023.

Mortality investigations of collared Boreal Caribou are required as an *ESA* permit condition. As of the submission date for the EIS/EA, there were five mortalities in 2023 and three mortalities in 2024. The cause of death included wolf (4), natural causes (1), and undetermined (2).

Summary of Existing Conditions

The Project is located within the Churchill Range. The landscape is largely characterized as boreal forest with an aggressive fire regime and many small-to-large lakes scattered throughout. Historical occupancy data as well as more recent MECP telemetry data reveals that Boreal Caribou occur across much of the range but have been scarce from southern areas around Lac Seul and Sioux Lookout for decades due to persistent or permanent human activity. There are a number of calving lakes within the range including DeLesseps, Churchill, Birch, Confederation, Lac Seul, and Lake St. Joseph (MNRF 2014). Wintering areas are associated with mature coniferous refuge habitat that has not been disturbed. Collaring data from MECP (2010 – 2013) as well the Project monitoring program (2023 onwards) has revealed that landscape connections exist in the northern part of the Churchill Range with areas north of the Cat River system in the Kinloch Range as well as areas northwest in Berens Range. Churchill range has been impacted by fire, most recently in 2021 which burned a large area close to the Project. Two extremely large fires (1961) are regenerated to a point where they are expected to provide essential Boreal Caribou habitat. The most

prominent ongoing human impact on Boreal Caribou habitat within the Churchill range is forest harvesting; the southern portion of the range in particular has been subjected to extensive harvest. An updated assessment of disturbance in the Churchill Range is provided in Section 6.13.5.

Analogous to the Provincial monitoring program from 2010 – 2013, the Project based telemetry program has revealed regular, seasonal movements between Churchill Range, Berens Range and Kinloch Range suggesting that Boreal Caribou in these ranges are part of the same regional population. The telemetry program initiated in 2023 has revealed the distribution, site fidelity and confirmation of use of key habitats including calving and wintering areas previously classified by MECP as well as revealed new seasonal range areas. Aerial surveys have revealed relatively consistent Boreal Caribou densities between 0.025 to 0.029 caribou/km^2 each year and consistent use of wintering areas classified by MECP and revealed through the monitoring program. Calf recruitment has varied across years, from low or declining in 2021 and 2023 to the potential for increased population growth in 2022 and 2024 (see Section 6.13.5). Overall analysis has revealed that This confirms the RPSA and RSHA population are in a state of long-term decline irrespective of the addition of the Project to the landscape (Section 6.13.5).

6.13.3 Identification of Potential Effect Pathways

The initial step in the assessment process is to identify interactions between the Project and Boreal Caribou that can result in pathways to potential effects prior to the application of mitigation measures. These potential effects may be direct, indirect and/or positive effects, where applicable. Table 6.13-16 includes the potential interactions of the Project with Boreal Caribou, prior to the application of the mitigation measures. The professional judgement of technical experts experienced with mining Projects in Ontario and Canada as well as input from Indigenous communities, government agencies and the public informed the identification of those interactions that are likely to result in a pathway to a potential effect due to a measurable change on Boreal Caribou. These pathways to potential effects are further described below for each phase of the Project, along with the rationale for those interactions excluded from further assessment. Section 6.13.4 provides a description of the mitigation measures applied to during all phases of the Project. The residual effects, after the application of the mitigation measures, are then described and further evaluated in Section 6.13.6, using the criteria and indicators identified in Section 6.13.1.4.

Construction Phase

The construction phase of the Project is expected to be developed over a 3-yr period and will include site preparation, construction of mine infrastructure, and other related activities. The following interactions with the Project result in pathways to potential effects on Boreal Caribou as described below. After mitigation is applied to each pathway, the residual effects are assessed using the criteria identified for each pathway:

- Site preparation activities for the mine site area, including clearing, grubbing, and bulk earthworks, interacts with Boreal Caribou.
    - These activities result in pathways to potential effects on Boreal Caribou due to:
        - The clearing of vegetation that may directly and indirectly affect habitat;
        - The use of equipment which may indirectly affect habitat and movement corridors due to sensory disturbance associated with noise and light; and,
        - The use of equipment may increase the potential for collisions and may change the risk of mortality.

- The assessment of potential effects on Boreal Caribou includes the change in habitat, the indirect change in habitat, the change in range conditions, the change in population demography, and the change in community via predator-prey dynamics from these pathways.

- The construction of the mine access road, airstrip, and the transmission line, including the associated site preparation activities and the development of the aggregate resource areas interacts with Boreal Caribou.
  - These activities result in pathways to potential effects on Boreal Caribou due to:
    - The clearing of vegetation that may directly and indirectly affect habitat;
    - The use of equipment which may indirectly affect habitat and movement corridors due to sensory disturbance associated with noise and light; and,
    - The use of equipment may increase the potential for collisions and may change the risk of mortality.
  - The assessment of potential effects on Boreal Caribou includes the change in habitat, the indirect change in habitat, the change in range conditions, the change in population demography, and the change in community via predator-prey dynamics from these pathways.
- All other Project activities interact with Boreal Caribou and result in a pathway to a potential effect on Boreal Caribou due to the use of equipment which may indirectly change habitat due to sensory disturbance associated with noise and light. The assessment of potential effects on Boreal Caribou includes the indirect change in habitat, the change in population demography, and the change in community via predator-prey dynamics from this pathway.
  - There is no plausible interaction between the employment and expenditures activities and Boreal Caribou during any Project phase.

Operations Phase

The operations phase is anticipated over a 10-year period. The following interactions with the Project result in pathways to potential effects on Boreal Caribou as described below. After mitigation is applied to each pathway, the residual effects are assessed using the criteria identified for each pathway:

- Project activities associated with the operation of the mine site, including the open pit mine, the management of overburden, mine rock, tailings and ore in designated facilities, and the water management and treatment facilities interacts with Boreal Caribou.
  - These activities result in pathways to potential effects on Boreal Caribou due to:
    - The operation of the mine and associated equipment which may change sensory disturbances; and
    - The ongoing open pit dewatering during operations will reduce groundwater levels and result in changes to hydrology which may indirectly affect habitat.
  - The assessment of potential effects on Boreal Caribou includes the indirect change in habitat, the change in population demography, and the change in community via predator-prey dynamics from this pathway.
- The operation and maintenance of mine site infrastructure, including the mine access road, the transmission line and the airstrip interacts with Boreal Caribou.

- These activities result in pathways to potential effects on Boreal Caribou due to:
  - The management of vegetation which may indirectly affect habitat for Boreal Caribou;
  - The use of equipment, operation of Project vehicles and haul trucks, and the operation of aircraft may change sensory disturbances which may indirectly affect habitat and movement corridors; and,
  - The use of equipment may increase potential collisions with Boreal Caribou and may change the risk of mortality.
- The assessment of potential effects on Boreal Caribou includes the indirect change in habitat, the change in population demography, and the change in community via predator-prey dynamics from these pathways.

The operation of the process plant, the accommodations complex, the management of the overburden and ore stockpiles will not interact with Boreal Caribou. Progressive reclamation activities are unlikely to interact with Boreal Caribou and their habitat as these will be limited during the operation phase.

Decommissioning and Closure Phase

Activities occurring during the active closure phase will include re-grading, placement of cover, and revegetation. The following interactions with the Project result in pathways to potential effects on Boreal Caribou as described below. After mitigation is applied to each pathway, the residual effects are assessed using the criteria identified for each pathway:

- The reclamation of impacted areas, such as by re-grading to provide stable slopes and reduce the potential for erosion, placement of cover in designated areas to provide stability, and revegetation activities interacts with Boreal Caribou.
  - These activities result in pathways to a potential effect on Boreal Caribou due to:
    - The change in vegetation communities from revegetation activities may directly affect habitat;
    - Ground disturbances from regrading may change the contribution of surface water and indirectly affect habitat; and,
    - The use of equipment may change sensory disturbances and air emissions (including dust) which may indirectly affect habitat.
  - The assessment of potential effects on Boreal Caribou includes the change in habitat, the indirect change in habitat, the change in range conditions, the change in population demography, and the change in community via predator-prey dynamics from these pathways.

Removal of assets, the demolition and recycling and/or disposal of remaining materials and the removal and disposal of demolition-related wastes in approved facilities and filling of the open pit basin is not anticipated to result in potential effects on Boreal Caribou and potential effects are unlikely. Beyond closure, the activities will be primarily monitoring, and there are no anticipated potential effects to Boreal Caribou.

6.13.4 Mitigation Measures

The federal mitigation hierarchy described in Section 6.13.1.1 has been followed to avoid and minimize potential effects on Boreal Caribou and further described below. Section 4 describes the assessment and

selection of alternatives that are suitable for the Project and includes evaluation criteria to characterize the potential effects on Boreal Caribou.

The mitigation hierarchy prescribes that losses are to be avoided and minimized to the full extent of reasonableness before offsetting is considered so that offsetting is undertaken only as a last resort for unavoidable "residual" losses (Poulton 2018, Barbé & Frascaria-Lacoste 2021). The rationale for the mitigation hierarchy is the risk involved in offsetting, specifically, the risk that the offset Projects will fail or that they will not produce the necessary compensation (Poulton 2018). Terrestrial systems are dynamic and complex. Restoring, enhancing, or creating terrestrial ecosites or ecosystems has inherent difficulties and associated uncertainty relative to preservation via avoidance or application of mitigation measures.

The best practice for proponents is to adhere to the hierarchy of measures comprised of giving preference to:

1) "Avoiding" the destruction or alteration of critical habitat over minimizing the destruction or alteration of critical habitat through Project design and location to avoid sensitive areas through siting. Avoidance measures are actions taken to prevent harm to the SAR and their habitat through choice of design, location, and timing so that there is no Project interaction with the species or its habitat.

2) "Minimizing" the destruction or alteration of critical habitat over restoring altered or destroyed critical habitat on-site. Minimization of habitat loss is achieved by adjusting the footprint scale, layout, juxtaposition, applying mitigation and protection measures and best practices within critical or important habitat, and/or construction timing (phasing) to avoid sensitive periods (e.g. calving) or sensitive seasonal habitats (e.g. seasonal core use areas).

3) "Restoring" altered or destroyed critical habitat on-site over "offsetting measures" to counterbalance harmful impacts of residual effects. Onsite revegetation and restoration can occur following construction and through the Project lifecycle. This also includes use of best practices to minimize operational impacts and monitoring of restoration and mitigation success.

    - The Project includes onsite progressive and enhanced revegetation and restoration to accelerate Boreal Caribou habitat restoration at closure with a focus on revegetating disturbed areas after Project construction consistent with the pre-disturbance state. Mature coniferous forest for Boreal Caribou is always the target state for the Closure phase. Habitat restoration aims to ensure that the restored landscape is indistinguishable from the adjacent undisturbed landscape to the greatest extent possible. In some areas, the post-closure landscape will include permanent topographical alterations and ecotypes not previously present in the local area. Onsite progressive revegetation would occur during the life of the mine in relation to supporting the closure phase and driven by an on-site restoration plan prepared as a living document with periodic updates during operation and closure for ongoing MECP SARB review and input. Onsite pre-mine vegetation communities serve as reclamation targets to guide the development of the post-mining landscape. The intended purpose is to accelerate Boreal Caribou habitat revegetation and reduce the Project physical footprint from direct disturbance. Overall, the reclamation plan focus is to re-establish pre-mine ecosites to the extent that is possible given the constraints imposed by the current uncertainties on geotechnical stability of reclamation cover systems and biophysical constraints imposed by mining (post-mining topography, changes to surficial materials) and the re-creation of Boreal Caribou habitat. Therefore, mature coniferous and refuge forest types preferred by Boreal Caribou is a

restoration goal, with avoidance of creation of vegetation types such as mixed or deciduous forest ecosystems that could attract Moose potentially increasing predation risk for Boreal Caribou.

4) "Offsetting" consists of implementing beneficial actions to offset/compensate for residual Project effects through off-site habitat restoration of a legacy disturbance, enhancement (e.g. infill planting or treatment to accelerate a vegetation successional pathway), creation (e.g. constructed Boreal Caribou calving island), or protection Projects (e.g. development deferral). When offsetting is appropriate, it is important that it be guided by clear conservation objectives and priorities relative to landscape disturbance and fragmentation effects. A key point under the mitigation hierarchy for offsets is that they are only used to address the residual impacts of development after avoidance, mitigation, and restoration are implemented. Offsetting measures are actions to benefit the species and its habitat (i.e., compensation measures to offset with multipliers for uncertainty and time delays). Offsetting is the intentional creation of measurable benefits to compensate for biological losses (i.e., habitat destruction, habitat damage, population loss) from the residual effects of human development that remain after all reasonable steps have been taken to avoid or minimize losses. Offsetting is the last option in the hierarchy of measures to compensate for impacts to the species and their habitat. Measures to offset must be specifically intended to deliver gains beyond those that would otherwise be achieved by planned or ongoing activities required for the implementation of the work, undertaking or activity, including post-Project remediation or rehabilitation. Offset measures include (1) Positive management actions - physical interventions to improve ecological conditions (e.g., ecosite restoration and/or enhancement), and (2) Averted losses - legal or other measures to preserve existing ecological conditions (e.g., long-term development deferral or habitat protection).

Avoiding and Minimizing

Onsite mitigation measures that will be implemented to avoid or minimize the effects of the Project on Boreal Caribou include:

- Development of a compact mine site to limit the areal extent of disturbance.
- During construction, co-locate the transmission line, airstrip and mine access road within a shared infrastructure corridor, where feasible.
- Align the new transmission line route adjacent to the existing E1C transmission line corridor, to the extent possible, to reduce the creation of new linear corridors.
- During construction, operation and closure phases of the Project, implement relevant mitigation measures for dust from Section 6.2, including:
    - During operation, the process plant emission sources will be enclosed where possible and be designed to allow good atmospheric dispersion. To reduce emissions, dust control equipment and best practices will be used, where necessary, as described below:
        - Conveyor transfer (drop) points will be controlled via enclosure or water spray;
        - Crushed ore stockpile will be enclosed, and emissions controlled by a baghouse;
        - A wet scrubber or equivalent will be used to control emissions in grinding (baghouse controlled);

- Truck unloading at the primary crusher will be enclosed and emissions controlled by a baghouse;
- Drill rigs will be equipped with a dust shroud on the drill and a wet suppression (spray) system will be used;
- Truck placement of mine rock onto the CDF will be controlled using water sprays and surface wetting;
- Travel surfaces will be maintained to minimize silt (fine material);
- Crushing of ore materials and reclaim at stockpiles will be controlled by baghouses;
- The vents from the lime silo will be controlled by a dust collector;
- Areas for ore mixing and handling will be controlled by dust collectors; and
- A regular maintenance schedule will be followed to ensure baghouses and dust collectors are functioning properly.

  - During construction, operations and active closure, a dust management plan will be implemented to identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed;
  - Dust emissions from roads and mineral stockpiles will be controlled through the application of water spray and supplemented by dust suppressants, if required;
  - Site roads will be maintained in good condition, with regular inspections and timely maintenance completed to minimize the silt loading on the roads; and,
  - Vehicle speeds will be limited.

- During construction, operation and closure phases, implement relevant mitigation measures for noise from Section 6.3, including:
  - Motorized equipment will be selected or designed with mufflers/silencers to limit noise emissions;
  - Reversing alarms should be dimmable with white noise and/or strobe light but in accordance with the applicable health and safety regulations;
  - Check that equipment and machinery used on site is maintained in good working conditions through regular maintenance and inspection;
  - Prohibit the use of engine brakes and require the engines to be stopped for vehicles on standby, depending on seasons and weather;
  - Operate vehicles and equipment such that impulsive noise is minimized, where possible; and,
  - For helicopter use during transmission line construction, maintain minimum flight altitudes unless engaged in construction tasks, landing or departure.
- During construction, operation and closure phases of the Project, implement mitigation for lighting to minimize sensory disturbance, including:

  - To prevent a direct line-of-sight from light, maintain light sources below natural barriers such as tree lines or artificial barriers such as berms; and,
  - Minimize light spill and glare using shielding on stationary light sources and direct lighting downwards where practical.
- During construction, operation and closure phases of the Project, implement the relevant mitigation measures for wildlife from Section 6.12, including:
  - During all phases, prohibit hunting and trapping by employees and contractors within the PDA and while working on site;
  - Provide wildlife (including Boreal Caribou and other applicable SAR) awareness training to Project employees and transport contractors;
  - Properly secure, store, and dispose of all domestic solid waste products and similar materials at an offsite licensed facility, particularly anything that is an attractant for scavenging wildlife. All domestic solid waste products will be transported to a landfill off-site and therefore mitigating the habitat sink effect of increased predator densities that can be created due to access to landfill sites; and
  - Document (and report as needed) observed wildlife, sign / tracks and wildlife-vehicle collisions and alter mitigation measures as appropriate.
- During construction of the Project, minimize the disturbance in Category 1 and 2 Boreal Caribou habitats by using existing trails and roads for travel;
- Do not disturb encountered Boreal Caribou, during all phases of the Project;
- During construction of the mine access road and transmission line:
  - Minimize the area cleared with heavy machinery in Category 1 Boreal Caribou habitat to the extent possible recognizing the need for clear sightlines for safety along the mine access road;
  - Reduce predator sight lines by minimizing the removal of woody vegetation along the transmission line in Boreal Caribou location clusters and adjacent to Category 1 habitat (overwintering and calving) by limiting removal to hazard trees and only clearing for safe access and infrastructure needs;
  - Avoid clearing and construction activities in Category 1 Boreal Caribou nursery habitat during the calving and nursery period (May 1 to September 15); and
  - During construction and operation of the airstrip, avoid construction and overflights of Category 1 nursery habitats during the nursery period (May 1 to September 15).
  - Efforts will be made to re-supply the mine with bulk of deliveries aiming to be outside the calving period.

- During the operation of the mine access road and transmission line:
    - Reduce Project-related traffic speed along the mine access road in sections traversing Category 1 habitat during seasonally sensitive periods, particularly along segments with identified crossing locations;
    - Project-related vehicles travelling on the mine access road must come to a stop if Boreal Caribou are encountered and provide them with the right-of-way and time to safely cross the roadway and into native cover without undue sensory disturbance;
    - Minimize vegetation management along the transmission line corridor within Category 1 habitat to that necessary for safe operation; and,
    - In areas where Boreal Caribou have been recorded crossing the existing transmission line, retain vegetation and undertake strategic vegetation treatments to reduce the potential for barriers to movement.
    - If Boreal Caribou are found to be crossing linear features created by the Project in new areas (outside of the currently identified cluster of movement locations), implement vegetation treatments to mitigate potential barrier effects in these new locations.
    - A controlled access gatehouse/checkpoint and signage are proposed to control unauthorized use of the 18-km mine access road leading to the mine site. An access management strategy will be developed with local Indigenous communities and MNR to provide access for traditional land and resource use activity along this newly accessible area. Efforts will be made to re-supply the mine with bulk of deliveries aiming to be outside the calving period.
- During the closure of the Project, incorporate Boreal Caribou habitat features into the overall closure plan, where possible, including:
    - Revegetate suitable areas within the PDA using species that will support the development of mature coniferous refuge habitat for Boreal Caribou, and incorporate the restoration of lichen and lichen treatments in select areas; and,
    - Remove or otherwise regraded stockpiles (including surficial soil and ore) to facilitate Boreal Caribou access.
- In collaboration with Indigenous communities and MECP, design and implement a habitat restoration program for Boreal Caribou, that includes:
    - The creation of suitable Boreal Caribou calving habitat through the reclamation of a small island in the open pit basin of Springpole Lake and revegetate the island with mature coniferous forest;
    - The development of suitable restoration of habitat of existing disturbed areas for Boreal Caribou; and,
    - The deferral of forestry and mineral exploration lands where suitable Boreal Caribou habitat exists.
    - The application of mitigation measures to specific pathways and phases are illustrated in Table 6.14-4. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation on similar Projects.

Habitat Restoration and Offsetting

Forest-dominated landscapes are often embedded with other land uses and contribute to achieving many Sustainable development goals by providing multiple ecosystem services essential to society. 'Forest/ecosite restoration' lacks an authoritative definition, but in broad terms, it is the process of improving the health, productivity, and functioning of a forest through a planned process that aims to regain ecological integrity (Mansourian 2005) and associated forest-related goods and services (Maginnis & Jackson 2007) in human-modified forest landscapes" (Stanturf et al. 2023).

Habitat Restoration

Restoration principles should consider (1) a design informed by a scale with a focus on landscapes, (2) achieving a result of net gain to biodiversity and ecosystem integration with a focus to maintain/enhance natural ecosites within landscapes, (3) economically viable restoration methods tailored to the local context using a variety of approaches and methods, (4) basing actions on inclusive, transparent, and empowering governance processes (i.e., stakeholder consultation and regulatory context), (5) applied adaptive management based on evidence to achieve long-term resilience (6) sustainability and mainstreaming within an appropriate jurisdictional context (e.g., land management plan, Integrated landscape management), (7) an equitable balance of trade-offs between achievement of primary goals and continued provision of multiple benefits (Besseau et al. 2018, IUCN 2016).

Restoration practices differ from standard silvicultural practices by applying multiple techniques and additional effort to restore ecological function (e.g., connectivity) and repair damaged (fragmentation) or destroyed (lost/removed/altered) habitat because of human disturbance sources (Sarr & Puettmann 2008, Stanturf et al. 2014). This is because ecological restoration is a landscape approach that considers more than stand-level interventions (Standturf et al. 2023, Standturf & Mansourian 2020).

The Project includes progressive and enhanced onsite restoration of its Project footprint throughout the life of the Project so that Boreal Caribou habitat restoration is effectively accelerated at closure.

Offsetting Measures and Compensation

Offsite habitat offsetting is the intentional creation of measurable benefits to compensate for biological losses (i.e., habitat destruction, habitat damage, population loss) from the residual effects of human development that remain after all reasonable steps have been taken to avoid or minimize losses. Measures to offset must be specifically intended to deliver gains beyond those that would otherwise be achieved by planned or ongoing activities required for the implementation of the work, undertaking or activity, including post-Project remediation or rehabilitation. Offset measures include:

- Positive management actions (physical interventions) to improve ecological conditions (e.g. ecosite restoration via enhanced silviculture, stand treatment, stand improvement, natural seed supplementation, or other measures).
- Averted losses (legal or other measures) to preserve existing ecological conditions (e.g. development deferrals or creation of protected areas).

To meet regulatory requirements, FMG is advancing various potential offsetting opportunities including:

- Opportunities to undertake enhanced restoration of lands subject to recent forest fires.
- Opportunities to undertake enhanced restoration on lands subject to forestry activities through partnership with the forestry industry.

- Opportunities identified by Ontario pursuant to the provincial Woodland Caribou Recovery Strategy. For example, potential habitat restoration in the vicinity of the abandoned South Bay mine.
- Partnership deferrals in other parts of the Churchill Range..
- At closure, the Project includes the construction of a Boreal Caribou calving island (linked to the Project's fish habitat development area)

FMG is presently evaluating/seeking securement of potential areas for development deferral (e.g. forestry deferral) in priority focus areas proximate to the Project to contribute towards the overall amount of area to ultimately be compensated. Collaborating with parties on the Trout Lake FMP planning process for the period 2031-2041. The planning process would be expected to start in 2028 and the timeframe aligns with the potential Project construction phase through early operations. This provides an opportunity for the Project to be considered in the planning of future forestry activities during life of mine such that Boreal Caribou habitat can be appropriately managed towards supporting Ontario's Recovery Strategy. Forest management on Crown land in Ontario is the ultimate responsibility of the Ontario Minister of Natural Resources (MNR). The Crown Forest of Ontario is subdivided into forests or management units for the purpose of forest management. The Trout Lake Forest is approximately 1,030,840 hectares in size. The forest borders Lac Seul and the Wabigoon Forest to the south, the Whiskey Jack Forest and the Red Lake Forest to the west, the Whitefeather and Cat Slate Forests to the north, and the Lac Seul Forest to the east. The Trout Lake Forest is currently operating under the 2021 - 2031 Forest Management Plan. The Lac Seul Forest is approximately 1,070,567 hectares in size. The forest borders the English River and the Wabigoon forest to the south, the Whiskey Jack Forest and the Trout Lake Forest to the west, the Cat Slate Forests to the north, and the Caribou Forest to the east. The Lac Seul Forest is currently operating under the 2024 - 2034 Forest Management Plan.

The Crown may delegate the responsibility for many aspects of forest management to companies through the licensing of Sustainable Forest Licences for particular management units. Planning is done through the use of forest management plans for a 10-year period and will normally be renewed every ten years. The strategic, long-term planning and the operational planning for the 10-year plan period are conducted prior to final plan approval. The implementation of operations is scheduled annually in an Annual Work Schedule (AWS) to provide the link between the work approved in the forest management plan and the required financial resources on an annual basis.

FMG will work with the Forest Resource Licence Holders and MNR during the forest management planning process to ensure the Springpole Project is included in future forest allocations. The Trout Forest Management Plan will begin renewal activities in 2028 which aligns with the current Springpole Project schedule. The timing will allow for the Springpole Project to be included in the next FMP forest allocations, FMP's have a forest inventory contingency which can include the Springpole Project and FMG will participate in the annual work schedule review process to confirm their activities in the Trout Forest align with the future 2031-2041 Forest Management Plan.

The measures described above address the mitigation hierarchy in the Federal Offsetting Policy for Biodiversity (Section 6.13.1.1), in that measures have been identified which avoid and minimize adverse effects to the extent possible. Measures have also been identified that will support restoration and include onsite revegetation to accelerate the reclamation of Boreal Caribou habitat at closure. The restoration plan would aim to re-establish pre-mine ecosites to the extent possible given that the post-closure landscape will include permanent topographical alterations and ecotypes that are not currently present in the local area. The development of mature coniferous and refuge forest types preferred by Boreal Caribou would be

the restoration goal, while avoiding the creation of vegetation types such as mixed or deciduous forest ecosystems that could attract Moose thereby potentially increasing a predation risk for Boreal Caribou.

Offset measures may include positive management actions to improve ecological conditions (such as ecosite restoration via enhanced silviculture, stand treatment, stand improvement, natural seed supplementation, or other measures) or measures to avert losses by preserving existing ecological conditions (such as development deferrals or creation of protected areas).

Monitoring programs will be implemented to verify the accuracy of the predicted effects, assess the effectiveness of the implemented mitigation measures, and may be further optimized in response to monitoring data. Extensive monitoring programs are in place for the Project with several years of data collection completed. The monitoring of the rehabilitation measures for onsite mine components or offsite road restoration Projects will provide feedback on the effectiveness of these measures in restoring habitat function and use for Boreal Caribou. Monitoring for the Project going forward is further described in Section 12 and will be further refined during the permitting phase to incorporate conditions of approvals and permits. Consultation on the monitoring programs is expected to continue through all phases of the Project.

6.13.5 Analytical Methods

To quantify the direct and indirect effects of removing habitat from the PDA, habitat mapping was overlaid with the PDA in geographic information system (GIS) tools, and the removal areas were calculated. The most updated enhanced Forest Resource Inventory (eFRI) mapping was used for the purposes of this effects assessment to support the analyses. In addition, Boreal Caribou habitat models that identify the distribution of key high quality seasonal habitats within a given range (Elkie et al. 2013, Hornseth and Rempel 2016) were used to quantify the distribution of Boreal Caribou habitats and effects from the Project.

To quantify the demographic effects from the Project Multiple lines of evidence were used to help predict the Project's effects on population state (abundance, rate of population growth (λ), and seasonal distribution) including population reconstruction and trend modeling, scenario analysis of population Sustainability and dynamic modelling of lambda

For most habitat and demographic indicators, multiple data sources and methods have been used to evaluate the potential effects on Boreal Caribou in the context of all available evidence to date. This approach provides the opportunity to thoroughly evaluate multiple lines of evidence pertaining to effects assessment and provide a weight-of-evidence approach to support conclusions. Further details on the methods are provided in Section 6.13.5.2, Section 6.13.5.3, Section 6.13.5.4, Section 6.13.5.5 and Section 6.13.5.6.

Further details on the methods are provides in Section 6.13.5.1.7.

6.13.5.1 Approach to Quantifying Habitat

Understanding the habitat preferences of Boreal Caribou is crucial for developing accurate and effective habitat models. In Ontario, the Province has developed habitat models for Boreal Caribou that identify the distribution of key habitats within a given range (Elkie et al. 2013, Hornseth and Rempel 2016) and these models were used for the effects assessment to quantify the distribution of Boreal Caribou habitats:

- North–West Ontario Boreal Caribou Refuge Habitat Model (Elkie et al. 2012);
- Classified General Habitat Description (GHD) for Boreal Caribou (Hornseth and Rempel 2016) (Appendix P-4.1).

In addition to the Provincial models, the Resource Selection Probability Function (RSPF) nursery and calving models (Appendix P-4.2 and Appendix P-4.3) as well as movement models were also developed with recent satellite telemetry data and aerial survey monitoring results:

- RSPF models were developed using the satellite telemetry data to identify the distribution of potential calving areas within the Churchill Range based on the habitat selection behaviour displayed by the collared cows (Appendix P-4.2). In addition, a nursery RSPF was developed using GHD Spring Category 2 and GHD Category 1 areas (Appendix P-4.3).
- Brownian Bridge Movement Models (BBMM's) and Circuitscape Models were used to quantify baseline landscape connectivity currently in Churchill Range and calculate potential changes to connectivity from Project components.

The Provincial Boreal Caribou habitat strategy also quantifies mature coniferous and refuge habitat areas (MNRF 2020) for Boreal Caribou using the Conventional North-West Caribou Refuge Habitat Model (Elkie et al 2012) as part of the inputs into the Dynamic Caribou Habitat Strategy framework (MNRF 2014f). The forest unit, species composition, and forest age drive the suitability for refuge and/or mature coniferous habitat suitability, where Trout Lake and Lac Seul Forest Management Plans had available Forest Resource Inventory data.

All models used the updated eFRI and disturbance data obtained from the Province in September 2023. In addition, one of the Calving RSPF (Appendix P-4.3, Ferit 2024) was developed with recently available disturbance data from the Provincial Impact Assessment Model (PIAMM). Disturbance was quantified using both the federal and provincial methods:

- **Federal Approach** - Anthropogenic disturbance features were defined as those visible on 30-m Landsat imagery buffered by 500m and forest cover burned by wildfire within the past 40 years, current to 2015 (per ECCC 2020 coverage), but updated with available provincial disturbance layers (eFRI, forestry data, forest fire data) to 2022, including the Wataynikaneyap Transmission Line (and associated disturbances), and any recent forestry road construction since 2017. The total cumulative disturbance, as per the federal approach was calculated for the Churchill Range (RSHA). The federal disturbance results were used in analyses of population demography effects undertaken at the both the population and RSHA scales.
- **Provincial Approach** – The same criteria applied as with the Federal method; however, the disturbance age threshold was reduced from less than 40 years to less than 37 years. This approach was applied to habitat and demographic analyses undertaken at the RSHA scale (Churchill Range) and finer scales (LSA, PDA+500m, PDA).

Environment Canada (EC 2011) concluded that a modified 500 m buffer of total disturbance was the best conservative choice to account for the direct and indirect effects of total disturbance on local Boreal Caribou population calf recruitment and population growth (λ), with the acknowledgment that there can be regional variation in response thresholds for local Boreal Caribou populations (EC 2012; CBFA 2016). To account for potential indirect effects to habitat, a 500 m buffer around the PDA was included in all analyses, per ECCC (2020).

The existing anthropogenic and natural disturbance within Churchill Range are shown in Figure 6.13-5. All anthropogenic disturbance is buffered by 500m to incorporate indirect impacts on habitat function. Updated disturbance polygons, including natural sources (e.g., fire, insects, blowdowns) and anthropogenic sources (forestry, linear features), were provided by MECP in September 2023.

The updated FRI from the following Forest Management Units (FMU) used in all habitat and movement models includes (Figure 6.13-6):

- Lac Seul Forest (2021)
- Trout Lake FMU (2019)
- Caribou Forest (2020)
- Whiskey Jack (2016)
- Cat Lake FMU (2014)
- Wabigoon (2012)
- English River (2015)
- Far North (2011)

Enhanced FRI (eFRI) was used wherever available.

The prediction of potential habitat loss was quantified through multiple methods and multiple scales unique to each indicator, as described below.

6.13.5.2 Assessment of Direct and Indirect Habitat Loss

Changes to Regulated Boreal Caribou Habitat

The GHD for the Forest-dwelling Woodland Caribou (MECP 2020) acknowledges that Boreal Caribou rely directly and indirectly on the entire range (comprised of sub-range habitat features including high-use areas, seasonal ranges, and remaining areas within the range) to carry out their life processes. Activities which impair or eliminate the connectivity of sub-range habitat features are likely to adversely affect the ecological function of sub-range habitat features which can result in indirect habitat loss through displacement and avoidance. MECP regulates habitats and the amount of disturbance per range under this policy (see Section 6.13.1.1).

Under GHD, Category 1 habitat is sub-range habitat features delineated as seasonal core use areas that exhibit repeated and intensive use for spring calving/summer calf rearing, over-winter foraging, and travel corridors for seasonal movement between core use areas. Category 2 habitat represents seasonal ranges for Boreal Caribou, while Category 3 is the remaining habitat. Boreal Caribou habitat is categorized as follows:

- **Category 1:** Sub-range habitat features and high-use areas that exhibit repeated intensive use by individual Boreal Caribou or groups (e.g., nursery areas, winter use areas, and travel corridors), often over multiple years. These habitat features or areas are considered to have low tolerance / high sensitivity to alteration from disturbance before their function or value in supporting Boreal Caribou is compromised (MNR 2013). Category 1 areas are nested within Category 2 range areas and are dependent on the refuge function provided at this larger spatial scale.
- **Category 2:** Seasonal ranges are large sub-range habitat features or areas with greater than 100 km^2 of interconnected patches of mature (greater than 40 to 60 years in age) Jack Pine and/or Black Spruce stands that are used across multiple years, which delineate the majority of current Boreal Caribou distribution within a range. Boreal Caribou are generally not distributed evenly within seasonal ranges within a given year. Individual animals and groups utilize the extent of these ranges over multiple years as a refuge to effectively space themselves out from threats such as

anthropogenic disturbance or predators that may change annually. These landscape-scale habitat features, or areas are considered to have moderate tolerance/sensitivity to disturbance.

- **Category 3:** The remaining areas within the range have a high tolerance to alteration before the function is compromised. These areas indirectly support Boreal Caribou by maintaining (buffering) the overall predator refuge function within their range. This category has biophysical features and forest composition consistent with seasonal ranges but are currently young vegetation communities such as regenerating burn areas that are less than 40 years old. Category 3 has the capacity to become future habitat when the forest cover matures and connectivity with Category 2 habitats is restored within the range. These areas are not generally occupied for long periods of time; however, Boreal Caribou may travel through them. These areas may become more highly used when forest cover matures and connectivity with other currently occupied seasonal ranges is restored.

To quantify the direct and indirect loss of habitat as measured by the distribution of MECP-regulated Category 1, 2, and 3 GHD habitats, disturbance was determined by measuring the removal of habitat from the PDA, PDA + 500 m buffer, LSA, and RSHA (Churchill Range) per GHD habitat type (Table 6.13-2 and Table 6.13-3 and Table 6.13-4).

The distribution of Category 2 and 3 habitats within Churchill Range was updated with the recent disturbance and FRI data received from MECP. As per Provincial direction, RSPF modelling was used to update the current distribution of Category 2 and 3 habitats within the Churchill Range (Hornseth and Rempel 2016). This method maps potential habitat value based on modelling associations of observed Boreal Caribou use with land cover, linear features, and other environmental variables. The Category 2 (RSPF) model was based on seven classes from the Landsat based Provincial Forest Classification (PLC) plus esker lines, mapped forest fires, and anthropogenic linear features (Appendix P-4.1). Maps of the variables are provided in Appendix P-4.1 (Table A1), along with PLC class definitions. Calculations are conducted in the specialized GIS program, Landscape Scripting Language (LSL) (Kushneriuk and Rempel 2011), which allows for multiple-scale modelling using spatial averaging of hexagons. For Category 2 maps, an intersection of 3-ha hexagons with landscape variables is conducted first, and then spatial averages generated at the 5,000-ha scale are used for the RSPF analysis. This scale was used because it resulted in the highest performance relative to all other scales that were assessed (Hornseth and Rempel 2016). All calculations of potential effects to Category 2 and 3 GHD habitats are using these updated RSPF model results.

In addition, for GHD Category 1 areas, given they have not been updated recently by MECP, the amount of each GHD nursery and GHD wintering area impacted by legacy disturbed anthropogenic (e.g., forestry) and natural (e.g., fires) factors has also been calculated to assess the potential effect of existing disturbances on the landscape on these key features outside of disturbance that the Project may create. This disturbance assessment is not necessary for Category 2 or 3 GHD mapping as the GHD has already been updated using the most recent FRI and disturbance information from MECP.

Table 6.13-1: Disturbance by Preferred Project on Regulated Boreal Caribou Habitat (GHD) at PDA, PDA + 500 m, LSA and RSHA (Churchill Range) Scales of Investigation (Figure 6.13-8)

Habitat Type Impacted [(1)]	PDA			LSA†		RSHA (Churchill Range)	
	km²	%LSA‡	%RSHA	km²	%RSHA	km²	%
MECP GHD Category 1 Nursery Areas							
Legacy Disturbance (natural and anthropogenic)[1]	2.47	0.65	0.06	91.16	2.13	664.91	15.56
Incremental Direct Habitat Disturbance (PDA) [2,3]	1.60	0.42	0.04	1.60	0.04	1.60	0.04
Incremental Indirect Habitat Disturbance (PDA + 500 m buffer) [4]	17.05	4.46	0.40	289.27	6.77	265.59	6.22
TOTAL direct disturbance (without 500 m buffer)	**4.07**	**1.07**	**0.10**	**92.76**	**2.17**	**666.51**	**15.60**
TOTAL disturbance (direct from PDA + indirect via 500 m buffer)	**21.12**	**5.89**	**0.49**	**382.03**	**8.94**	**932.10**	**21.81**
***TOTAL* MECP GHD Category 1 Nursery Areas**						**4273.2**	
MECP GHD Category 1 Winter Use Areas							
Legacy Disturbance (natural and anthropogenic)	1.06	1.93	0.03	31.91	1.03	538.83	17.39
Incremental Direct Habitat Disturbance	0.01	0.02	0.00	0.01	0.00	0.01	0.00
Incremental Indirect Habitat Disturbance	1.84	3.35	0.06	22.91	0.74	22.91	0.74
TOTAL direct disturbance (without 500 m buffer)	**1.07**	**1.95**	**0.03**	**31.92**	**1.03**	**538.84**	**17.39**
TOTAL disturbance (direct from PDA + indirect via 500 m buffer)	**2.91**	**5.3**	**0.09**	**54.83**	**1.77**	**561.75**	**18.13**
***TOTAL* MECP GHD Category 1 Winter Use Areas**						**3098.5**	
MECP GHD Category 2 Seasonal Ranges[4]							
Direct habitat disturbance [1]	14.98	3.02	0.26	14.98	0.26	14.98	0.26
Indirect habitat disturbance [2]	48.31	9.74	0.83	480.99	8.29	432.65	7.45
TOTAL	**63.29**	**12.76**	**1.09**	**495.97**	**8.55**	**447.63**	**7.71**
TOTAL MECP GHD Category 2 Seasonal Ranges[4]						**5803.6**	
MECP GHD Category 3 Remaining Ranges[5]							
Direct habitat disturbance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indirect habitat disturbance	0.02	0.03	0.00	63.72	0.71	47.17	0.53
TOTAL	**0.02**	**0.03**	**0.00**	**63.72**	**0.71**	**47.17**	**0.53**
TOTAL MECP GHD Category 3 Remaining Ranges[5]						**8924.7**	

Notes:

1 Legacy disturbance is based on the federal disturbance-based layer and includes the current existing disturbance on the landscape from natural (fires) and anthropogenic (forestry) sources within the Churchill Range

2 Incremental disturbance is what the PDA adds to the existing disturbance from other sources (per scale of investigation)

3 Direct disturbance is based on the PDA

4 Indirect disturbance is PDA + 500 m buffer.

5 Categories 2 and 3 do not have legacy disturbance calculations as disturbance is already incorporated into the updated GHD (see Appendix A).

† The LSA extends beyond the boundary of the RSHA (Churchill Range) north of the Project as portions of the PDA occur close to the Kinloch Range boundary and the application of the 10 km buffer extends into the Kinloch Range.

‡ Percentages are the percent of available habitat impacted within a given scale of investigation.

Table 6.13-2: Disturbance and Fragmentation from the Project (PDA, PDA + 500m, LSA scales) on Regulated Boreal Caribou Habitat (GHD) Polygons within the Churchill Range

Habitat Type Impacted	Churchill Range		
	PDA	PDA + 500m[1]	LSA[2]
MECP GHD Category 1 Nursery Areas			
Incremental number of polygons impacted	4	1	10
Incremental number of polygons bisected[3]	2	0	0
MECP GHD Category 1 Winter Use Areas			
Incremental number of polygons impacted	1	0	0
Incremental number of polygons bisected[1]	1	0	0

[1] Additional impact beyond the impact of just the PDA

[2] Additional impact beyond the impact of the buffered PDA (500 m)

[3] Only polygons greater than 5 km^2 before and after transection are considered

Assessment of Impacts to Range Scale Category 2 and 3 GHD Habitats

The Project's impacts on Category 2 and 3 habitats were evaluated using two methods, summarized below and provided in detail in Appendix P-4.1 and Appendix P-4.2.

Predictive Category 2 and 3 RSPF

Methods describing model updates to the baseline Category 2 and 3 GHD mapping within Churchill Range are in Appendix P-4.1. The PDA was then added to the baseline Category 2 and 3 distributions to assess the extent of effects on Category 2 and 3 from the Project. The net effect of the PDA on Category 2 and Category 3 habitat showed little change in the distribution of categories, as at the broad scale of the model these were relatively minor changes to the landscape (Appendix P-4.1). The average Category 2 and 3 values changed from 0.519 to 0.514 between the current baseline and future conditions (future condition is the addition of the Project on the landscape), with less than 1% change Table 6.13-4). Results suggest that several linear features must occur in close proximity to generate a strong negative effect on Category 2 habitat (Appendix P-4.1). Note that Category 2 is an aggregation of the individual seasonal effects (Table 6.13-4). In conclusion, the PDA had only a minor negative influence (-0.96%) on the prevalence of Category 2 habitat in the Churchill Range.

Table 6.13-3: Comparison of mean Category 2 and 3 habitat, season categories, and seasonal probabilities of use, between current condition and future condition with proposed Project (see Appendix A)

Variable	Range	Season	Current Condition	Future Condition	% Change
Category 2 & 3	**Churchill**	**All Seasons**	**0.519**	**0.514**	**-0.96%**
Prob High Use	Churchill	Spring	0.155	0.141	-9.03%
Prob High Use	Churchill	Summer	0.486	0.477	-1.85%
Prob High Use	Churchill	Fall	0.344	0.340	-1.16%
Prob High Use	Churchill	Winter	0.263	0.269	2.28%
Prob of Use	Churchill	Spring	0.143	0.138	-3.50%
Prob of Use	Churchill	Summer	0.123	0.120	-2.44%
Prob of Use	Churchill	Fall	0.126	0.125	-0.79%
Prob of Use	Churchill	Winter	0.108	0.111	2.78%

Provincial Impact Assessment Model (PIAMM)

In May 2024, a new source of FRI inventory became available through MNR that was recently developed. This data is an improvement on data available through Land Information Ontario (LIO) and is called the Provincial Impact Assessment Model (PIAM). Inventory data covered all the Berens and Churchill ranges and about half of the Kinloch range (Appendix P-4.1). PIAM including eFRI inventories and more recent inventories in northern management units. Although these data were relatively clean, additional pre-processing was required to make data suitable for analysis. An R script was written to process geometry and attributes.

Scenarios were created to represent baseline conditions and proposed combinations of the Project (see Appendix T for alternatives assessment). Scenario MAR_0_TL_0_T20 (Appendix P-4.1) represents the current baseline condition. Scenario MAR_1_TL_1 is for the proposed mine site area, mine access road and transmission line.

The model was run for four time periods. During this time, the forest aged, and at year 60, all mapped disturbances (mine access road, transmission line, and PDA) were removed. Maps were generated for each scenario and range, and the average Category 2 values were calculated for each range and for each time period. Time T20 represents the effect over the first 20 years, with the Springpole PDA present. T40 represents years 20 to 40, and T60 years 40 to 60. The final time period, T80, represents the post-Project condition for years 60 to 80 and onward where the Project has been fully removed. Category 2 values are binary (0,1), and the average values represent the percent area across the range belonging to Category 2.

A comparison of the pre-Project condition (MAR_0_TL_0_T20) with the preferred Project (MAR_1_TL_1_T20) for the Churchill range reveals almost no difference (Appendix P-4.1) and very little difference in average Category 2 level for the average of the three ranges, or for Churchill specifically (Appendix P-4.1, Table 2). This is likely because the addition of the Project adds proportionally little additional disturbance to the existing condition already in the Churchill Range (Appendix P-4.1, Figure 4), and the increase in linear feature density wasn't sufficient to result in a large change in the probability of use.

A comparison across the four time periods from Project start (0 to 20) to the end of the analysis period (60 to 80) shows a trend of initially decreasing up until T40, then subsequently increasing as the forest gets older and recent disturbance becomes 40 years plus (Appendix P-4.1, Figure 6, Table 2). At T80, there is another jump upward, as Project disturbance is removed at this time, and the Category 2 average once again matches the reference condition.

Overall, adding the Project to the Churchill Range results in little decrease in Category 2 habitat.

Seasonal Core Use Areas

In addition to MECP GHD data, other methods exist to quantify seasonal core use areas for Boreal Caribou, including kernel density analysis of telemetry and aerial survey data and predictive RSPF models.

65% Kernel Analysis

Kernel analyses of recent winter aerial surveys (2021-2024) and satellite telemetry data (2023-2024) were used to identify additional nursery and overwintering areas potentially not identified in the current GHD data. Aerial survey data from 2021 to 2024 was used to generate Kernel Density Estimator (KDE) surfaces to identify over-wintering areas. KDE methods quantifying 65% kernels from satellite telemetry data (2023 – 2024) for overwintering (December 1 to March 31st) and nursery periods (May 1 to September 15) were run to identify more recent seasonal core use areas. These areas were mapped with MECP Category 1 data

(Figure 6.13-7 and Figure 6.13-1). Wintering areas delineated through annual aerial surveys and satellite telemetry consistently overlapped the Category 1 GHD wintering areas (Figure 6.13-1). Similarly, calving and nursery distribution kernels from the telemetry study (2023 and 2024) consistently overlapped Category 1 Calving and Nursery GHD identified areas (Figure 6.13-7, Figure 6.13-10). Areas impacted by the Project are summarized in Table 6.13 4.

Table 6.13-4: Direct and Indirect Disturbance by Preferred Project on Seasonal Core Use Areas at PDA, PDA + 500 m, LSA and RSHA (Churchill Range) Scales of Investigation

Habitat Type Impacted (1)	PDA			LSA†		Churchill Range	
	km²	%LSA‡	% RSHA	km²	% RSHA	km²	%
Nursery Habitat[1]							
Direct habitat disturbance[2]	0.09	0.02	0.00	0.09	0.00	0.09	0.00
Indirect habitat disturbance[3]	2.16	4.75	0.06	114.00	3.32	84.24	2.46
Wintering Habitat[4]							
Direct habitat disturbance	0.12	0.26	0.01	0.12	0.01	0.12	0.01
Indirect habitat disturbance	2.57	5.65	0.11	5.16	0.23	5.16	0.23
Area of Pooled Nursery Habitat [5]							
Direct habitat disturbance[1]	4.17	0.84	0.07	4.17	0.07	4.17	0.07
Indirect habitat disturbance[2]	35.83	7.22	0.62	428.67	7.39	377.99	6.51
Area of Pooled Wintering Habitat[6]							
Direct habitat disturbance[1]	1.12	1.76	0.01	1.12	0.01	1.12	0.01
Indirect habitat disturbance [2]	27.53	43.21	0.31	55.97	0.63	55.97	0.99

[1]65% Nursery Kernels from satellite telemetry program

[2]direct disturbance from PDA

[3]indirect disturbance is PDA + 500 m

[4]65% Wintering Kernels from satellite telemetry program & Kernel Density Estimates from Aerial Surveys

[5]Pooled Nursery = MECP GHD Nursery & Nursery telemetry kernels (Figure 6.13-7)

[6]Pooled Wintering =MECP GHD Wintering + Wintering telemetry kernels and aerial survey (Figure 6.13-3)

† The LSA extends beyond the boundary of the RSHA

‡ Percentages are the percent of habitat impacted per scale of investigation

Predictive RSPF Calving/Nursery Habitat Modelling

Although general range condition is mapped using predictive models of GHD Categories 2 and 3 (including summer and spring probability of use), the effect of landscape configuration and development on calving/nursery habitat (Category 1 habitat) is not modelled. Category 1 habitat is generally mapped using direct observations of cows and calves through aerial surveys in spring and summer, and then delineating areas using hand-drawn maps. This approach provides confirmed evidence of areas used by Boreal Caribou for reproduction but is not able to either identify areas that could serve as calving and nursery areas, but currently are not used, or to predict the change in availability of calving areas as the landscape changes over time, either through the addition or removal of anthropogenic disturbances, or through the aging and succession of disturbed forest over time.

A recent study by Walker et al. 2024 found that females displayed strong site fidelity in 15% of 99 females tracked, but 35% showed habitat fidelity, moving to new locations with similar habitat characteristics. The remainder showed a combination of site and habitat fidelity over the years monitored. Walker et al. 2024 concluded that management for calving areas should include a combination of site fidelity approaches, where mapped sites known to be used for calving are protected, but habitat models should also be developed to predict potential new locations for calving. For environmental impact assessments, it is helpful to apply a predictive model to assist in the evaluation of changes to calving and nursery areas over time.

Predictive RSPF models that spatially correlate with existing Category 1 GHD nursery areas, calving and nursery delineations from the satellite telemetry program with underlying environmental conditions (consistent with the criteria used by MECP to identify Category 1 habitat) were developed (Appendix P-4.2, P-4.3; Figure 6.13-8 and Figure 6.13-9). These models were applied to estimate relative change in available nursery habitat over time after the Project was applied to the landscape (Appendix P-4.2, P-4.3 and Table 6.13-6).

Two calving/nursery RSPFs (Appendix P-4.2, P-4.3) were developed to assess the extent to which the availability of calving habitat changed over time and the impact the Project would have on the existing predicted distribution of calving habitat (Figure 6.13-9, Figure 6.13-10)

A calving RSPF model was developed using recent satellite telemetry data (May 1 to June 30, 2023) from collared Boreal Caribou with sufficient location data (n=48 caribou) to predict the locations of female Boreal Caribou to predict calving habitat suitability across the RPSA and Churchill Range (Appendix P-4.2, Figure 6.13-7, Figure 6.13-9). Spatial covariates used in the RSPF modelling effort were derived to reflect both natural habitat and disturbance from anthropogenic and natural sources. Thus, a final objective was to change the baseline covariates to reflect the expected change due to the Project and to calculate the corresponding expected change in habitat suitability. RSPF models of habitat relationships provide a means of predicting habitat suitability and inference of habitat loss consequences (Dyson et al. 2022). Probable calving locations were determined using standard methods that applied 3-day minimum average movement distances.

A second calving RSPF was developed relating existing MECP delineations of calving and nursery (Category 1) areas to underlying environmental conditions, including GHD models of summer and spring probability of use. An overlay of GHD Category 1 Nursery habitat on seasonal Category 2 GHD probability of high use in summer revealed a high spatial correlation (Appendix P-4.3). This suggests that the variables used to map summer probability of use are likely to be also useful for predicting Category 1 habitat. Based on this initial assessment, a predictive model for calving and nursery areas that relates directly to the criteria MECP uses for identifying Category 1 habitat was developed. The model was then applied through time to estimate the relative change in the availability of Category 1 habitat due to the Project and simulated landscape changes.

The telemetry-based RSPF (Appendix P-4.2) was then compared to the GHD-based calving RSPF (Appendix P-4.3) to assess congruity and ability to predict areas classified as Category 1 nursery habitats classified by MECP. The spatial fit of the GHD based RSPF was more tightly aligned with the MECP Category 1 map. This strong correlation based on the predictive model allowed for the prediction of the future availability of Category 1 habitat based on simulated anthropogenic and natural disturbance changes.

Table 6.13-5. Direct and Indirect Disturbance by Preferred Project on Predicted Calving / Nursery Areas at PDA, PDA + 500 m, LSA and RSHA (Churchill Range) Scales of Investigation

Habitat Type Impacted (1)	PDA			LSA†		RSHA/Churchill Range	
	km²	%LSA‡	% RSHA	km²	% RSHA	km²	%
Predicted RSPF Calving /Nursery Habitat[1]							
Direct habitat disturbance (km²)[2]	15.15	2.96	0.28	15.15	0.28	15.15	0.28
Indirect habitat disturbance (km²)[3]	57.14	11.15	1.08	507.72	9.56	497.19	9.36

1 Calving / Nursery RSPF (Appendix P-4.3, Rempel 2024)
2 Direct disturbance from PDA
3 Indirect disturbance = PDA + 500 m buffer for PDA calculation, LSA for other calculations. Direct disturbance is removed.
† The LSA extends beyond the boundary of the RSHA
‡ Percentages are the percent of species available habitat

6.13.5.3 Sensory Disturbance

Indirect loss of habitat includes areas adjacent to the Project that may experience indirect effects, such as edge effects and noise affecting movement behaviour. Indirect loss of habitat is measured within a zone of influence, which is the area between an activity's spatial footprint and the extent of the activity's effects on the surrounding habitat and wildlife populations (Wilson 2016). The indirect loss of Boreal Caribou habitat was calculated using a 500 m buffer of legacy disturbance + incremental new disturbance from the Project footprint, based on ECCC 2020 guidance for a recommended disturbance management threshold buffer.

Sensory disturbance can affect Boreal Caribou by a change in movement behaviour. A change in movement dynamics arising from habitat change and sensory disturbance, including avoidance of the mine site or linear corridors is a potential effect. Specifically, a change in movement has potential implications on the timing, movement rate, or habitat use when Boreal Caribou are moving between seasonal core use areas and can increase energy demands. The scale and extent of Boreal Caribou movement deflections and avoidance of roads and other semi-permeable infrastructure varies with the volume of traffic, the density of roads in the region and the regularity and size of traffic using the road (Curatolo and Murphy 1986; Dau and Cameron 1986; Singer and Beattie 1986; Murphy and Curatolo 1987; Dyer et al. 2002; Vistnes and Nellemann 2008; Lendrum et al. 2013; Sawyer et al. 2013; Wilson et al. 2016). Wilson et al. (2016) revealed strong individual responses to roads and infrastructure suggesting that the effect of infrastructure from roads may not be constant across individuals. However, most studies have documented some level of semi-permeable barrier effect created by roads to Boreal Caribou movement. Seasonal Boreal Caribou movements vary by season and sex and are influenced by habitat matrix condition, spatial requirements, disturbance, and mortality risk:

- Pregnant adult female Boreal Caribou disperse (spatially separate from other caribou) to solitary seasonal (calving/calf rearing) ranges, but their overall home ranges typically will overlap with other bulls and cows in other seasons (Mallory & Hillis 1998). Pregnancy rates are often high, but calf survival is generally low, particularly during the first month of life resulting in low calf recruitment (Pinard et al. 2012);
- During the fall rut, bulls may move >100km (Environment Canada 2012). Boreal Caribou mate polygynously, with mating occurring in loose harems (Thomas et al. 1989); males defend access to mates such that larger and older individuals dominate the reproductive success of males (Hirotani 1994), resulting in reproductive output dominated by relatively few males.
- Female annual home range sizes are more restricted near anthropogenic activity (Wilson et al. 2016).

Noise can impact Boreal Caribou in several ways, such as:

- Lower calf weights of calves born closer to infrastructure,
- Reduced probability of pregnancy [consecutive daily (n=40) exposure to military jet overflights was predicted to have a 4-5% decrease in the probability of pregnancy under normal environmental conditions (Maier et al. 1998)], Increased vigilance from perceived threats affecting time spent for other purposes (feeding), resulting in reduced body weight from increased energetic demand,
- Displacement from/avoidance of suitable habitat in proximity to infrastructure (roads, mines);
- Interrupted resting bouts when exposed to excessive or unpredictable noise [(e.g., overflights in late winter at exposure levels $\geq$98 dBA Maier et al. 1998)].

Boreal Caribou habitat potentially affected by sensory disturbance from noise was determined by applying a modelled 40 dBA continuous sound level contour (Section 6.3) from the mine site area and associated 80 dBA discontinuous sound level contour to the surrounding Category 1 Boreal Caribou habitat mapping for the airstrip and transmission line to generate a single zone of influence area (Figure 6.13-22). Assessment of noise disturbance is focused on operations for the MSA (Year 4 conservative case scenario). The indirect changes for the construction and operation of the MAR and transmission line are of very short duration and temporary.

No federal or provincial continuous noise disturbance thresholds are specific for Boreal Caribou. However, a 40 dBA continuous noise threshold is typically used as a disturbance benchmark (i.e., >5 dBA above ambient noise) for Boreal Caribou and other wildlife, equivalent to a suburban area's noise at night. Federal acoustical guideline limits for continuous ambient noise generated by mining operations with respect to the effects of noise on wildlife is less than 45 dBA during nighttime and less than 55 dBA during daytime. Sustained noise effects associated with the Project operation assessed through predictive acoustic modelling fall below the guidelines. Science literature indicates that terrestrial wildlife responses begin at noise levels of approximately 40 dBA, and 20% of papers documented impacts below 50 dBA (Shannon et al. 2015). Perra et al. 2022 reported the lower auditory threshold for Boreal Caribou to be 30 Hz (15 dBA), whereas in previous studies, this threshold was reported to be 63 Hz (18 dBA) suggesting that sounds thought to be beyond the hearing range of Boreal Caribou are likely audible.

No federal or provincial discontinuous noise disturbance thresholds are specific for Boreal Caribou. An 80 dBA discontinuous noise contour (a precautionary level derived from a science literature review) was applied to the airstrip for both the north and south approaches. Boreal Caribou responses to aircraft overflights vary by season and are categorized as mild during late winter and strongest during post-calving (Maier et al. 1998). Responses tend to be short-term and mild compared to reactions to predators or perceived predators but generally were greater as slant distances decreased and aircraft speeds increased (Harrington & Veitch 1991, Lawler et al. 2005). Responses also vary by aircraft type, altitude and distance, herd size and composition, and previous exposure to frequent overflights (Anderson 2007), with cow/calf pairs exhibiting the most sensitive response to aircraft disturbance (Maier et al. 1998). An upper aircraft noise threshold resulting in a response by Boreal Caribou is reported to be >98 dBA (Maier et al. 1998, Harrington & Veitch 1991, Lawler et al. 2005, Anderson 2007). Distance thresholds for Boreal Caribou that resulted in a response from discontinuous noise from aircraft ranged from 30 – 2000m, with 300m being typical, and altitude thresholds ranged from 30 – 500m, with 300m being typical (Anderson 2007). Boreal Caribou were most sensitive during the calving period.

6.13.5.4 Landscape Fragmentation and Connectivity

Boreal Caribou populations require large ranges comprised of continuous tracts of undisturbed mature to old-growth coniferous refuge habitat to persist (Darby and Pruitt 1984; Brown et al. 1986; Bradshaw et al. 1995; Stuart-Smith et al.1997; Rettie and Messier 2000; Courtois 2003). These large tracts of habitat reduce the risk of predation by allowing Boreal Caribou to maintain low population densities throughout the range and allowing them to avoid areas of high predation risk (Rettie and Messier 2001; Brown et al. 2003). Increases in landscape fragmentation can reduce the function of habitat to provide refuge from predators. To evaluate the probability of the Project impacting landscape connectivity to habitat, geospatial analysis (ArcMap version 10.3) was undertaken on the modelled North-West Boreal Caribou Refuge Habitat distribution (Figure 6.13-6) using a suite of metrics to predict the change in fragmentation including:

- Mean Patch Size (The average patch size of contiguous habitat within a landscape) —Fragmentation of Boreal Caribou habitat decreases when the mean patch size increases. Therefore, reductions in mean patch size should be avoided to the extent possible to reduce impacts to Boreal Caribou.
- Edge Density (Length of edge per hectare for the landscape)—When the edge density decreases, fragmentation of boreal caribou habitat decreases. Therefore, increases in edge density should be avoided to the extent possible to reduce impacts on Boreal Caribou.
- Total Edge (Total length of edge for the landscape)—When the total edge decreases, fragmentation of the boreal caribou habitat decreases. Therefore, increases in total edge density should be avoided to the extent possible to reduce impacts on Boreal Caribou.

Using these metrics, the modelled Boreal Caribou habitat distribution and function are compared to the predicted developed condition to determine the level of impact due to fragmentation.

Assessment of Impacts to Refuge Habitat

Refuge from predation is regarded as a key factor influencing Boreal Caribou distribution and habitat use at multiple spatial and temporal scales (Bergerud 1974; Rettie and Messier 2000; Racey and Arsenault 2007; Environment Canada 2012). Refuge for Boreal Caribou is provided through large, undisturbed areas of old or mature conifer upland forest and lowlands dominated by Jack Pine and/or Black Spruce (Brown et al. 2003; Ferguson and Elkie 2004). The distribution of mature coniferous and refuge habitat for Boreal Caribou in Ontario is modelled using the provincial North-West Boreal Caribou Refuge Habitat Model developed by MNR (Elkie 2013, Figure 6.13-6), where forest unit, age as well as species composition are key inputs.

The resultant model surfaces were used as inputs to evaluate the extent to which the Project would impact the distribution and connectivity of refuge habitat (Table 6.13-7). Impacts on landscape connectivity were measured through changes in mean patch size and edge density of refuge habitat blocks. Decreases in patch size, increases in edge density or total edge reflect an increase in landscape fragmentation.

Table 6.13-6: Change in Refuge Habitat from Baseline to Post-Development in the Churchill Range (RSHA)

	Baseline/Current Refuge Habitat	Future Refuge Habitat	Change
Mean Patch Size (km^2)	1.19	1.18	-1.11 %
Edge Density (m/ha)	64.60	64.65	0.08 %
Total Edge (km)	48,933.64	48,741.73	-0.39 %

All anthropogenic disturbance is buffered by 500m to incorporate indirect impacts on refuge habitat.

Assessment of Impacts to Landscape Connectivity

Landscape connectivity was evaluated using three methods to support a lines-of-evidence assessment.

- Kernel Density Estimator (KDE+) method to identify areas of significant intersection of Boreal Caribou movements and activity relative to the Project within the RSHA.
- Brownian Bridge Movement Models to evaluate Boreal Caribou patterns of movements across the landscape in relation to habitat use and biological season within the RSHA and Population RSA.
- Circuitscape Models to assess connectivity in the context of resistance surfaces on the landscape across biological seasons within the RSHA and Population RSA.

Kernel Density Estimators and Activity Centers

Boreal Caribou satellite telemetry data obtained from MECP (2010 to 2013) and recent telemetry data from FMG's regional scale collaring program (February 2023 to April 2024) were used to identify potential locations of clusters of movement activity using Kernel Density Estimation plus (KDE+) analytical method (Bil et al. 2013, 2016) to identify areas where significant clusters of movement activity by a given Boreal Caribou occurred relative to the Project footprint (Figure 6.13-13 and Figure 6.13-14). A 100 m default bandwidth was used for KDE+ analyses to account for the spatial accuracy of the data and to avoid over-smoothing the output results in identifying clusters of movement. The Monte Carlo method of repeated random simulations (n = 800 simulations) was then conducted to generate cluster identification thresholds to assess the significance of these locations (defined as clusters above the 95th percentile level) identified using the KDE+ method. These locations were overlaid with the PDA, and potential locations where Project components may interact with Boreal Caribou movement and habitat connectivity were identified (Table 6.13-7).

Table 6.13-7: Number of Activity Movement Clusters per MAR1 and TL 1

Project Component	Length (km)	Number of Significant Clusters	Cluster Strength Score		Length of Clusters (km)		
			Mean	Range	Total	Mean	Range
Mine Access Road (MAR 1)	16.142	3	0.519	0.406 - 0.652	0.788	0.263	0.118 - 0.436
Transmission Line (TL 1)	92.315	18	0.436	0.112 – 0.945	6.265	0.348	0.072 – 1.679

Landscape Movement

Dynamic Brownian Bridge Movement Models (BBMM's) were used to quantify Boreal Caribou habitat use and movement. Specifically, these models were used to produce individual utilization distributions for Boreal Caribou, which were combined to provide a metric of habitat use across both the RSHA and the population RSA. Models were run separately for calving (May 7 to July 14), post-calving (July 15 to November 14), and nursery dates (May 1 to September 15), as well as early winter (November 15 to January 20), late winter (January 20 to March 5), over winter (December 1 to March 31), and spring (March 5 to May 6).

BBMM's use fine-scale observations, such as telemetry data, to estimate the probability of space use (Horne et al., 2007; Kauffman et al., 2021; Palm et al., 2015; Seidler et al., 2015) and delineate highly utilized habitat (Fischer et al., 2013; Kranstauber et al., 2012) and travel routes (Kauffman et al., 2021; Sawyer et al., 2009). During modelling, the probability of use is calculated using consecutive telemetry locations along an individual's movement trajectory. This incorporates the duration and distance of consecutive steps with the Brownian motion variance, which is a static estimate of the individual's mobility based on general movement direction and speed (Horne et al., 2007; Sawyer et al., 2009). Dynamic BBMM's similarly estimate probability of use but differ in that the Brownian motion variance estimate is allowed to vary (i.e., is dynamic) in time and space along the individual's movement trajectory (Byrne et al., 2014; Kranstauber et al., 2012). As a result, these movement models produce utilization distributions that more accurately reflect movement trajectories.

As dynamic BBMM's quantify patterns of movement, the resulting utilization distributions show both stopover sites and travel corridors between them (Palm et al., 2015). Travel corridors can be considered estimates of connectivity informed by actual Boreal Caribou movement under existing conditions.

Dynamic BBMM's were fit with the move package (Kranstauber, 2023) in R (R Core Team, 2023). Five model parameters were defined: Resolution, Margin, Window Size, Location Error, and Time Step (Kranstauber, 2023). Resolution determines the size of spatial raster outputs. Margin and Window Size were set based on recommendations from the available literature (Kranstauber et al., 2012). In the model, the Margin sets the number of telemetry locations before a change in movement analysis is possible. This was set to 11 telemetry locations. Window Size is the number of consecutive telemetry locations over which Brownian motion variance is calculated and must be at least twice the number of telemetry locations as the Margin (Kranstauber, 2023). Window Size was set to 31 telemetry locations. Generally, differences in the Margin and Window Size have little effect on model outputs (Kranstauber, 2023). One individual was dropped from the Calving and Nursery analysis as they did not have enough telemetry locations to accommodate the Window Size and Margin. Location Error is the error associated with telemetry locations. No Location Error estimates were available for these data. As such, a Location Error of 10 m was estimated based on an inspection of the standard errors of the collar fixations. Time Step is the time interval over which the movement model is calculated, which should be approximately 1/15th of the collar fix rate (Kranstauber, 2023). These default values were used. Before the models were fit, movement segments in which the time lag (i.e., fixation) variance was larger than expected (> 10 hours) were identified and removed for each individual (Kranstauber, 2023). After the models were fit, they were averaged over all Boreal Caribou for each time period. The resulting values were normalized to range from 0 to 1.0 and inversed so that low values indicate movement corridors and high values indicate areas of high use. The resulting model output was fit with contours showing the 99, and 95 % utilization distributions.

The PDA was then overlayed on the resultant BBMM maps to assess the probability of the Project impairing the movement of Boreal Caribou (Figure 6.13-15 to Figure 6.13-19).

Landscape Connectivity

Boreal Caribou freely move between the Kinloch, Churchill, and Berens Ranges. Therefore, changes in habitat configuration in the Churchill Range have the potential to impair movement and connectivity to neighbouring ranges. A connectivity model was developed using the Circuitscape application (McRea 2013) and run on the combined area of the Kinloch, Churchill, and Berens Ranges.

Two input layers are required for the connectivity model: a resistance raster and a focal node raster. A 150-m resolution resistance raster was created using the GHD Spring Resource Selection Function (RSF) created by Hornseth and Rempel (2016). The RSF output of the Kinlock, Churchill, and Berens Boreal Caribou ranges were integrated, filling small holes between the model outputs using a 500-m moving window average. The RSF predicted use values were reclassified into five bins using the Jenks natural breaks classification method, rounded to the nearest five hundredths (0.05). The upper level of the third natural breaks bin was replaced with the predicted high-use threshold of Boreal Caribou in the Churchill range (Ferit 2024). Resistances between 1 – 1000 Ω were assigned based on previous scientific literature (Bowman et al. 2020; McRae, 2006). Low resistance values (i.e., resistance of 1 Ω) represent landscapes in which the focal species can traverse without impediment and correspond to high RSF values (i.e., high use) (Table 6.13-9) High resistance values (i.e., resistance of 1000 Ω) represent a landscape in which the focal

species would incur a significant cost to traverse and correspond to low RSF values (i.e., low use) (Table 6.13-9).

Table 6.13-8: Assigned Resistance Values

RSF Bin	Spring RSF Value[(a)]	Expected Boreal Caribou Use	Assigned Resistance Value (Ω)
5	0.5500 – 1.0000	Very High	1
4	0.2368 – 0.5500	High	10
3	0.1500 – 0.2368	Moderate	50
2	0.0500 – 0.1500	Low	100
1	0.0000 – 0.0500	Nil	1000

(a) Where overlapping ranges occur, the higher end of the lower input range is inclusive, and the lower end of the higher input range is exclusive.

Focal nodes represent Spring Boreal Caribou core use areas and were produced using the centroid of the 85% kernel density utilization distribution (KUD) created from MECP GHD Category 1 data and FMG telemetry data collected during spring between 15 April 2023 and 21 June 2024, inclusive. Focal nodes were converted to a 150-m resolution raster for use within the program. The connectivity model was run using Circuitscape Version 4.0.5 in pairwise modelling mode to produce a map representing habitat connectivity in current (Ω).

The PDA was then overlayed on the resultant Circuitscape map to assess the probability of the Project impairing connectivity amongst ranges (Figure 6.13-16, Figure 6.13-17).

6.13.5.5 Assessment of Change in Range Condition

The recommended disturbance management threshold, based on Environment Canada and Climate Change (2020), is 65% undisturbed (or 35% disturbed) habitat within a local population range to achieve a 60% probability of self-sustainability (i.e., a stable or growing population) over a 20-year horizon. Lower amounts of range-scale disturbance would theoretically result in higher probabilities of local population self-sustainability.

Ontario provincial criteria for disturbance assessment differs from the Federal criteria with respect to age of disturbance. Federally, boreal forest less than 40 years old is considered disturbed and greater than 40 years is considered undisturbed. In Ontario, young forest is defined as less than 37 years old, and it is assumed that Boreal Caribou refuge and winter habitat begin to become suitable at 40 years of age, but it may take more than 50 years for Boreal Caribou to frequent previously disturbed habitat (MNRF 2014b).

High densities of linear disturbance features provide efficient travel corridors for Wolves (Dickie et al. 2017) and can lead to the loss of the predation refugia thought necessary to sustain Boreal Caribou (DeMars & Boutin 2018). The relationship between Boreal Caribou habitat use and natural disturbance (fire) is complex, with the response of Boreal Caribou to fire affected by habitat characteristics (Dalerum et al. 2007; Skatter et al. 2017; DeMars et al. 2019; Konkolics et al. 2021). The importance of habitat fragmentation increases with an increasing deterioration of the matrix condition (Ramírez-Delgado et al 2022) and is linked to declining populations and reduced genetic diversity in threatened Boreal Caribou populations (Anderson & Thompson 2023).

The provincial Range Management Policy (MECP 2019) as well as the federal recovery strategy (ECCC 2020) directs that Boreal Caribou ranges will be managed such that the amount of cumulative disturbance remains at or moves toward a level that supports a self-sustaining Boreal Caribou population (i.e., less than 35%

cumulative disturbance/range). Provincial assessments of cumulative disturbance of the Churchill Range were assessed in 2012 and 2017:

- The Churchill Range is 21,265 km^2.
- The integrated range assessment for Churchill Range described the cumulative disturbance level in 2012 to be 41.3% (water included in the calculation), composed of 35.9% (7,634.6 km^2) anthropogenic disturbance, 5.4% (1,148.3 km^2) fire disturbance and an overlap of both disturbance types of 1.9% (403.5 km^2), resulting in 58.6% of the range in an undisturbed state as of 2012 (MNRF 2014b). If water was excluded from the disturbance calculation disturbance increased from 41.3% to 51.7% (MNRF 2014b).
- A provincially updated disturbance assessment of the Churchill Range was undertaken in 2017 and placed the cumulative disturbance level at 45.5% (water included in the calculation; 28 July 2022, MECP Memorandum of review of the Springpole Gold Project Draft EIS/EA).

An updated range condition habitat disturbance assessment on the Churchill Range is provided below, using the most current available eFRI and disturbance data acquired through a data sharing agreement with MECP in 2023, comprised of Trout Lake FMU data provided by Paper Excellence Group (formerly Domtar) and supplemented with publicly available information including the most current LandSat imagery to support the cumulative effects assessment for the Project (Section 7.0). Since Boreal Caribou rely directly and indirectly on the entire range to carry out their life processes, the condition of their range informs the relative tolerance to alteration and determines the risk due to a particular activity.

The updated Churchill Range disturbance assessment using Federal criteria indicates a disturbance level of 41.6% (8,850.1 km^2), resulting in 58.4% of the Churchill Range in an undisturbed state as of 2024. The addition of the Project would increase the future conditions of the Churchill Range by 0.58% (51.1 km^2) to 41.9% (8,901.2 km^2) disturbed.

The updated Churchill Range disturbance assessment using Provincial criteria indicates a total disturbance level of 41.6% composed of 7% fire disturbance and anthropogenic disturbance 34.7% (Table 6.13-10). The addition of the Project would increase the future conditions of the Churchill Range by 0.58% to 41.9% disturbed.

Table 6.13-9: Area of fire and anthropogenic disturbance calculated using Provincial methods for current conditions (CC) and future conditions (FC).

Study Area	Study Area (km^2)	Fire	Anthro	Both	%Fire	%Anthro	%Total disturbance	Overlap[1]
RSA-Hab (CC)	21264.8	1480.565	7369.491	8850.057	7.0%	34.7%	41.6%	6.8%
RSA-Hab (FC)	21264.8	1480.565	7420.625	8901.19	7.0%	34.9%	41.9%	6.8%

1 Percentage of anthropogenic disturbance that overlaps with natural disturbance (fire).

6.13.5.6 Assessment of Changes in Population Abundance and Demography

Effects on population abundance, demography, and relative distribution were evaluated through consideration of two key pathways. Ultimately habitat disturbance drives most effects pathways for Boreal Caribou:

- **Apparent Competition - Change in Predator-Prey Dynamics Pathway**— The predicted change in the risk of mortality to Boreal Caribou and resultant community dynamics between Caribou, Moose, and Wolves was measured using the relative abundance and distribution of Caribou, Moose, and Wolves during aerial surveys (2021-2024) and supplemented with qualitative assessment in

consideration of experience with other mine operations, literature, and Project-specific factors. The apparent competition pathway is still ultimately driven by habitat disturbance as Moose and Wolves can benefit at the expense of Boreal Caribou as a result of habitat disturbance.

- **Habitat Disturbance Pathway**— the Project will incrementally increase the cumulative disturbance in the Churchill Range which could result in changes in the probability of population persistence or population growth. The Project will also directly and indirectly impact seasonal habitats used by Boreal Caribou (see Section 6.13.2 and 6.13.3) which could result in changes in population growth. Multiple lines of evidence were used to help predict the Project's effects on population state (abundance, rate of population growth (λ), probability of persistence and seasonal distribution), population reconstruction and trend modeling, scenario analysis of population sustainability and dynamic modelling of lambda.

Project design (compact footprint, use of legacy disturbance footprints to the extent possible) and mitigations (application of Boreal Caribou BMPs) are predicted to minimize or avoid effects on Boreal Caribou mortality risk resulting from the Project (e.g., Caribou-Vehicle collisions). Potential for Boreal Caribou mortality from rights-based hunting is not predicted to increase because of the Project, particularly since the amount of change in habitat access and habitat change is minuscule compared to other sources of broad-scale landscape change from other sources such as forestry roads.

Apparent Competition - Change in Predator-Prey Dynamics

Alteration of habitat can result in trophic effects on predator-prey relationships resulting in higher predation rates on Boreal Caribou (Bergerud 1988; Stuart-Smith et al. 1997; Rettie and Messier 1998; Schaefer et al. 1999; James and Stuart-Smith 2000; Wittmer et al. 2005; Environment Canada 2011). Habitat disturbance can functionally impair habitat function by potentially increasing predation risk for Boreal Caribou through apparent competition. Apparent competition is an increased predation of Boreal Caribou because of increased alternate prey, such as Moose responding to habitat changes caused by disturbance (e.g., increased browse availability and amount of early succession deciduous and mixedwood forest covers), and the subsequent response by a shared predator (Wolf and Black Bear) to increased Moose densities (Seip 1991, 1992; James and Stuart-Smith 2000; Wittmer et al. 2005; Neufeld 2006; Courtois and Ouellet 2007; Courbin et al. 2008; Environment Canada 2011, 2012; Dickie et al. 2017; Johnson et al. 2019; Fryxell et al. 2020; ECCC 2020; MECP 2020), and facilitated through improved predator travel efficiency in modified landscapes (Kittle et al. 2017, Johnson-Bice 2023).

At the RSPA and RSHA scales, changes in early succession habitats are primarily driven by forestry activity and natural disturbance (fire) and can affect community dynamics, such as changes in species distribution and abundance.

Moose Distribution and Abundance

Moose metrics were derived from annual winter aerial survey observations of animals and signs to determine the overlap of the Moose distribution with the Boreal Caribou distribution using adaptive density kernels (Figure 6.13-23, Figure 6.13-24, Figure 6.13-25 and Figure 6.13-26;). As expected, Boreal Caribou and Moose were spatially separated in all years (2021-2024), except for partial overlap in:

- 2021 - 2 locations in Churchill range in proximity to TL alternatives (Figure 6.13-23)
- 2022 - 1 location in Berens range (Figure 6.13-24)

- 2023 – no overlaps detected (Figure 6.13-25)
- 2024 – 4 locations in Berens range (Figure 6.13-26)

Wolf Distribution and Abundance

Wolf metrics were derived from annual winter aerial survey observations of animals and signs to determine the overlap of the Wolf, Moose, and Boreal Caribou distribution using adaptive density kernels (Figure 6.13-23, Figure 6.13-24, Figure 6.13-25 and Figure 6.13-26;).

Wolf-Boreal Caribou relative distribution overlaps were detected in:

- 2021 – 1 location in Kinloch Range (Figure 6.13-23)
- 2022 – 4 locations, including a Wolf/Boreal Caribou kill site East of Slate Falls (Figure 6.13-24)
- 2023 – 4 locations (Figure 6.13-25)
- 2024 – 3 locations, all within Berens Range, including a Wolf/Boreal Caribou kill site Southwest of Mamakwash Lake (Figure 6.13-26)

Wolf-Moose relative distribution overlaps were detected in:

- 2021 – 4 locations (Figure 6.13-23)
- 2022 – 12 locations (Figure 6.13-24)
- 2023 – 4 locations (Figure 6.13-25)
- 2024 – 9 locations (Figure 6.13-26)

Across aerial survey years, a large proportion of detected Wolf-Boreal Caribou overlap areas were also associated with Moose-Boreal Caribou overlap or Wolf-Moose overlap. This is consistent with the apparent competition pathway, resulting in increased Boreal Caribou mortality associated with the increased presence of alternative prey (Moose) and their shared predator (Wolf). There were more locations for Wolf-Moose overlap than Wolf-Boreal Caribou locations. This is consistent with wolf distribution ecology driven by prey availability and density.

Assessment of Mortality Risk

Relative distribution analysis across aerial survey years (2021-2024) indicates a pattern that the majority of detected Wolf-Boreal Caribou overlap areas were associated with areas of Moose-Boreal Caribou overlap or Wolf-Moose overlap (Figure 6.13-23; Figure 6.13-24; Figure 6.13-25; Figure 6.13-26). This is consistent with the apparent competition pathway, which results in increased Boreal Caribou mortality associated with the increased presence of alternative prey (Moose) and their associated shared predator (Wolf). There were a greater number of wolf-moose overlap locations than Wolf-Boreal Caribou locations. This is consistent with Wolf distribution ecology which is driven by prey availability and density. There were no Caribou-Wolf or Caribou-Moose overlaps of relative distribution in the proximity of the Project in 2022 or 2024. There was one Caribou-Wolf and one Caribou-Moose overlap of relative distribution at a single location on TL1 in 2023. There was one Caribou-Moose overlap detected at two locations on TL1 that corresponded to a similar location in 2023; all overlaps occurred where an existing TL occurs west of Slate Falls. The addition of the Project to the landscape is not expected to significantly increase mortality risk from the apparent competition pathway.

Population State and Habitat Disturbance

Multiple lines of evidence were used to help predict the Project's effects on habitat on the population state (abundance, rate of population growth (λ), probability of persistence and seasonal distribution) on Boreal Caribou:

- Population reconstruction and trend modeling
- Scenario Analysis of Population Sustainability
- Dynamic Modelling of Lambda

Population Reconstruction and Trend Modelling

To discern patterns of population structure, abundance, and trend, population reconstruction and trend models were constructed in Microsoft Excel© for each Boreal Caribou range using Provincially published historical data from the Integrated Range Plans (MNRF 2014a, MNRF 2014b, MNRF 2014c) and winter population aerial survey data (2021, 2022, 2023, and 2024). Model construction involved linear interpolation between survey years using demographic data and available λ estimates (to calculate population density for a given year) and demographic structure data between successive survey years. A third-degree polynomial was used to fit a population trend line to a 3-year moving average of abundance estimates for the study population (Figure 6.13-20). The polynomial was used because it is more sensitive to fluctuations in population size than a linear or log-linear trend line (Kuzyk 2016, Arsenault et al. 2019). Third-degree polynomial regression more accurately captures non-linear relationships, provides a higher degree of flexibility to fit a trend line to observed data points, and improves prediction accuracy compared to linear regression (Vucetich & Peterson 2012; Haili & Rao 1992). The objective of model fitting was to enable the assessment of population performance metrics of the study population with respect to changes over time in; 1) population state (winter abundance and demographic composition); 2) vital rates (λ, calf recruitment, sex ratio); and 3) historical range of variability relative to the long-term (13-yr) mean.

- **Baseline Case** (2010-2024) – population reconstruction with trend analysis indicated a declining population in recent years (Figure 6.13-20) with an estimated mean **λ = 0.957 ±15.0% (0.813-1.100; 95% CI)** for the RPSA (Table 6.13-10). Estimates of λ based on historical values taken from IRA (Provincial Integrate Range Assessment) reports for the RSHA and RSPA were 0.955 and 0.931, respectively.
- **Forecast Models** - Simulation of proposed Project disturbance net effect involved the utilization of the baseline case with a Projection of the population trend model out to 80 years using the mean population λ (0.957; 2010-2024). The effect of the Project on population abundance was Projected (80 years) at Churchill Range (RSHA), Population RSA, and LSA based on proportional loss of available Category 1 calving and nursery habitat (+500m buffer), with a 50% Project disturbance effect at 60 years and effect disappearing at 80 years. The purpose was to evaluate spatial and temporal scales of effect relative to baseline state and at multiple spatial scales. An alternative to identifying natural populations (i.e., Churchill Range, RPSA) is to define a "population of interest" in terms of the spatial extent of the anticipated drivers of change (Roy et al. 2019). This approach reduces the likelihood of including mixed population trajectories of multiple populations within a single analysis (Roy et al. 2019). However, the spatial drivers may have different scales (e.g., local habitat change and landscape level change) and may be nonstationary (e.g., disturbance) or change through time (e.g., ecological succession). Forecast modelling applied 2 scenarios: (1) permanent loss and (2) temporary (5-yr) loss of Category 1 Calving/Nursery habitat after which alternative

habitat is found. The purpose was to evaluate Project effects with respect to temporary versus permanent loss (Table 6.13-11, Table 6.13-12). Forecast models were developed for the preferred Project footprint and each Project alternative (Figure 6.13-28). The results pertaining to alternatives assessment are in Appendix T.

Scenario Analysis of Population Sustainability

The effect of disturbance on the long-term sustainability of the Boreal Caribou population under current versus future conditions was assessed at two spatial scales: RSPA, RSHA (Churchill Range). The buffered (500m) Project footprint was added to the current disturbance signature to assess future conditions. Multiple approaches were used to assess the effect of the Project on long-term sustainability (Appendix P-4.4):

- **Federal ECCC** use statistical relationships between disturbance and recruitment measuring the probability of persistence (POP) derived from the M4 model of buffered anthropogenic disturbance and unbuffered fire per Johnson et al. 2020.
    - POP is defined as the probability of observing stable or positive growth (λ ≥ stable) of Boreal Caribou local populations over a 20-year period at varying levels of total range disturbance (fires ≤ 40 years + anthropogenic disturbances buffered by 500 m); also known as the disturbance management threshold (ECCC 2020).
- **Modelling of Lambda (λ)** to assess effects of change in disturbance and recruitment rates to estimate % change in disturbance resulting from the Project on Boreal Caribou calf recruitment and survival. Lambda (λ) is the proportion of change in population size (*N*) from one year to the next. It is a measure of population growth. If λ >1.0, the population is increasing; if λ = 1.0, the population is stable; and if λ <1.0, the population is declining. Four methods are applied (1) population reconstruction, (2) empirical modelling of historical data, (3) Vital Rate Modelling of λ using the female-only equation (Hatter & Bergerud 1991) on historical data and recent (2021-2023) aerial survey datasets, and (4) Leslie-matrix modelling.

Federal ECCC

The POP varied depending on the scale of analysis:

- At the RSPA level, the current total disturbance of 31.7 % infers a POP to maintain a self-sustaining population of 68.8%. Under future conditions total disturbance is 68.7%, inferring in a POP of 31.8% (a decrease of 0.39%).
- At the Churchill Range (RSHA) scale, the current total disturbance of 41.6% infers a 52.9% POP. Under future conditions 41.9% total disturbance infers a 52.5% POP, a decrease of 0.73% (<1% change).

The Project adds marginally to the risk of sustainability, with a minor decrease in λ of <1% caused by disturbance at the RSA scale (regardless of method used to calculate λ) resulting from the overall Project (Table 6.13-10) and a small decrease in the POP of -0.39% at the RSPA scale and -0.73% at the RSHA (Churchill Range) scale(Appendix P-4.4).

Modelling of Lambda (λ)

Three modelling approaches were used to evaluate the effect on λ of disturbing the Category 1 nursery polygon directly impacted by the PDA (Appendix D):

- **Empirical Modelling** of the RSPA using data regression analysis of recent surveys (2021-2023) indicated a declining population trend (estimated mean **λ = 0.949**) (Table 6.13-10, Table 6.13-11). An estimate of λ can be obtained through log-linear regression of $\ln(N_t)$ versus *t,* where *N* is the observed number of Boreal Caribou at time *t*.
- **Vital Rate Modelling of λ** based on adult female survivorship and changes to calf recruitment using vital rates obtained from the IRA reports and applying the female-only equation (Hatter & Bergerud 1991). Vital rate modelling using IRA calf recruitment rates (Model 1) yielded an estimated mean **λ= 0.953** (Table 6.13-10). Vital rate modelling using recruitment from recent aerial surveys (Model 2) yielded an estimated mean **λ=0.964** (Table 6.13-11).
- **Leslie Matrix Modelling** to simulate λ over longer time horizons (1-55 years) resulted in an estimated mean **λ=0.937** Table 6.13-10).

All estimates of lambda (λ) (which reflect population growth) from all methods fall within the 95% CL of λ=0.957 +/- 15.0% (0.813 - 1.100) at the RSPA scale (Table 6.13-10).

Table 6.13-10: Potential Project effects on λ based on population modelling lines of evidence.

Population Modelling Method	Spatial Scale	Modelled λ estimates		
		Baseline Case	Project Case with Preferred Alternative MAR1_TL1	% Change from Baseline
Sustainability Metrics under Current Conditions				
Empirical Model of λ (based on 2021-2023 surveys) (Ferit 2024 – Appendix D)	Population RSA	0.949	---	---
	RSHA	---	---	---
Vital Rate Model 1 of λ (based on IRA estimates 2009-2013) (Ferit 2024 – Appendix D)	Population RSA	0.953	---	---
	RSHA	0.960	---	---
Vital Rate Model 2 of λ (based on 2021-2023 surveys) (Ferit 2024, Table 3)	Population RSA	0.964	---	---
	RSHA	---	---	---
Scenario Analysis of Sustainability Metrics under Current versus Future Conditions				
Population Reconstruction Trend Model (2010-2024)	Population RSA	0.957	0.956	-0.10
	Survey Area	0.957	0.953	-0.42
	RSHA	0.957	0.950	-0.73
ECCC Disturbance / Recruitment Model M4 (Ferit 2024, Appendix D- Table 11)	Population RSA	0.9668	0.9665	-0.03
	RSHA	0.9434	0.9427	-0.07
	LSA	0.9543	0.9425	-1.24
Leslie Matrix Model 1 (using ECCC method to estimate drop-in vital rates from addition of Project time 3 to 30 yrs) (Ferit 2024, Appendix D - Table 12)	Population RSA	0.9365	0.9362	-0.03
	RSHA	0.9365	0.9357	-0.09
	LSA	0.9365	0.9230	-1.44
Leslie Matrix Model 2 (using Change in Category 1 calving/nursery habitat to estimate change in fecundity; time 3 to 30 yrs) (Ferit 2024, Appendix D- Table 13)	Population RSA	0.9365	0.9364	-0.01
	RSHA	0.9365	0.9361	-0.04
	LSA	0.9365	0.9324	-0.44

Baseline Case λ = **0.9365** (Leslie Matrix Modeling) to **0.9668** (ECCC Disturbance-Recruitment Model M3)
Project Case λ = **0.9230** (Leslie Matrix Modelling) to **0.9665** (ECCC Disturbance-Recruitment Model M3)

Table 6.13-11: Comparison of Project effect on λ with respect to temporary vs permanent effect to Category 1 Nursery polygon

Population Reconstruction Trend Model	Project Alternative Scenarios	Spatial Scale	Modelled λ Estimates Applied to Change in Category 1 Calving / Nursery Habitat	
			Permanent Loss*	Temporary Loss**
Baseline Case (2010-2024)		Population RSA	0.957	0.957
		Survey Area	0.957	0.957
		RSHA	0.957	0.957
Preferred Alternative	**MAR1_TL1**	Population RSA	0.956	0.956
		Survey Area	0.953	0.956
		RSHA	0.950	0.956

* Permanent loss (no alternative habitat found) modelled out to 80 yrs;

** Temporary loss (alternate habitat found after 5 yr) modelled out to 80 yrs

Altered Population Vital Rates

Population vital rates include adult female survival, calf recruitment, population growth rate (λ) and mortality risk. Changes in vital rates affects population performance with respect to probability of persistence and population state (abundance, growth, distribution).

Adult Female Survival

Adult female survival was assessed using MECP data from 2010 – 2013 and the more current available telemetry study data. Annual adult female survival was estimated from telemetry data using the Kaplan-Meier method of survival analysis (Pollock et al. 1989). The telemetry data were right-censored with time-at-risk based on the number of months since the animal was live-captured, and are summarized in Table 6.13-12:

Table 6.13-12: Summary of adult female survival rates.

Year	Adult Female Survival (%)			
	Churchill Range/ RSHA	Berens Range	Kinloch Range	Population RSA
2010			0.98	0.98
2011	0.87	0.89	0.86	0.87
2012	0.87	0.87	0.85	0.86
2013	0.80	0.82		0.81
2014	0.85	0.80		0.83
2015-2023	No data			
2024	1.00	1.00	0.67	0.90
Mean	**0.88**	**0.88**	**0.84**	**0.85**

Calf Recruitment

Winter calf recruitment was assessed for the RPSA using historical Provincial data (population and telemetry), Project annual aerial surveys (2021-2024), and field studies. Where calf recruitment data were available, calf recruitment indicators suggest a declining trend in the RPSA during the years assessed (Table 6.13-13).

Table 6.13-13: Boreal Caribou calf recruitment indicators.

Year	Calves/ 100 Cows	Calves/ 100 Adults	% Calves in Population	Population Indicator Trend
2011	16.4	15.1	12.8	Decline
2012	14.9	9.2	8.2	Decline
2013	23.3	19.2	14.7	Stable to Declining
2014	19.5	20.2	18.2	Decline
2015	22.4	18.5	15.3	Stable to Declining
2016 - 2020	No data			
2021	16.7	12.2	10.9	Decline
2022	28.4	18.4	15.6	Growth to Stable
2023	20.1	13.4	11.8	Decline
2024	29.5	21.7	17.8	Growth
Mean	**21.6**	**15.8**	**13.7**	**Decline**

Note: Calf recruitment as an "indicator of population state" - Assuming 85% annual adult female survival and a calf/cow structure ≥28.9 calves/100 Cows, if the proportion of calves (% calves) is:

>15% = population growth
12 – 15% = population stability
≤10% = population decline

Summary of Lambda - Population Growth Rate (λ)

Lambda (λ) is the proportion of change in population size (*N*) from one year to the next. If λ >1.0, the population is increasing; if λ = 1.0, the population is stable; and if λ <1.0, the population is declining.

- **All 4 lines of evidence** (see above): (1) population reconstruction, (2) empirical modelling of historical data, (3) Vital Rate Modelling of λ using the female-only equation (Hatter & Bergerud 1991) on historical data and recent (2021-2023) aerial survey datasets, and (4) Leslie-matrix modelling, **collectively indicate a declining population (λ estimates range from 0.94 to 0.98) regardless of the addition of the Project to the RPSA.**

Summary of Population Modelling Lines of Evidence

There are several approaches to assess long-term sustainability and risk to the population, including the ECCC approach of relating the level of disturbance to recruitment rate and probability of sustainability, mapping changes in GHD Category 2 and 3 habitats, changes to calving and nursery habitats, and calculating changes to the expected population trend. Each of these approaches offers slightly different perspectives on the impact of disturbance resulting from the proposed Project activity.

Regardless of the modelling approach used, all lines of evidence indicate λ values ranging from 0.923 to 0.967, all of which are below a sustainable λ of 1.00 (Table 6.13-10). This confirms the RSPA and Churchill Range population (which are the scales that are most ecologically meaningful to Boreal Caribou given their home range size) are in a state of long-term decline irrespective of the addition of the Project to the landscape. The (Appendix P-4.4).

The net effect of calving area disturbance through temporary or permanent removal of Category 1 Nursery Habitat by the Project on λ is minimal (0.011-0.084% drop in λ). . The effect on λ is greater for permanent versus temporary removal scenarios across all scenarios.

The Boreal Caribou population at the RSPA and RSHA (Churchill Range) scales are in decline with modelling methods lines of evidence revealing a consistently low estimated λ; however, the Project adds minimally to the population trend in λ of <1% caused by incremental new disturbance resulting from the overall Project.

6.13.5.7 Assumptions and the Use of the Conservative Approach

For the purposes of this effects assessment, the following assumptions have been made:

- The PDA contains buffers to allow for flexibility for design optimizations during Project permitting. The buffer includes approximately 250 m around the mine site area, a 40 m wide corridor for the TL, and the 30 m wide corridor for the mine access road. Where the mine access road and transmission line are aligned together, the buffer is included within a 60 m wide corridor. The PDA overcalculates the Project footprint by 661 ha.
- The most updated enhanced Forest Resource Inventory (eFRI) mapping was used for the purposes of this effects assessment to support the analyses presented in this assessment.
- It has been conservatively assumed that all vegetation within the PDA will be removed during construction and as a result, all wildlife habitat within the PDA will be removed. In reality, vegetation communities will be maintained in specific areas to provide a buffer along waterbodies and mine site infrastructure.
- Progressive rehabilitation will occur at select locations during construction and operation when disturbance activities have been completed. Nevertheless, to be conservative, the assessment of the effects assumes that final rehabilitation activities will be completed during the closure phase.

There are no federal or provincial noise disturbance thresholds specific for wildlife, but a 40 dBA continuous noise threshold is typically used as a disturbance benchmark (i.e., >5 dBA above ambient noise), which is equivalent to the noise of a suburban area at night. Science literature indicates that terrestrial wildlife responses begin at noise levels of approximately 40 dBA, and 20% of papers documented impacts below 50 dBA (Shannon et al. 2015). The continuous noise threshold to evaluate the effects of sensory disturbance is assumed to be greatest within the 40 dBA contour around the PDA (Appendix H-3). Noise disturbance is assessed during operations for the MSA (Year 4 worst-case scenario). The indirect changes for the construction and operation of the MAR and transmission line are of short duration and temporary.

Characterization of Residual Effects

The residual effects on Boreal Caribou include direct habitat losses, indirect habitat alterations, change in range condition, altered population demography, sustainability and mortality risk effects during the Project. Mitigation measures that will primarily address the Project mechanisms potentially causing residual effects are proposed. For this characterization, it is assumed that all mitigation will be followed.

The residual effects of the Project on Boreal Caribou and their habitats after the application of mitigation were assessed as discussed in the subsections below. The following list summarizes the interactions or components in which no residual effect occurs and, therefore, are not included in the following subsections:

- Mine construction and operations are anticipated to occur during night and day, and additional artificial lighting will be required. However, with the implementation of mitigation for lighting

through all phases light trespass in the LSA will remain consistent with an intrinsically dark isolated rural area, therefore the potential effect from this pathway will be effectively mitigated..

- Reclamation success will be monitored and evaluated to ensure the suitability of the measures applied and provide opportunities for an adaptive management process for any site-specific issues such as invasive and non-native species, erosion, or unsuccessful revegetation.
- During the closure phase, sensory disturbances that indirectly impacted habitat will be discontinued, resulting in no residual indirect effects on the habitat of Boreal Caribou due to noise/sensory disturbances. Residual effects from sensory disturbance in construction and operations phases are included below.

6.13.5.8 Direct Habitat Changes

A direct change in Boreal Caribou habitat will occur during construction within the PDA. It has been conservatively measured that 1,528 ha and 184 ha will be removed from the mine site area and mine access road of the PDA respectively during construction. An additional 315 ha of habitat is assessed to be altered in the transmission line corridor. However, a substantial segment of the transmission line follows adjacent to the existing corridor for the E1C transmission line. Additionally, the corridors required for the mine access road and transmission line have been collocated to limit the creation of new corridors.

The key mitigation measures to reduce the potential effects includes:

- Development of a compact mine site to limit the areal extent of disturbance. The Project mine site is substantially smaller than all other operating mines of similar ore processing capacity;
- Co-locating the mine access road and transmission line along the same corridor to reduce linear disturbances;
- Avoid clearing and construction activities in Category 1 Boreal Caribou nursery habitat during the calving and nursery period (May 1 to September 15);
- During construction of the Project, minimize the disturbance in Category 1 and 2 Boreal Caribou habitats by using existing trails and roads for travel, where feasible;
- Minimize the area cleared with heavy machinery in Category 1 Boreal Caribou habitat as practical recognizing the need for clear sightlines for safety along the mine access road;
- Minimize the removal of woody vegetation in areas adjacent to Category 1 habitat; and,
- Undertake progressive rehabilitation measures for the Project including the removal of construction-related facilities, the reclamation of disturbed lands and implementation of a revegetation plan including revegetation trials during operations.

With the effective implementation of these mitigation measures, the residual effect on local habitat due to direct habitat disturbance will be limited to the PDA. The residual effects are anticipated to last until the forest regenerates to a suitable state for Boreal Caribou but will be fully mitigated once the habitat returns to a mature coniferous refuge habitat for Boreal Caribou.

The analysis of the changes in Boreal Caribou habitat is based on GHD Category 1 Habitats (provided by MECP), supplemented by recent aerial survey data (2021-2024), satellite telemetry data (2023- 2024) as well as an RSPF approach (Appendix P-4.1, Appendix P-4.2, and Appendix P-4.3). Analysis compared the existing distribution (baseline/existing conditions) of seasonal core use areas (nursery, calving, and overwintering

areas) to the future condition with the construction of the Project. As a result, the following changes in Boreal Caribou habitat are predicted:

- A reduction of 407 ha of GHD Category 1 Calving/Nursery Habitat, which represents 1.07% of the nursery habitat available in the LSA and 0.10% of the nursery habitat available in the Churchill Range;
- A reduction of 107 ha of GHD Category 1 wintering habitat, which represents 1.95% of the wintering habitat available in the LSA and 0.03% of the wintering habitat available in the Churchill Range; and,
- A reduction of 149.8 ha of Category 2 habitat, which represents 3.02% of the LSA and 0.26% of the RSA.

The construction within the PDA will not remove any Category 3 habitat.

Based on the existing data (MECP GHD Category 1 data, recent telemetry and aerial survey results) and RSPF modelling, there is alternate nursery habitat available in the Churchill Range (Appendix P-4.2, Appendix P-4.3). Furthermore, the results determined that there is little change in the distribution of Category 2 or Category 3 habitat at the Churchill Range scale across seasons or pooled seasons (Appendix P-4.2).

To mitigate the residual effect of the reduction in habitat, offsetting opportunities described in section 6.13.4 will be advanced to achieve effective habitat offsetting for Boreal Caribou. Restoration actions may also include rehabilitation of Category 3 habitats which could be undertaken to expedite landscape-level connectivity between higher-quality habitat patches.

Adaptive management and monitoring of the effectiveness of mitigation and offsetting measures is described in Section 12.

6.13.5.9 Indirect Habitat Changes

This criterion aims to analyze the indirect effects of a Project on habitat (i.e., not direct habitat removal) and individuals. During construction and operations, indirect habitat effects may occur as the Project footprint alters the suitability of habitat due to sensory disturbances, such as noise, and dust..

Sensory disturbance during the construction of the Project is short term, and also infrequent along the linear corridors (mine access road and transmission line) as construction progresses and doesn't take place in any one place for long periods of time. During the operations phase, sensory disturbance due to the operation of the mine site area and the mine access road, rare the primary mechanisms for indirect habitat effects on Category 1 and 2 Boreal Caribou habitat.

The modelled 40 dBA sound level contour applied to the mine site area and mine access road during the operation phase lies within the 500 m buffer of the mine access road (which overprints Category 1 habitat). It extends beyond the 500 m buffer of the mine site area for variable distances of approximately 1 to 2 km (Figure 6.13-18).

It is predicted that over time, Boreal Caribou would habituate to ambient mine noise that is below the provincial or federal guideline limits (40 dBA for daytime and 45 dBA for nighttime for continuous/predictable noise). however, sensory disturbance may impact the frequency of use of areas adjacent to the mine. Boreal Caribou are predicted to have a short-term negative response (e.g., startle reflex) to sources of intermittent or unpredictable noise increases (e.g., drilling, blasting, vehicle operation

and low-level aircraft). Boreal Caribou adjacent to the mine may behaviourally respond to noise by increased vigilance and avoidance.

The key mitigation measures to reduce the potential effects from sensory disturbances due to noise include:

- Motorized equipment will be selected or designed with mufflers / silencers to limit noise emissions;
- Subject to applicable health and safety regulations, reversing alarms will use dimmable white noise and/or strobe lights;
- Regular maintenance and inspection of equipment and machinery used on site to ensure good working condition;
- Prohibiting the use of engine brakes and shutting off engines when vehicles are stopped or on standby, depending on seasons and weather;
- Operate vehicles and equipment to minimize impulsive noise, where possible; and
- Maintain a minimum flight altitude for helicopter use during transmission line construction, unless the helicopters are engaged in construction tasks, landing or departure;

With the effective implementation of these mitigation measures, the residual effect due to sensory disturbance will be limited to the LSA.

The current baseline case was compared with the addition of the Project (Appendix P-4.1). As a result, the following indirect changes in Boreal Caribou habitat (Table 6.13-2) are predicted:

- A reduction in the area of Category 1 Nursery Habitat within 500m buffer of the PDA of 211.2 ha, which represents 5.89% of the LSA and 0.49% of the RSHA;
- A reduction in the area of Category 1 Winter Use Habitat within 500m buffer of the PDA of 291 ha , which represents 5.3% of the LSA and 0.9% of the RSHA;
- A reduction in the area of Category 2 habitat of 483.1ha which represents 9.74% of the LSA and 0.83% of the RSHA, during construction, indirectly due to vegetation clearing; and,
- A reduction in the area of Category 3 habitat of 0.02 km^2 which represents 0.03% of the LSA and not detectable in the RSHA (0%) indirectly due to construction within the PDA.

The analysis shows that the effect of the Project on the disturbance to the distribution of Category 2 or Category 3 varies based on season but overall the proposed Project had only a minor negative influence (-0.96%) on the overall prevalence of Category 2 (high-use) habitat (Table 6.13-2 & Appendix P-4.1).

Habitat Connectivity

Avoidance behaviour, including refuge from predation, influences Boreal Caribou distribution and habitat use at multiple spatial and temporal scales (Bergerud 1974; Rettie and Messier 2000; Racey and Arsenault 2007; Environment Canada 2012). Refuge for Boreal Caribou is provided through large, undisturbed areas of old or mature conifer upland forest and lowlands dominated by Jack Pine and/or Black Spruce (Brown et al. 2003; Ferguson and Elkie 2004). Boreal Caribou refuge habitat was modelled for the Churchill Range as per the North-West Refuge Boreal Caribou Habitat Model (Elkie et al., 2012). Model results indicate that the refuge habitat is widely distributed southeast of the Project, interspersed with fire disturbance areas and forest depletion areas (Figure 6.13-11). Within these refuge areas, landscape analysis reveals that the Project would alter mean patch size, edge density, and total edge by small increments of less than 1.5%. Mean patch size increases by 1.4%, a small change that would be considered a nominal improvement for local

Boreal Caribou but would not increase habitat degradation relative to that habitat function indicator. Edge density is reduced by less than 1%, which is a slight improvement for landscape fragmentation considerations, but this is offset by a small increase (0.5%) in the total edge. Overall, the landscape analysis results indicate that Project development neither enhances nor reduces habitat configurations for Boreal Caribou with respect to connectivity via patch size or edge effects.

Movement dynamics and the assessment of semi-permeable barriers was evaluated using KDE+ analysis. The analysis revealed three centers of movement activity along the mine access road where the Project has the potential to cause local scale semi-permeable barrier effects for Boreal Caribou moving across the landscape (Figure 6.13-12). In the absence of mitigation, the development of the mine access road has the potential to reduce local habitat access and function near its midpoint. This analysis assists in determining the mitigation measures to be implemented and monitored for adaptive management needs.

KDE+ analysis also revealed 18 locations along the transmission line corridor, including in areas associated with the Category 1 nursery area southeast of the mine site area (same as those identified for the mine access road) and an area with both nursery and overwintering habitat west of Slate Falls Nation (Table 6.13-5, Figure 6.13-13). Boreal Caribou frequently use this location despite the existing transmission line corridor on the landscape, suggesting some habituation to this feature. However, most (n=15) of the hotspots occur within the section of the transmission line that is parallel with the existing E1C transmission line in proximity to Slate Falls Nation, and the remaining locations (n=3) are on the co-located mine access road/transmission line. Therefore, in the absence of mitigation, the KDE+ analysis predicts that the development of the transmission line may contribute to existing reduced localized habitat access and function of these seasonal habitat areas, however, given Boreal Caribou are currently using these areas along existing linear corridors on the landscape and construction will occur outside the Boreal Caribou nursery period, the magnitude of the potential barrier effect is predicted to be small. Indeed, recent telemetry data does not indicate a barrier effect is occurring from the existing transmission line corridors. .

Circuitscape and BBMM results indicate that the northern portion of the Churchill Range has greater landscape connectivity than the southern portion of the range (Figure 6.13-16 to Figure 6.13-17). This is predominately due to the higher levels of existing habitat disturbance and fragmentation due to forestry activities and fire in the southern portion of the range (Figure 6.13-5). The BBMM results are based on recent satellite telemetry data and reflect the behaviour of those collared individuals captured within 100 km of the Project; they reflect the behaviour of Boreal Caribou that are currently using areas Projectaround the Project. BBMM results reveal seasonal differences in movement behaviour and probability of use in collared animals (Figure 6.13-15). Boreal Caribou move across the landscape closer to the Project in the spring and summer months than during the early and late winter periods (Figure 6.13-15). BBMM results also reveal that Boreal Caribou are frequently crossing the existing E1C transmission line and, in the spring and summer months, are using an area west of Slate Falls Nation quite frequently (Figure 6.13-15). Therefore, collared animals currently choose to cross and spend time adjacent to this corridor in both spring and summer months, suggesting habituation to areas in proximity to transmission lines. The implementation of key mitigation measures will reduce the potential effects on habitat connectivity at these crossing locations and will be effective in buffering barrier effects that may occur. These measures include:

- Enforcing reduced speed limits along the mine access road during the operation phase within Category 1 habitat;
- Ensuring Project-related vehicles travelling on the mine access road come to a stop if Boreal Caribou are encountered and providing them with the right-of-way to cross the road; and,

- Reducing predator sight lines by limiting removal to hazard trees and only clearing for safe access and infrastructure needs, and strategic planting of vegetation.

With the implementation of these mitigation measures, the potential residual effects of changes to movement are anticipated to be reduced and/or not further impaired.

6.13.5.10 Change in Range Condition

The disturbance within the range was calculated using both the federal and provincial approaches with analogous results and used to determine the change in range condition.

Using the Federal disturbance criteria, there is currently a disturbance level of 41.6%, with 58.4% of the Churchill range currently in an undisturbed state as of 2024. With the addition of the PDA, there would be a slight increase to the disturbance to the Churchill Range, resulting in an overall disturbance of 41.9% (Table 6.13-10).

Using the Provincial disturbance criteria, there is currently a disturbance level of 41.6%. With the addition of the PDA, there would also be a slight increase, and the overall disturbance to the Churchill Range with the addition of the Project would be 41.9% (Table 6.13-10).

6.13.5.11Change in Population State

During construction, operation and closure of the Project, the potential for change in population state and probability of persistence is evaluated through pathways including apparent competition (altered mortality from predators) and altered habitats and range condition.

Change in Apparent Competition - Predator-Prey Dynamics

The mine access road and transmission line have the potential to provide movement corridor functions for predators, such as Wolves, which may increase the mortality risk for Boreal Caribou. These linear corridors cross Category 1 habitats, potentially contributing to increased mortality risk. Boreal Caribou from Berens, Kinloch, and Churchill Ranges have been documented using the calving areas throughout the region through previous satellite telemetry programs (Provincial program from 2010 – 2013) and the recent telemetry program initiated in February 2023 by FMG. Recent data indicates that animals, primarily from the Berens Range, use local GHD Category 1 calving/nursery habitat within the LSA. Direct impacts to GHD Category 1 nursery habitats could increase mortality risk to Boreal Caribou by Wolves which may potentially reduce calf recruitment for local Boreal Caribou.

The key mitigation measures to reduce the potential effects from changes in population demography due to altered mortality from predators includes:

- Reducing predator sight lines by limiting removal to hazard trees and only clearing for safe access and infrastructure needs, and strategic planting of vegetation to provide visual barriers.
- Minimize the removal of woody vegetation in areas adjacent to Category 1 habitat; and,
- Collocating the mine access road and transmission line and following adjacent the E1C to the extent feasible towards minimizing new linear disturbance on the landscape.

With the implementation of these mitigation measures, the potential effect from this pathway will be reduced but is anticipated to occur within the LSA during operations once the infrastructure corridors are established and continue until closure.

Altered Risk of Incidental Mortality from Collisions

Based on experience with other similar low vehicle frequency and low speed roads, collision risk relative to Boreal Caribou are anticipated to be negligible. With the implementation of key mitigation measures, such as speed limits, providing Boreal Caribou the right-of-way when encountered, and communications protocols for mine access road vehicles, the risk of mortality for Boreal Caribou due to collisions with Project-related vehicles during operations is highly unlikely.

Change in Population State and Persistence

The mine access road and transmission line corridor traverse a Category 1 Nursery Area. mine site is directly adjacent to a nursery area and sensory disturbance could impact the area. The key mitigation measures to reduce the potential effects from changes in population demography due these pathways (habitat removal, sensory disturbance) includes:

- Development of a compact mine site to limit the areal extent of disturbance;
- Co-locate infrastructure with existing and planned infrastructure where possible;
- Avoid clearing and construction activities in Category 1 Boreal Caribou nursery habitat during the calving and nursery period (May 1 to September 15);
- Undertake progressive rehabilitation measures for the Project including the removal of construction-related facilities, the reclamation of disturbed lands and implementation of a revegetation plan; and,
- Implement habitat offsetting for the loss of Category 1 habitat areas through deferrals and/or offsite rehabilitation of Category 3 habitats.

While the implementation of these mitigation measures will reduce the potential effect, the Project is anticipated to alter the abundance and distribution of Boreal Caribou that seasonally occur within the Category 1 Nursery polygon adjacent to the Project. Nursery habitat functions are maintained elsewhere in the RSHA as measured by current GHD mapping as well as the predictive RSFP nursery model developed using the GHD mapping (Appendix P-4. 2, P -4.3).

Population Vital Rates and Probability of Persistence

During construction and operations, direct and indirect habitat effects were evaluated through assessing:

- Calf production and subsequent calf recruitment into the adult population;
- Adult female survival rate;
- Probability of Persistence (POP)
- Cascading local effect to population λ.

Several approaches were used to assess long-term sustainability and risk to the population, including the ECCC approach of relating the level of disturbance to recruitment rate and POP, changes to calving and nursery habitats, and calculating changes to the expected population trend. Based on the modelling results, all lines of evidence indicate λ values ranging from 0.923 to 0.967, all of which are below a sustainable λ of 1.00 (Table 6.13-10). This confirms the RSPA and RSHA (Churchill Range), which are the scales that are most ecologically meaningful to Boreal Caribou given their home range size, are in a state of long-term decline irrespective of the addition of the Project to the landscape. The net effect of calving area disturbance

through temporary or permanent removal of Category 1 Nursery Habitat by the Project on λ is minimal (a reduction between 0.011 or 0.084% in λ) at the ecologically meaningful scale (Churchill Range, RPSA).

The Boreal Caribou population at the RSPA and RSHA (Churchill Range) scales are currently under a risk to sustainability with modelling methods lines of evidence revealing a consistently low estimated λ (a threshold of 1.00 required for a self-sustaining or increasing population). However, the Project contribution is negligible with a decrease in λ of less than 0.1% caused by incremental new disturbance .

6.13.6 Significance of Residual Effects

The policy setting determines regulatory standards or thresholds to determine the significance of effects on Boreal Caribou. Canada commits to continuing to implement the three pillars of the 2018 Federal Action Plan for Boreal Caribou (ECCC 2018), including assessment of critical habitat (biophysical attributes and the maintenance of 65% undisturbed (or 35% disturbed) or strong evidence of self-sustaining populations, validated by ECCC, from population data collected over an extended period). The updated Churchill Range disturbance assessment using Federal criteria indicates an existing disturbance level of 41.6%. This existing disturbance estimate is composed of 7% fire disturbance and 34.7% anthropogenic disturbance, the majority of which is from forestry. The addition of the Project would increase the disturbance level in Churchill Range by 0.3% to 41.9%, resulting in 58.1% of the Churchill Range remaining in an undisturbed state.

For the purposes of this report and a significant residual effects assessment under this EA, a significant residual effect on Boreal Caribou is something that results in a significant change in habitat availability and effectiveness, cumulative and range-scale effects, demography, and community via predator-prey dynamics. Mitigation measures include actions to reduce impacts, compensation, and monitoring programs.

A conservative general environmental practitioner approach informed by professional experience and consultation was used to assess the magnitude. If Project-related changes do not occur at the RSHA or RSPA scales and Boreal Caribou Habitat form and function are retained, the magnitude of the residual effect is Level I. A moderate residual effect was considered if Project-related changes occur at the RSHA or RSPA scales but are minor and < 1% change. A high residual effect was considered if Project-related changes occur at the RSHA or RSPA scales are >1% change.

Due to the protected status of Boreal Caribou under SARA (2002) and the ESA (2007) and the importance placed upon them by Indigenous communities, the VC is sensitive and requires special measures to support the predicted change. Therefore, the ecological and social context is considered moderate (Level II).

6.13.6.1 Direct Habitat Changes

A residual effect on Boreal Caribou will occur due to the direct loss of habitat (including Category 1 Nursery habitat) at the RSHA scale during the construction and operation phases. The predicted residual effects will be a 0.10% reduction in GHD Category 1 Calving/Nursery Habitat, a 0.03% reduction in GHD Category 1 wintering habitat, and a 0.26% reduction in GHD Category 2 habitat available in the Churchill Range (RSHA scale). Nursery habitat functions are maintained elsewhere in the RSHA as measured by current GHD mapping as well as the predictive RSFP nursery model developed using the GHD mapping (Appendix P-4.2, P -4.3).

In addition, Category 2 RSPF modelling results (Appendix P-4.1) revealed that the net effect of the Project on Category 2 and Category 3 habitat showed little change in the distribution of categories, as at the broad scale of the model these were relatively minor changes to the landscape (Appendix P-4.1). The average Category 2 and 3 values changed from 0.519 to 0.514 between the current baseline and future conditions

(future condition is the addition of the Project on the landscape), which is less than 1% change. In conclusion, the Project had a minor negative influence (-0.96%) on the prevalence of Category 2 habitat in the Churchill Range.

Relative to the significance determination attributes and rankings for Boreal Caribou (Table 6.13-15) and with the application of mitigation measures, including measures to avoid, minimize, restore and offset residual habitat losses, the magnitude of the residual effect is moderate (Level II) as Project-related habitat changes occur at RSHA scale but are minor and <1% change. The geographic extent of the residual effect is confined to the LSA (Level I), however the duration is considered high (Level III), as the effects may only be fully mitigated once the habitat returns after closure. The frequency of the residual effects are predicted to be low (Level I) as the residual effect will occur once during construction phase. It is predicted that the residual effect will be partially reversible during revegetation at closure and includes offsetting objectives that will be immediately implemented to offset habitat loss in the short term (Level I) as regrowth of the vegetation supporting Boreal Caribou will occur over time but site conditions within the PDA will be permanently altered and some areas of the PDA will not be revegetated (i.e., CDF) at post-closure. The timing of the residual effect is considered low (Level I) as the construction activities, which include vegetation clearing, will not occur during the sensitive nursery period for Boreal Caribou.

As a result, the adverse residual effect on Boreal Caribou due to a direct change in habitat is predicted to be not significant.

6.13.6.2 Indirect Habitat Changes

It is predicted that there will be a residual effect on Boreal Caribou due the indirect loss of habitat from sensory disturbance. The predicted residual effect includes a 0.49% reduction in GHD Category 1 Nursery Habitat, a 0.9% reduction in GHD Category 1 Winter Use Habitat, and a 0.83% reduction in GHD Category 2 habitat at the RSHA scale. Nursery habitat functions are maintained elsewhere in the RSHA as measured by current GHD mapping as well as the predictive RSFP nursery model developed using the GHD mapping (Appendix P-4. 2, P -4.3). Landscape analysis on the degree of predicted connectivity indicates that Project development neither enhances nor reduces habitat configurations for Boreal Caribou. Further, collared Boreal Caribou currently choose to cross the existing E1C transmission line and spend time adjacent to this transmission line corridor in both spring and summer months, it appears there some level of habituation to this feature. Relative to the significance determination attributes and rankings for Boreal Caribou (Table 6.13-15) and with the application of mitigation measures, including measures to avoid, minimize, restore and offset residual habitat losses, the magnitude of the residual effect is moderate (Level II) as Project-related indirect habitat changes occur at RSHA scale but are minor and < 1% change. The residual effect is confined to the LSA and therefore the geographic extent is low (Level I). The residual effect will be fully mitigated once the sensory disturbance is discontinued at closure, and therefore the duration is moderate (Level II). As the residual effect will occur intermittently throughout construction and operations, the frequency of the residual effect is high (Level II), however it will be reversible (Level I) at closure when sensory disturbances will cease. The timing of the residual effect is considered low (Level I) as the construction activities, which include vegetation clearing, will not occur during the sensitive nursery period for Boreal Caribou.

As a result, the adverse residual effect on Boreal Caribou due to an indirect change in habitat is predicted to be not significant.

6.13.6.3 Change in Range Conditions

There will be a residual effect on Boreal Caribou due direct habitat disturbance, which predicts a 0.3% increase in disturbance to the Churchill Range. Under both the provincial and federal Boreal Caribou recovery strategies, Boreal Caribou in Churchill Range are designated as unlikely to be self-sustaining because the amount of critical habitat available does not meet the threshold of 65% undisturbed habitat (ECCC 2020) due to cumulative disturbance from fire and forestry operations. However, it is reasonably expected that Ontario will adjust forestry plans going forward to achieve the target. Regardless, the weight of evidence is such that the Project would contribute no to little cumulative effects and is unlikely to result in a measurable adverse effect on the population growth of Boreal Caribou in the Churchill Range. In addition, the Project will be required to meet regulatory requirement including achieving an overall benefit for the species.

Relative to the significance determination attributes and rankings for Boreal Caribou (Table 6.13-15) and with the application of mitigation measures, including measures to avoid, minimize, restore and offset residual habitat losses, the magnitude of the residual effect is moderate (Level II) as Project-related habitat changes occur at RSHA scale but are minor and < 1% change. The residual effect of direct habitat removal is confined to the LSA and therefore the geographic extent is low (Level I). The duration of the residual effect is considered high (Level III), as the effects may only be fully mitigated once the habitat returns after closure. The residual effect will occur intermittently throughout construction and operations, and the frequency of the residual is a Level II. The residual effect will be partially reversible (Level II) as regrowth of the vegetation supporting Boreal Caribou will occur over time but site conditions within the PDA will be permanently altered and some areas of the PDA will not be revegetated (i.e., CDF) at post-closure and includes offsetting objectives that will be immediately implemented to offset habitat loss in the short term (Level I). The timing of the residual effect is considered low (Level I) as the construction activities, which include vegetation clearing, will not occur during the sensitive nursery period.

As a result, the adverse residual effect on Boreal Caribou due to a change in range condition is predicted to be not significant.

6.13.6.4 Change in Population State

Changes in population state and probability of persistence were assessed at multiple scales. The Project is located in Churchill Range but data from both MECP and FMG's baseline programs has revealed that Boreal Caribou from adjacent ranges of Kinloch and Berens seasonally use habitats in the Churchill Range. A biologically defined population of Boreal Caribou in this region is not limited to the spatial boundaries of Churchill Range but conservatively at least the Churchill Range, Kinloch Range and Berens Range. However, the habitat is managed through the range management policy in Ontario which is the Churchill Range for this Project. The magnitude of changes in population state is measured through lambda (population growth) and probability of persistence (POP) and summarised per scale.

Population Growth (Lambda)

A residual effect on Boreal Caribou is predicted due to changes in demography, specifically a local reduction in calf recruitment for Boreal Caribou who use the nursery areas directly and indirectly impacted by the Project. The residual effect stems from indirect loss of habitat through avoidance of suitable habitat because of sensory disturbance and increased mortality risk from apparent competition or predator access. Although Boreal Caribou are currently crossing the existing E1C transmission line corridor, west of Slate Falls Nation and frequently spending time within and adjacent to this feature, the widening of the corridor for the proposed transmission line has the potential to alter this behaviour. Further, Boreal Caribou have

concentrations of activity west and south of the mine site area and mine access road and increased sensory disturbance from Project activities would be expected to change patterns of habitat use around these features. As a result of this disturbance to nursery areas, demographic model results (Appendix P-4.4) revealed that the predicted change in recruitment was minor, (R_f) was -0.26% for the RSPA and -0.17% for the RSHA. Likewise, models predicted change in survival was <1%, with a change of -0.005% for the RSPA and -0.042% for the RSHA (Appendix P-4.4). Based on the lines of evidence from population modelling (Section 6.13.5.6), no significant difference to change in λ from baseline state to project case was detectable at the RSPA or RSHA scales. All analyses revealed λ estimates in baseline state and project/future case were within the long term mean λ = 0.957 ±15.0% (0.813-1.100; 95% CI) at the RPSA scale.

With respect to λ, no residual effect was detectable through lines of evidence modelling at the RSPA or RSHA scales (i.e., mean λ = 0.957 ±15.0% (0.813-1.100; 95% CI), which is consistent with a magnitude of Level I at the RSPA and RSHA scales. Nursery habitat functions are maintained elsewhere in the RSHA as measured by current GHD mapping as well as the predictive RSFP nursery model developed using the GHD mapping (Appendix P-4. 2, P -4.3), recent research has demonstrated that Boreal Caribou will use new calving areas (Walker et al 2022). The geographic extent of the residual effect extends beyond the LSA as Boreal Caribou from neighbouring Berens and Kinloch ranges move into Churchill Range to calve and is therefore considered moderate (Level II). The duration of the residual effect is high (Level III), as rehabilitation will occur post-closure, and effects may only be fully mitigated once the habitat is restored. The frequency of the residual effect is moderate (Level II) as it occurs once during construction and then ongoing through operations via sensory disturbance focused around the mine. However It is predicted that the residual effect will be partially reversible during revegetation at closure and includes offsetting objectives that will be immediately implemented to offset habitat loss in the short term (Level I) The timing of the residual effect is considered low (Level I) as the construction activities, which include vegetation clearing, won't occur during the sensitive nursery period.

As a result, the adverse residual effect on Boreal Caribou due to a change in population state is predicted to be not significant at the RSHA or RSPA scales

Probability of Persistence

The threshold POP for Boreal Caribou is 65% (per ECCC 2020). Sustainability modelling (Appendix D) revealed a POP of 68.5% at RSPA scale which is 3.5% above the threshold; and a POP of 52.5% at the RSHA scale (Churchill Range) which is 12.5% below the threshold). Therefore, at the RSHA Scale (Churchill Range), the magnitude of the residual effect is predicted to be moderate (Level II) because Project-related changes in POP incrementally decrease the POP for the Churchill range <1% (RSHA -0.73% in POP change). However, at the RSPA scale (Population scale), the magnitude of the residual effect is predicted to be low (Level I) because Project-related changes in POP incrementally decrease the POP by -0.39% but overall the at this scale, the POP (68.5%) is still above the ECCC threshold of 65%. The geographic extent of the residual effect is the LSA where direct habitat impacts occur and is therefore considered low (Level I). The duration of the residual effect is high (Level III), as rehabilitation will occur post-closure, and effects may only be fully mitigated once the habitat is restored. The frequency of the residual effect is moderate (Level II) as it occurs once during construction and then ongoing through operations via sensory disturbance focused around the mine. However It is predicted that the residual effect will be partially reversible during revegetation at closure and includes offsetting objectives that will be immediately implemented to offset habitat loss in the short term (Level I) The timing of the residual effect is considered low (Level I) as the construction activities, which include vegetation clearing, won't occur during the sensitive nursery period.

As a result, the adverse residual effect on Boreal Caribou due to a change in probability of persistence (POP) is predicted to be not significant at the RSHA or RSPA scales.

Summary of Key Findings

The Project is located within the Churchill Range. The landscape is largely characterized as boreal forest with an aggressive fire regime and many small-to-large lakes scattered throughout. Historical occupancy data as well as more recent MECP telemetry data reveals that Boreal Caribou occur across much of the range but have been scarce from southern areas around Lac Seul and Sioux Lookout for decades due to persistent or permanent human activity. The Project based telemetry program has revealed regular, seasonal movements between Churchill Range, Berens Range and Kinloch Range suggesting that Boreal Caribou in these ranges are part of the same regional population. The telemetry program initiated in 2023 has revealed the distribution, site fidelity and confirmation of use of key habitats including calving and wintering areas previously classified by MECP as well as revealed new seasonal range areas. Aerial surveys have revealed relatively consistent Boreal Caribou densities between 0.025 to 0.029 caribou/km^2 each year and consistent use of wintering areas classified by MECP and revealed through the monitoring program. Calf recruitment has varied across years, from low or declining in 2021 and 2023 to the potential for increased population growth in 2022 and 2024 (see Section 6.13.5).

Regarding GHD habitats there will be reduction of 407 ha of GHD Category 1 Calving/Nursery Habitat, which represents 1.07% of the nursery habitat available in the LSA and 0.10% of the nursery habitat available in the Churchill Range. A reduction of 107 ha of GHD Category 1 wintering habitat, which represents 1.95% of the wintering habitat available in the LSA and 0.03% of the wintering habitat available in the Churchill Range and a reduction of 149.8 ha of Category 2 habitat, which represents 3.02% of the LSA and 0.26% of the RSA. Overall, the net effect of the PDA on Category 2 and Category 3 habitat showed little change in the distribution of categories, as at the broad scale of the model these were relatively minor changes to the landscape. The average Category 2 and 3 values changed from 0.519 to 0.514 between the current baseline and future conditions (future condition is the addition of the Project on the landscape), with less than 1% change. In conclusion, the PDA had only a minor negative influence (-0.96%) on the prevalence of Category 2 habitat in the Churchill Range.

There will be an incremental 0.3% increase in disturbance to the Churchill Range caused by the Project.

The current extent of cumulative disturbance in the Churchill Range is 41.6% primarily due to existing and historical forestry operations and fire and the amount of critical habitat available does not meet the threshold of 65% undisturbed habitat (ECCC 2020). However, it is reasonably expected that Ontario will adjust forestry plans going forward to achieve this target. Regardless, the weight of evidence is such that the Project would contribute no to little cumulative effects and is unlikely to result in a measurable adverse effect on the population growth of Boreal Caribou in the Churchill Range. In addition, the Project will be required to meet regulatory requirement including achieving an overall benefit for the species through comprehensive habitat restoration or deferrals to offset habitat loss from the Project.

At the broad landscape scale important to Boreal Caribou, the Project (after application of mitigation measures) is predicted to have negligible residual effects with respect to population growth (lambda, λ), no residual effect was detectable through lines of evidence modelling at either population scale (RSPA or RSHA) scales (mean λ = 0.957 ±15.0% (0.813-1.100; 95% CI). With respect to probability of persistence (POP), results reveal (at both RSHA and RSPA scales) minor changes (<1%) in risk from the Project. At the landscape scale the greatest effects on Boreal Caribou are a result of expansive disturbance from forestry and wildfire and the addition of the Project to the landscape is not predicted to have a significant

incremental effect on the Boreal Caribou population trend, nor probability of persistence at the RSPA scale, and only a minor effect on at the Churchill Range scale.

6.13.7 Confidence Prediction

Scientific inference is associated with uncertainty, and prediction confidence (i.e., level of confidence in assessment results) depends on the level of uncertainty and the way it is addressed.

Primary factors affecting confidence in the predictions made in the Boreal Caribou assessment include:

- availability and accuracy of baseline data;
- accuracy of ecosystem maps, geospatial data, and associated Boreal Caribou habitat models;
- level of understanding of the strength of primary pathways in terms of the effects they are likely to have on each VC;
- level of certainty associated with the effectiveness of proposed mitigations, where applicable;
- level of understanding of baseline conditions, range of natural variation, and resilience of VC populations; and
- level of understanding of the cumulative drivers of change in measurement indicators and associated effects on populations, including uncertainty in climate change projections with respect to weather, hydrological patterns/cycles, and fire frequency and intensity, and the associated responses Boreal Caribou.

Uncertainty was managed by:

- reviewing historical data and relevant studies completed in the Boreal Caribou ranges;
- completing quality assurance and quality control of baseline data;
- assuming Boreal Caribou would be present in potential habitats where they may occur but were not observed;
- using the best available land cover data and disturbance data for the updated habitat mapping;
- development of habitat and demographic models by external subject matter experts and use of standard government Boreal Caribou habitat models, methods, and procedures;
- using data to make inferences about biological and ecological interactions and mechanisms of change;
- using a weight of evidence approach to support inference and express confidence in the assessment;
- using the maximum disturbance area to account for potential future Project refinements, which increased confidence that effects were not underestimated;
- comparing assessment results to relevant published scientific literature; and

Overall, there is a moderate to high degree of confidence in predictions related to the changes to Boreal Caribou and best management practices during the Project lifespan would be implemented to mitigate effects on Boreal Caribou and their habitats. Uncertainty was primarily and appropriately addressed by making assumptions that conservatively overestimated rather than underestimated potential effects (i.e., a precautionary assessment). Follow-up monitoring will address residual uncertainty by measuring the extent to which the EA predictions have been predicted.

6.13.8 References

Anderson N. and A.M. Thompson. 2023. Landscape genetic analysis of population structure and barriers to gene flow in a managed forest range of boreal woodland Boreal Caribou (Rangifer tarandus caribou). Cons. Genetics (in review).

Anderson, B.A. 2007. A literature review of the effects of helicopter disturbance and noise on selected wildlife species. Prepared for U.S. Army Alaska and CH2M Hill Inc. 230 pp.

ArrowBlade Consulting Services (ArrowBlade). 2014. Wabauskang Traditional Knowledge and Use in the area of the Springpole Gold Access Corridor Project.

Arsenault, A.A., Rodgers, A.R., and K. Whaley. 2019. Demographic status of moose populations in the Boreal Plain Ecozone of Canada. Alces 55: 43-60.

Barbé, H. and N. Frascaria-Lacoste. 2021. Integrating ecology into land planning and development: between disillusionment and hope, questioning the relevance and implementation of the mitigation hierarchy. Sustainability 13: 12726. https://doi.org/10.3390/su132212726.

Bergerud, A.T. 1974. Decline of Boreal Caribou in North America Following Settlement. J. Wildl. Manage. 38:757–770.

Bergerud, A.T. 1988. Caribou, Wolves and Man. Trends in Ecology & Evolution 3:68-72.

Besseau, P., S. Graham, and T. Christophersen. 2018. Restoring Forests and Landscapes: the key to a sustainable future. https://www.forestlandscaperestoration.org/images/gpflr_final%2027aug.pdf.

Best, I.N., L. Brown, C. Elkin, L. Finnegan, C.J.R. McLellan, and C.J. Johnson. 2024. Cut vs. fire: a comparative study of the temporal effects of timber harvest and wildfire on ecological indicators of the boreal forest. Landscape Ecol. 39:81. https://doi.org/10.1007/s10980-024-01882-4.

Bil, M., R. Andrášik, and Z. Janoška. 2013. Identification of Hazardous Road Locations of Traffic Accidents by Means of Kernel Density Estimation and Cluster Significance Evaluation. Accident Analysis and Prevention 55:265-273.

Bil, M., R. Andrášik, T. Svoboda, and J. Sedonik. 2016. The KDE+ Software: A Tool for Effective Identification and Ranking of Animal-Vehicle Collision Hotspots Along Networks. Landscape Ecol. 31:231-237.

Bowman, T., J.D. Flicker, R. Guttromson, M. Halligan, R.E. Llanes, and R. Schiek. 2020. Broadband Characterization and Circuit Model Development of Transmission-Scale Transformers (No. SAND-2020-10847). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States).

Bradshaw, C.J.A., S. Boutin, D.M. Hebert, and A.B. Rippin. 1995. Winter Peatland Habitat Selection by Woodland Boreal Caribou in Northeastern Alberta. Canadian Journal of Zoology 73:1567-1574. Accessed March 2021. Available at https://cdnsciencepub.com/doi/pdf/10.1139/z95-185.

Brown, G.S., F.F. Mallory, and W.J. Rettie. 2003. Range Size and Seasonal Movement for Female Woodland Boreal Caribou in the Boreal Forest of Northeastern Ontario. Rangifer Special Issue No. 14: 227-233.

Brown, W.K., J. Huot, P. Lamothe, S.N. Luttich, M. Pare, G. St. Martin, and J.B. Theberge. 1986. The Distribution and Movement Patterns of Four Woodland Boreal Caribou Herds in Québec and Labrador. Rangifer Special Issue no. 1: 43-49.

Byrne, M.E., J. Clint McCoy, J.W. Hinton, M.J. Chamberlain, and B.A. Collier. 2014. Using dynamic Brownian bridge movement modelling to measure temporal patterns of habitat selection. Journal of Animal Ecology 83(5): 1234-1243.

Courbin, N., D. Fortin, C. Dussault, and R. Courtois. 2008. Landscape management for woodland caribou: the protection of forest blocks influences wolf-Boreal Caribou co-occurrence. Landscape Ecol. 24: 1375-1388.

Courtois, R. 2003. La conservation du Boreal Caribou forestier dans un contexte de perte d'habitat et de fragmentation du milieu. Ph.D. thesis, Université du Québec à Rimouski. 350 pp.

Courtois, R. and J.-P. Ouellet. 2007. Modeling the impact of moose and wolf management on persistence of woodland caribou. Alces 43: 13-27.

Curatolo, J.A. and S.M. Murphy. 1986. The Effects of Pipelines, Roads, and Traffic on the Movements of Caribou, Rangifer tarandus. The Canadian Field-Naturalist 100: 218-224.

Dalerum, F., S. Boutin, and J.S. Dunford. 2007. Wildfire effects on home range size and fidelity of boreal Caribou in Alberta, Canada. Can. J. Zool. 85(1): 26–32. doi:10.1139/z06-186.

Darby, W.R. and W.O. Pruitt, Jr. 1984. Habitat Use, Movements and Grouping Behaviour of Woodland Caribou, Rangifer tarandus Caribou, in Southeastern Manitoba. Canadian Field-Naturalist 98: 184-190.

Dau, J.R. and R.D. Cameron. 1986. Effects of a Road System on Boreal Caribou Distribution during Calving. Rangifer 6(2): 95–101.

DeCesare, N.J., M. Hebblewhite, H.S. Robinson, and M. Musiani. 2009. Endangered, apparently: the role of apparent competition in endangered species conservation: Apparent competition and endangered species. Anim. Conserv. 13(4): 353–362. doi:10.1111/j.1469-1795.2009.00328.x.

DeMars, C.A. and S. Boutin. 2018. Nowhere to hide: Effects of linear features on predator–prey dynamics in a large mammal system. J. Anim. Ecol. 87(1): 274–284. doi:10.1111/1365-386 2656.12760.

DeMars, C.A., R. Serrouya, M.A. Mumma, M.P. Gillingham, R.S. McNay, and S. Boutin. 2019. Moose, caribou, and fire: have we got it right yet? Can. J. Zool. 97(10): 866–879. doi:10.1139/cjz-2018-0319. https://doi.org/10.7557/2.6.2.588.

Dickie, M., R. Serrouya, R.S. McNay, and S. Boutin. 2017. Faster and Farther: Wolf Movement on Linear Features and Implications for Hunting Behavior. Journal of Applied Ecology 54:253–263.

Dyer, S.J., J.P. O'Neill, S.M. Wasel, and S. Boutin. 2002. Quantifying Barrier Effects of Roads and Seismic Lines on Movements of Female Woodland Boreal Caribou in Northeastern Alberta. Canadian Journal of Zoology 80: 839-845.

Dyson, M., S. Endicott, C. Simpkins, J.W. Turner, S. Avery-Gomm, C.A. Johnson, M. Leblond, E.W. Neilson, R. Rempel, P.A. Wiebe, J.L. Baltzer, F.E.C. Stewart, and J. Hughes. 2022. Existing Boreal Caribou habitat and demographic models need improvement for Ring of Fire impact assessment: A roadmap for improving the usefulness, transparency, and availability of models for conservation. bioRxiv Preprint: https://www.biorxiv.org/content/10.1101/2022.06.01.494350v3.

Elkie, P., A. Smiegielski, M. Gluck, J. Elliott, R. Rempel, R. Kushneriuk, B. Naylor, J. Bowman, B. Pond, Derek Hatfield and Sean Heringer. 2013. Ontario's Landscape Tool. Ontario Ministry of Natural Resources. Forest Policy Section. Sault Ste. Marie Ontario.

Environment and Climate Change Canada (ECCC). 2018. Action Plan for the Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada – Federal Actions. Species at Risk Act Action Plan Series. Environment and Climate Change Canada, Ottawa. vii + 28 pp.

Environment Canada. 2011. Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Boreal Caribou (*Rangifer tarandus Caribou*), Boreal Population, in Canada: 2011 Update. Ottawa, Ontario, Canada. 102 pp. plus appendices.

Environment Canada. 2012. Recovery Strategy for the Woodland Boreal Caribou (Rangifer tarandus Caribou), Boreal Population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138pp.

Ferguson, S. and P. Elkie. 2004. Habitat Requirements of Boreal Forest Boreal Caribou during the Travel Seasons. Basic and Applied Ecology 5:465-474. doi:10.1016/j.baae.2004.04.011.

Firelight Research Inc. and Cat Lake First Nation. 2024. Cat Lake First Nation Indigenous Knowledge and Use Study for the Kita-Ki-Nan Indigenous-led Assessment of the Springpole Project.

Firelight Research Inc. and Lac Seul First Nation. 2024. Lac Seul First Nation Knowledge and Use Study for the Kita-Ki-Nan Indigenous-led Assessment of the Springpole Project.

Fischer, J.W., W. D. Walter, M. L. Avery. 2013. Brownian Bridge Movement Models to Characterize Birds' Home Ranges: Modelos de Movimiento de Puente Browniano Para Caracterizar el Rango de Hogar de las Aves, The Condor, Volume 115, Issue 2, 1 May 2013, Pages 298–305, https://doi.org/10.1525/cond.2013.110168

Forest Ecosystem Research and Information Technologies Environmental Consultants (Ferit). 2024. Report on GHD Category 1 Predictive Mapping for Churchill, Berens, and Kinloch Ranges. In Support of Springpole Project Assessment (June 4th, 2024).

Fryxell, J.M., T. Avgar, B. Liu, J.A. Baker, A.R. Rodgers, J. Shutter, I.D. Thompson, D.E.B. Reid, A.M. Kittle, A. Mosser, S.G. Newmaster, T.D. Nudds, G.M. Street, G.S. Brown, and B. Patterson. 2020. Anthropogenic Disturbance and Population Viability of Woodland Boreal Caribou in Ontario. J. Wildl. Manage. 1–15. doi:10.1002/jwmg.21829.

Halli, S.S. and K.V. Rao. 1992. Advanced Techniques of Population Analysis. ISBN 0306439972. Page 165.

Harrington, F. and A. Veitch. 1991. Short-term impacts of low level jet fighter training on Boreal Caribou in Labrador. Arctic 44(4):318-327.

Hirotani, A. 1994. Dominance rank, copulatory behaviour and estimated reproductive success in male reindeer. Animal Behaviour 48(4):929-936.

Horne, J.S., E.O. Garton, S.M. Krone, and J.S. Lewis. 2007. Analyzing animal movements using Brownian bridges. Ecology 88(9):2354-2363.

Hornseth, M.L. and R.S. Rempel. 2016. Seasonal resource selection of woodland Boreal Caribou (*Rangifer tarandus caribou)* across a gradient of anthropogenic disturbance. Canadian J. Zool. 94:79-93.

IUCN. 2016. Resolution 69 on Defining Nature-based Solutions (WCC-2016-Res-069). IUCN Resolutions, Recommendations and Other Decisions. 6-10 September 2016. World Conservation Congress Honolulu, Hawaii, USA. https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_069_EN.pdf.

James, A.R.C. and A.K. Stuart-Smith. 2000. Distribution of Boreal Caribou and Wolves in Relation to Linear Features. Journal of Wildlife Management 64: 154-159.

Johnson, C.J., Mumma, M.A. and M.-H. St.-Laurent. 2019. Modelling Multispecies Predator-prey Dynamics: Predicting the Outcomes of Conservation Actions for Woodland Caribou. Ecosphere 10(3): e02622.

Johnson, C.A., G.D. Sutherland, E. Neave, M. Leblond, P. Kirby, C. Superbie, and P.D. McLoughlin. 2020. Science to inform policy: Linking population dynamics to habitat for a threatened species in Canada. J. Appl. Ecol. 57(7): 1314–1327. doi:10.1111/1365-2664.13637.

Johnson-Bice, S.M., T.D. Gable, A.T. Homekes, S.K. Windels, J.K. Bump, and J.G. Bruggink. 2023. Logging, linear features, human infrastructure shape the spatial dynamics of wolf predation on an ungulate neonate. Ecol. Applic. 2023; e2911. https://doi.org/10.1002/eap.2911.

Kauffman, M.J., F. Cagnacci, S. Chamaillé-Jammes, M. Hebblewhite, J.G.C. Hopcraft, J.A. Merkle, … and S. Zuther. 2021. Mapping out a future for ungulate migrations. Science 372(6542): 566-569.

Kittle, A.M., M. Anderson, T. Avgar, J.A. Baker, G.S. Brown, J. Hagens, E. Iwachewski, S. Moffat, A. Mosser, B.R. Patterson, D.E.B. Reid, A.R. Rodgers, J. Shutter, G.M. Street, I.D. Thompson, L.M. Vander Vennen, and J.M. Fryxell. 2017. Landscape-level wolf space use is correlated with prey abundance, ease of mobility, and the distribution of prey habitat. Ecosphere 8(4): e01783.

Know History. 2022. The Traditional Knowledge and Land Use Study for the FMG Springpole Mine Project prepared for the Métis Nation of Ontario Region.

Konkolics, S., M. Dickie, R. Serrouya, D. Hervieux, and S. Boutin. 2021. A burning question: What are the implications of forest fires for woodland caribou? J. Wildl. Manag.: jwmg.22111. doi:10.1002/jwmg.22111.

Kranstauber, B., R. Kays, S.D. LaPoint, M. Wikelski, and K. Safi. 2012. A dynamic Brownian bridge movement model to estimate utilization distributions for heterogeneous animal movement. Journal of Animal Ecology 81(4): 738-746.

Kranstauber, B., M. Smolla, A.K. Scharf, and M.B. Kranstauber. 2023. Package 'move'.

Kunicky, H. 2021. Slate Falls: Through Memory and Material. A thesis submitted for the fulfilment of a Masters Degree in Northern Environment and Culture Lakehead University.

Kushneriuk, R.S. and R.S. Rempel. 2011. LSL- Landscape Scripting Language Ontario Ministry of Natural Resources, Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario.

Kuzyk, G.W. 2016. Provincial population and harvest estimates of moose in British Columbia. Alces 32:1-11.

Lawler, J.P., A.J. Magoun, C.T. Seaton, C.L. Gardner, R.D. Boertje, J.M. Ver Hoef, and P.A. Del Vecchio. 2005. Short-term impacts of military overflights on Boreal Caribou during calving season. Journal of Wildlife Management 69(3):1133-1146.

Lendrum, P.E., C.R. Anderson Jr., K.L. Monteith, J.A. Jenks, and R.T. Bowyer. 2013. Migrating Mule Deer: Effects of Anthropogenically Altered Landscapes. PLoS One 8: e64548.

Lyons, J.E., M.C. Runge, H.P. Laskowski, and W.I. Kendall. 2008. Monitoring in the context of structured decision-making and adaptive management. J. Wildl. Manage. 72(8): 1683-1692.

Maginnis, S. and W. Jackson. 2007. What is FLR and how does it differ from current approaches? Pages 5-20 in J. Rietbergen-McCracken, S. Maginnis, and A. Sarre (Eds.). The forest landscape restoration handbook. Earthscan.

Maier, J.A.K., S.M. Murphy, R.G. White, and M.D. Smith. 1998. Responses of Boreal Caribou to overflights by low-altitude jet aircraft. J. Wildl. Manage. 62(2): 752-766.

Mallory, F.F. and T.L. Hillis. 1998. Demographic characteristics of circumpolar caribou populations: ecotypes, ecological constraints, releases, and population dynamics. Rangifer 49-60.

Mansourian, S. 2005. Overview of forest restoration strategies and terms. In Forest Restoration in Landscapes: Beyond Planting Trees (pp. 8–13). Springer New York. https://doi.org/10.1007/0-387-29112-1_2.

McRae, B.H., V. Shah, and T. Mohapatra. 2013. Circuitscape 4 user guide. The Nature Conservancy, Fort Collins, Colorado. Accessed from: http://www.circuitscape.org.

Ministry of Natural Resources (MNR). 2012a. Categorizing and Protecting Habitat under the Endangered Species Act, 2007. Government of Ontario, Peterborough, Ontario. 14pp.

Ministry of Natural Resources (MNR). 2012b. Endangered Species Act Submission Standards for Activity Review and 17(2)© Overall Benefit Permits. Ontario Ministry of Natural Resources, Species at Risk Branch. Peterborough, Ontario. 14pp.

Ministry of Natural Resources (MNR). 2013. General Habitat Description for the Woodland Boreal Caribou (Forest-dwelling Boreal Population) (*Rangifer tarandus Caribou*). Government of Ontario, Peterborough, 27pp.

Ministry of Natural Resources (MNR). 2014. Best management practices for mineral exploration and development activities and woodland Boreal Caribou in Ontario. Accessed from: https://www.ontario.ca/page/best-management-practices-aggregate-activities-and-forest-dwelling-woodland-Caribou.

Ministry of Natural Resources (MNR). 2009. Ontario's Woodland Caribou Conservation Plan. Queen's Printer for Ontario, Toronto Ontario, Canada. 24 pp.

Ministry of Natural Resources and Forestry (MNRF). 2014a. Integrated Range Assessment for Woodland Boreal Caribou and their Habitat: Berens Range 2012. Version 1.1. Species at Risk Branch, Thunder Bay, Ontario, x + 71pp.

Ministry of Natural Resources and Forestry (MNRF). 2014b. Integrated Range Assessment for Woodland Boreal Caribou and their Habitat: Churchill Range 2012. Species at Risk Branch. Thunder Bay, Ontario x + 71pp.

Ministry of Natural Resources and Forestry (MNRF). 2014c. Integrated Range Assessment for Woodland Boreal Caribou and their Habitat in the Far North of Ontario: 2013. Species at Risk Branch, Thunder Bay, Ontario, xviii +124pp.

Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF). 2019. Cat Lake and Slate Falls First Nations Community Based Land Use Plan. July 2011. Accessed from: https://www.ontario.ca/page/cat-lake-and-slate-falls-first-nations-community-based-land-use-plan.

Ministry of the Environment, Conservation and Parks (MECP). 2019. Range Management Policy in Support of Woodland Boreal Caribou Conservation and Recovery. April 5, 2019. Accessed from: https://www.ontario.ca/page/range-management-policy-support-woodland-caribou-conservation-and-recovery.

Ministry of the Environment, Conservation and Parks (MECP). 2020. Best Management Practices for Mineral Exploration and Development Activities and Woodland Boreal Caribou in Ontario. https://www.ontario.ca/page/best-management-practices-mineral-exploration-and-development-activities-and-woodland-Caribou.

Ministry of the Environment, Conservation and Parks (MECP). 2020. General habitat description for the Forest-dwelling Woodland Caribou. Updated: July 09, 2021. Accessed from: https://www.ontario.ca/page/general-habitat-description-forest-dwelling-woodland-caribou.

Murphy, S.M. and J.A. Curatolo. 1987. Activity Budgets and Movement Rates of Boreal Caribou Encountering Pipelines, Roads and Traffic in Northern Alaska. Canadian Journal of Zoology 65:2483-2490.

Neufeld, L.M. 2006. Spatial Dynamics of Wolves and Woodland Boreal Caribou in an Industrial Forest Landscape in West-central Alberta. M.Sc. Thesis. University of Alberta, Edmonton, AB.

Ontario Woodland Caribou Recovery Team. 2008. Woodland Caribou (Rangifer tarandus caribou) (Forest-dwelling, Boreal Population) in Ontario. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 93 pp.

Palm, E.C., S.H. Newman, D.J. Prosser, X. Xiao, L. Ze, N. Batbayar, … and J.Y. Takekawa. 2015. Mapping migratory flyways in Asia using dynamic Brownian bridge movement models. Movement Ecology 3: 1-10.

Perra M, T Brinkman, P. Scheifle and S. Barcalow. 2022. Exploring auditory thresholds for Reindeer, *Rangifer tarandus*. J. Veterinary Behav. 52-53. pp 37-44. https://doi.org/10.1016/j.jveb.2022.05.002

Rowe, J.S. 1972. Forest Regions of Canada. Canadian Forestry Service Publication 1300, Department of Environment, Ottawa, Ontario. 172pp.

Roy, C., N. L. Michel, C. M. Handel, S. L. Van Wilgenburg, J. C. Burkhalter, K. E. B. Gurney, D. J. Messmer, K. Princé, C. S. Rushing, J. F. Saracco,R. Schuster, A. C. Smith, P. A. Smith, P. Sólymos, L. A. Venier, and B. Zuckerberg. 2019. Monitoring boreal avian populations: how can we estimate trends and trajectories from noisy data?. Avian Conservation and Ecology 14(2):8. https://doi.org/10.5751/ACE-01397-140208

Sarr, D.A. and K.J. Puettmann. 2008. Forest management, restoration, and designer ecosystems: Integrating strategies for a crowded planet. Ecoscience, 15(1), 17–26.

Sawyer, H., M. J. Kauffman, R. M. Nielson, and J. S. Horne. 2009. Identifying and prioritizing ungulate migration routes for landscape-level conservation. Ecological Applications, 19(8), 2016-2025.

Sawyer, H., M. J. Kauffman, A.D. Middleton, T.A Morrison, R.M. Nielson and T.B. Wyckoff. 2013. A Framework for Understanding Semi-permeable Barrier Effects on Migratory Ungulates. J. Appl. Ecol. 50, 68–78.

Schaefer, J.A., A.M. Veitch, F.H. Harrington, W.K. Brown, J.B Theberge and S.N. Luttich. 1999. Demography of Decline of the Red Wine Mountains Boreal Caribou Subpopulation. Journal of Wildlife Management 63: 580-587.

Seidler, R. G., R.A. Long, J. Berger, S. Bergen and J.P. Beckmann. 2015. Identifying impediments to long-distance mammal migrations. Conservation Biology, 29(1), 99-109.

Seip, D.R. 1991. Predation and Boreal Caribou Populations. Rangifer 11: 46-52.

Seip, D.R. 1992. Factors Limiting Woodland Boreal Caribou Populations and their Interrelationships with Wolves and Moose in Southeastern British Columbia. Canadian Journal of Zoology 70: 1494-1503.

Serrouya, R, M. Dickie, C. Lamb., H. van Oort, A.P. Kelly, C. DeMars, P.D. McLoughlin, N.C. Larter, D. Hervieux, A.T. Ford and S. Boutin. 2021. Trophic consequences of terrestrial eutrophication for a threatened ungulate. Proc. R. Soc. B Biol. Sci. 288(1943): 20202811. doi:10.1098/rspb.2020.2811.

Shannon, G., M. F. McKenna, L. M. Angeloni, K.R. Crooks, K. M. Fristrup, E. Brown, K. A. Warner, M.D. Nelson, C. White, J. Briggs, S. McFarland, & G. Wittemyer. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. Biological reviews of the Cambridge Philosophical Society, 91(4), 982–1005. https://doi.org/10.1111/brv.12207

Shannon, G., M. F. McKenna, L. M. Angeloni, K.R. Crooks, K.M Fristrup, E. Brown, E., Warner, K. A., Nelson, M. D., White, C., Briggs, J., McFarland, S., & Wittemyer, G. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. Biological reviews of the Cambridge Philosophical Society, 91(4), 982–1005. https://doi.org/10.1111/brv.12207

Singer, F.J. and J.B. Beattie. 1986. The Controlled Traffic System and Associated Wildlife Responses in Denali National Park. Arctic 39(3):195 – 203.

Skatter, H.G., M.L. Charlebois, S. Eftestøl, D. Tsegaye, J.E. Colman, J.L. Kansas, K. Flydal and B. Balicki. 2017. Living in a burned landscape: woodland Boreal Caribou(Rangifer tarandus caribou) use of postfire residual patches for calving in a high fire – low anthropogenic Boreal Shield ecozone. Can. J. Zool. 95(12): 975–984. doi:10.1139/cjz-2016-0307.

Slate Falls Nation and Odonaterra Community Environmental Strategies. 2024. Slate Falls Nation Health, Socio-economic, Indigenous Knowledge and Land Use Baseline Study.

Stanturf, J.A. and S. Mansourian. 2020. Forest landscape restoration: state of play. Royal Society Open Science, 7(12), 201218.

Stanturf, J.A., B.J. Palik and R.K. Dumroese. 2014. Contemporary forest restoration: A review emphasizing function. Forest Ecology & Management, 331, 292–323.

Stanturf, J.A., W.J. Harvey, G. Petrokofsky, A. Darabant, L. Petrokofsky, S. Adhikari, G. Arora, J. Bannister, M. Derkyi, E. Foli, M.R. Guariguata, M.L. Quevedo Fernandez and A.L. Trujillo-Miranda. 2023. Forest Related Nature-Based Approaches: Review of terms and concepts – from afforestation to forest landscape restoration. Report to the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection (BMUV). International Union of Forest Research Organizations, Vienna, Austria. IUFRO Occasional Paper No. 36. 55 pp.

Stuart-Smith, A.K, C.J.A Bradshaw, S. Boutin, D.M Hebert and A.B. Rippin. 1997. Woodland Boreal Caribou Relative to Landscape Pattern in Northeastern Alberta. Journal of Wildlife Management 61: 622-633.

Thomas, D. C., S. J Barry and H. P Kiliaan. 1989. Fetal sex ratios in caribou: maternal age and condition effects. The Journal of wildlife management, 885-890.

Thompson, I.D., P.A. Wiebe, E. Mallon, A.R. Rodgers, J.M. Fryxell, J.A. Baker and D. Reid. 2015. Factors influencing the seasonal diet selection by woodland Boreal Caribou(Rangifer tarandus tarandus) in boreal forests in Ontario. Can. J. Zool. 93(2): 87–98. doi:10.1139/cjz-2014-0140.

Vistnes, I. and C. Nellemann. 2008. The Matter of Spatial and Temporal Scales: A Review of Reindeer and Boreal Caribou Response to Human Activity. Polar Biol. 31, 399–407.

Vucetich, J.A. and R.O. Peterson 2012. The population biology of Isle Royale wolves and moose: an overview. URL: www.isleroyalewolf.org.

Walker, P.D., A.R. Rodgers, J. Shuter, J.M. Fryxell and E.H. Merrill. 2024. Woodland Boreal Caribou calving fidelity: Spatial location, habitat, or both? Ecol & Evol. 2024;14:e11480. https://doi.org/10.1002/ece3.11480.

Wilson, R.R., Parrett, L.S., Joly, K. and J.R. Dau. 2016. Effects of Roads on Individual Boreal Caribou Movements During Migration. Biological Conservation, 195:2-8.

Wilson, S. F., Nudds, T. D., Green, P. E., & de Vries, A. 2023. Effect of forest understorey stand density on woodland caribou (Rangifer tarandus caribou) habitat selection. Canadian Journal of Forest Research, 54(2), 158-167.

Wilson, S.F. 2016. Managing Zone-of-Influence Effects of Oil and Gas Activities on Terrestrial Wildlife and Habitats in British Columbia. Journal of Ecosystems and Management 16(1):1–14. Published by the Journal of Ecosystems and Management. http://www.jem-online.org/index.php/jem /index/585/507.

Wilson, S.F., T.D. Nudds, P.E.J. Green and A. de Vries. 2023. Effect of forest understory stand density on woodland Boreal Caribou (*Rangifer tarandus caribou*) habitat selection. J Forest Research: https://doi.org/10.32942/osf.io/m382v.

Wittmer, H.U., B.N. McLellan, D.R. Seip, J.A. Young, T.A. Kinley, G.S. Watts, G.S. and D. Hamilton. 2005. Population Dynamics of the Endangered Mountain Ecotype of Woodland Boreal Caribou (*Rangifer tarandus caribou*) in British Columbia, Canada. Canadian Journal of Zoology 83: 407-418.

Table 6.13-14: Boreal Caribou Criteria, Indicators and Rationale

Criteria	Indicators	Rationale
Direct Habitat Changes	• Areas of MECP GHD Category 1, 2 and 3 habitats directly lost in PDA • Numbers of MECP GHD Category 1 Areas fragmented by the PDA and within 10 km of the PDA • Areas of Predicted Use directly lost in the PDA • Changes in relative amounts (%) of Category 1, 2, and 3 from direct and indirect disturbance • Alignment with Existing or Proposed Disturbance	• Caribou rely on their entire range for survival, so maintaining the condition is essential. The RMP outlines three key principles for managing caribou habitats: • Cumulative Disturbance: Principle 1 emphasizes that cumulative disturbance within the range should be kept at levels that support a self-sustaining caribou population. • Habitat Arrangement: Principle 2 directs that the amount and arrangement of habitat should reflect natural landscapes, minimizing human impact. • Forest Composition and Structure: Principle 3 mandates that forest composition and structure within the range should maintain the ecological functions of sub-range habitats crucial for caribou. • Additionally, when planning activities, it is essential to consider minimizing the anthropogenic disturbance footprint by aligning activities with existing or proposed developments. Sensory disturbances (within 10 km) from development can also cause caribou to avoid otherwise suitable habitats.
Indirect Habitat Changes	• Areas of MECP GHD Category 1, 2, and 3 within 500 m buffer of PDA • Areas of Predicted Use within 500 m buffer of PDA • Changes in the relative amounts (%) of predicted use areas in the Churchill Range • Spatial extent of predicted sensory disturbance • Habitat Amount and Arrangement • Spatial distribution and abundance of movement corridors	
Change in Range Condition	• Cumulative disturbance at the Churchill Range Scale using both the federal and provincial disturbance models	
Change in Population Demography	• Altered mortality rates from Predators • Altered risk of incidental mortality from anthropogenic impacts • Changes in population abundance and seasonal distribution • Altered population vital rates (calf recruitment, probability of persistence, survival rates, lambda (λ), herd composition (age and sex))	• Changes in demography are assessed due to potential impacts from altered mortality risk, changes in population state (abundance and distribution), and/or altered vital rates (lambda, adult female survival, probability of persistence and calf recruitment) resulting from habitat disturbance and landscape connectivity. • Changes in predator-prey dynamics are assessed due to increased mobility and hunting efficiency by predators due to the creation or widening of linear

Table 6.13-14: Boreal Caribou Criteria, Indicators and Rationale

Criteria	Indicators	Rationale
Change in Community via Predator – Prey Dynamics	• Changes in the distribution and abundance of early successional habitat • Changes in the distribution and abundance of Moose • Changes in the distribution and abundance of Predators (Wolves and/or Black Bears) • Altered indirect mortality rates resulting from apparent competition effects and/or from parasite burdening	corridors and/or increases in Moose abundance due to the availability of early successional habitats resulting from Project development activities. • The Project may result in increased predation via the increase in alternate prey sources (moose), which in turn will lead to increased predation (wolves, bears, etc.) and increased parasite burdening (amount and spread). • Sensory and ground disturbance and vegetation clearing can result in physical disturbance of key habitat features (e.g., sub-range habitat) and lead to avoidance. Vehicle and equipment movement can result in accidental mortality (i.e., wildlife-vehicle collisions).

Table 6.13-15: Significance Determination Attributes and Rankings for Boreal Caribou

Attribute	Description	Category
Magnitude	A qualitative or quantitative measure to describe the size or degree of the residual effects relative to baseline conditions	**Level I:** Project-related changes (i.e., the residual effect) have a low potential to adversely affect Boreal Caribou and/or the habitat required for Boreal Caribou to carry out the life processes necessary to survive and reproduce. Habitat functions are likely maintained elsewhere in the RSA. **Project related changes occur at a local scale, but not at the RSHA or RSPA scale. Boreal Caribou habitat and population form and function are retained.** **Level II:** Project-related changes (i.e., the residual effect) have a moderate potential to adversely affect Boreal Caribou and/or the habitat required for Boreal Caribou to carry out the life processes necessary to survive and reproduce (e.g., habitat avoidance but not expected to have long-term impacts on population viability or change the status of local populations or the availability of sensitive habitats). Habitat functions are likely maintained elsewhere in the RSA. **Project-related changes occur at the RSHA or RSPA scale but are minor (<1% change).** **Level III:** Project-related changes (i.e., the residual effect) have a high potential to adversely affect Boreal Caribou or their habitats required to carry out the life processes necessary to survive and reproduce. Habitat functions are not maintained elsewhere in the habitat and population RSA. **Project-related changes occur at the RSHA or RSPA scale but are >1% change.**
Geographic Extent	The spatial extent over which the residual effect will take place	**Level I:** Effect is restricted to the LSA. **Level II:** Effect extends beyond the LSA. **Level III:** Effect extends beyond the RSHA.
Duration	The time period over which the residual effect will or is expected to occur	**Level I:** Effect occurs over the short term: less than or equal to 3 years. **Level II:** Effect occurs over the medium term: more than three years but less than 20 years. **Level III:** Effect occurs over the long term: greater than 20 years.
Frequency	The rate of occurrence of the residual effect	**Level I:** Effect occurs once, infrequently or not at all. **Level II:** Effect occurs intermittently or with a certain degree of regularity. **Level III:** Effect occurs frequently or continuously.
Reversibility	The extent to which the residual effect can be reversed	**Level I:** Effect is fully reversible. **Level II:** Effect is partially reversible or potentially reversible with difficulty and includes compensating for habitat loss on a short term timeframe to immediately offset habitat loss. **Level III:** Effect is not reversible.
Timing	A measure of whether the residual effect occurs during a sensitive period of the year	**Level I:** Effects do not occur during a sensitive period; or related effects are fully mitigated. **Level II:** Effects occur during a sensitive period and related effects are partially mitigated. **Level III:** Effects occur during a sensitive period; or related effects cannot be fully mitigated.

Table 6.13-16: Potential Interactions of Project Components on Boreal Caribou

Project Component / Activity	Boreal Caribou
Construction Phase	
Site preparation activities in the mine site area including clearing, grubbing and bulk earthworks	Yes
Development of aggregate resource and operation	Yes
Construction of the mine site access road	Yes
Development of temporary construction camp and staging areas (primarily on site, but potentially off site)	Yes
Construction of the fish habitat development area	Yes
Construction of the transmission line to the Project site	Yes
Construction of the onsite haul and access roads	Yes
Construction of cofferdams in north basin of Springpole Lake	Yes
Construction of buildings and onsite infrastructure	Yes
Construction of the water storage pond	Yes
Controlled dewatering of a portion of the north basin of Springpole Lake	Yes
Construction of the starter embankments for the CDF	Yes
Stripping of lake bed sediment and overburden at the open pit	Yes
Development of the surficial soil stockpile	Yes
Initiation of pit development in rock	Yes
Initiation of stockpiling of ore	Yes
Establishment and operation of water management and treatment facilities	-
Commissioning of the process plant	Yes
Employment and Expenditures	-
Operations Phase	
Operation of the process plant	Yes
Operation of open pit mine	Yes
Management of overburden, mine rock, tailings and ore in designated facilities	Yes
Operation of water management and treatment facilities	Yes
Accommodations complex operations	Yes
Operation and maintenance of mine site infrastructure, including the fuel farm	Yes
Progressive reclamation activities	Yes
Initial filling the open pit with water	-
Employment and Expenditures	-
Decommissioning and Closure Phase	
Removal of assets that can be salvaged	-
Demolition and recycling and/or disposal of remaining materials	-
Removal and disposal of demolition-related wastes in approved facilities	-
Reclamation of impacted areas, such as by re-grading, placement of cover and revegetation	Yes
Filling the open pit with water	-
Monitoring and maintenance	Yes
Employment and Expenditures	-

Note:
(-) The interaction is not expected, and no further assessment is warranted.

Table 6.13-17: Proposed Mitigation Measures for Potential Boreal Caribou Effects

Pathways to potential effect / Criteria	Phase			Proposed Mitigation Measure
	Con.	Op.	Cl.	
Direct change in Boreal Caribou habitat	•	•	•	Development of a compact mine site to limit the areal extent of disturbance.
	•	•	•	During construction, co-locate the transmission line, airstrip and mine access road within a shared infrastructure corridor, where feasible.
	•	•	•	Align the new transmission line route adjacent to the existing E1C transmission line corridor, to the extent possible, to reduce the creation of new linear corridors.
	•	•	•	During construction of the Project, minimize the disturbance in Category 1 and 2 Boreal Caribou habitats by using existing trails and roads for travel.
	•	•	•	○ In collaboration with Indigenous communities and MECP, design and implement a habitat restoration program for Boreal Caribou, that includes: • The creation of suitable Boreal Caribou calving habitat through the reclamation of a small island in the open pit basin of Springpole Lake and revegetate the island with mature coniferous forest; • The development of suitable restoration of habitat of existing disturbed areas for Boreal Caribou; and, • The deferral of forestry and mineral exploration lands where suitable Boreal Caribou habitat exists.
	•	•	•	During construction, operation and closure phases, implement relevant mitigation measures for noise from Section 6.3.
	•	•	•	During construction of the mine access road and transmission line: • Minimize the area cleared with heavy machinery in Category 1 Boreal Caribou habitat to the extent possible recognizing the need for clear sightlines for safety along the mine access road; • Reduce predator sight lines by minimizing the removal of woody vegetation along the transmission line in Boreal Caribou location clusters and adjacent to Category 1 habitat (overwintering and calving) by limiting removal to hazard trees and only clearing for safe access and infrastructure needs; • Avoid clearing and construction activities in Category 1 Boreal Caribou nursery habitat during the calving and nursery period (May 1 to September 15); and • During construction and operation of the airstrip, avoid construction and overflights of Category 1 nursery habitats during the nursery period (May 1 to September 15). • Efforts will be made to re-supply the mine with bulk of deliveries aiming to be outside the calving period.

Table 6.13-17: Proposed Mitigation Measures for Potential Boreal Caribou Effects

Pathways to potential effect / Criteria	Phase			Proposed Mitigation Measure
	Con.	Op.	Cl.	
Indirect change in Boreal Caribou habitat	•	•	•	During construction, operation and closure phases of the Project, implement relevant mitigation measures for dust from Section 6.2, including: • The process plant emission sources will be enclosed where possible and be designed to allow good atmospheric dispersion. • During construction, operations and active closure, a dust management plan will be implemented to identify potential sources of fugitive dusts, outline mitigation measures that will be employed to control dust generation and detail the inspection and record keeping required to demonstrate that fugitive dusts are being effectively managed; • Dust emissions from roads and mineral stockpiles will be controlled through the application of water spray and supplemented by dust suppressants, if required; • Site roads will be maintained in good condition, with regular inspections and timely maintenance completed to minimize the silt loading on the roads; and, • Vehicle speeds will be limited.
	•	•	•	○ During construction, operation and closure phases, implement relevant mitigation measures for noise from Section 6.3, including: • Motorized equipment will be selected or designed with mufflers/silencers to limit noise emissions; • Reversing alarms should be dimmable with white noise and/or strobe light but in accordance with the applicable health and safety regulations; • Check that equipment and machinery used on site is maintained in good working conditions through regular maintenance and inspection; • Prohibit the use of engine brakes and require the engines to be stopped for vehicles on standby, depending on seasons and weather; • Operate vehicles and equipment such that impulsive noise is minimized, where possible; and, • For helicopter use during transmission line construction, maintain minimum flight altitudes unless engaged in construction tasks, landing or departure
	•	•	•	○ During construction, operation and closure phases of the Project, implement mitigation for lighting to minimize sensory disturbance, including: • To prevent a direct line-of-sight from light, maintain light sources below natural barriers such as tree lines or artificial barriers such as berms; and, • Minimize light spill and glare using shielding on stationary light sources and direct lighting downwards where practical.

Table 6.13-17: Proposed Mitigation Measures for Potential Boreal Caribou Effects

Pathways to potential effect / Criteria	Phase			Proposed Mitigation Measure
	Con.	Op.	Cl.	
Change in range conditions for Boreal Caribou	•	•	•	During construction, operation and closure phases of the Project, implement the relevant mitigation measures for wildlife from Section 6.12.
	•	•	•	Do not disturb encountered Boreal Caribou, during all phases of the Project.
	•	•	•	During the operation of the mine access road and transmission line: • Reduce Project-related traffic speed along the mine access road in sections traversing Category 1 habitat during seasonally sensitive periods, particularly along segments with identified crossing locations; • Project-related vehicles travelling on the mine access road must come to a stop if Boreal Caribou are encountered and provide them with the right-of-way and time to safely cross the roadway and into native cover without undue sensory disturbance; • Minimize vegetation management along the transmission line corridor within Category 1 habitat to that necessary for safe operation; and, • In areas where Boreal Caribou have been recorded crossing the existing transmission line, retain vegetation and undertake strategic vegetation treatments to reduce the potential for barriers to movement. • If Boreal Caribou are found to be crossing linear features created by the Project in new areas (outside of the currently identified cluster of movement locations), implement vegetation treatments to mitigate potential barrier effects in these new locations. • A controlled access gatehouse/checkpoint and signage are proposed to control unauthorized use of the 18-km mine access road leading to the mine site. An access management strategy will be developed with local Indigenous communities and MNR to provide access for traditional land and resource use activity along this newly accessible area. Efforts will be made to re-supply the mine with bulk of deliveries aiming to be outside the calving period.
	•	•	•	During the closure of the Project, incorporate Boreal Caribou habitat features into the overall closure plan, where possible, including: • Revegetate suitable areas within the PDA using species that will support the development of mature coniferous refuge habitat for Boreal Caribou, and incorporate the restoration of lichen and lichen treatments in select areas; and, • Remove or otherwise regraded stockpiles (including surficial soil and ore) to facilitate Boreal Caribou access.
	•	•	•	In collaboration with Indigenous communities and MECP, design and implement a habitat restoration program for Boreal Caribou, that includes: • The creation of suitable Boreal Caribou calving habitat through the reclamation of a small island in the open pit basin of Springpole Lake and revegetate the island with mature coniferous forest;

Table 6.13-17: Proposed Mitigation Measures for Potential Boreal Caribou Effects

Pathways to potential effect / Criteria	Phase			Proposed Mitigation Measure
	Con.	Op.	Cl.	
				• The development of suitable restoration of habitat of existing disturbed areas for Boreal Caribou; and, • The deferral of forestry and mineral exploration lands where suitable Boreal Caribou habitat exists. • The application of mitigation measures to specific pathways and phases are illustrated in Table 6.14-4. Mitigation measures described in this section are expected to be effective for their intended purposes given their effective implementation on similar Projects.
	●	●	●	To meet regulatory requirements, FMG is advancing various potential offsetting opportunities including: • Opportunities to undertake enhanced restoration of lands subject to recent forest fires. • Opportunities to undertake enhanced restoration on lands subject to forestry activities through partnership with the forestry industry. • Opportunities identified by Ontario pursuant to the provincial Woodland Caribou Recovery Strategy. For example, potential habitat restoration in the vicinity of the abandoned South Bay mine. • Partnership deferrals in other parts of the Churchill Range. • At closure, the Project includes the construction of a Boreal Caribou calving island (linked to the Project's fish habitat development area)

Notes:
Con = construction; Op = operation; Cl = closure; ● = mitigation is applicable; – = mitigation is not applicable.

535000 550000 565000 580000 595000 610000 625000

5705000 5690000 5675000

Berens Range

Kinloch Range

Churchill Range

SLATE FALLS NATION

Casummit Lake
Penson Lake
Flannery Lake
Jackpine Lake
Hammerton Lake
Meen Lake
Wellein Lake
Simard Lake
Birch Lake
Keigat Lake
Zionz Lake
Dole Lake
Cluderay Lake
Dorothy Lake
Durkin Lake
Fawcett Lake
Nabemakoseka Lake
Springpole Lake
Gull Lake
Satterly Lake
Cromarty Lake
Obaskaka Lake
Superstition Lake
Graydarl Lake
Kezik Lake
Scanes Lake
Seagrave Lake
Skingle Lake
Burley Lake
Bertha Lake
Ruddy Lake
Deaddog Lake
Christina Lake
Strachan Lake
Fry Lake
Kaginot Lake
Bumpy Lake
Fawthrop Lake
Upper Kaginot Lake
Wesleyan Lake
Senior Lake
Rockmere Lake
Marsh Lake
Hailstone Lake
Drum Lake
Latreille Lake
Margaret Lake
North Bamaji Lake
Tarpley Lake
Bamaji Lake
Sesikinaga Lake
Snelgrove Lake
Austin Lake
Allison Lake
Jeanette

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LEGEND

- Proposed Mine Feature
- Project Development Area
- Local Study Area (LSA) for Caribou
- Caribou Range Boundary (labelled with name)
- First Nation Reserve
- Existing Road
- Existing Transmission Line
- Watercourse
- Waterbody

NOTES:
- Topographic information extracted from LIO, MNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
- 230 kV transmission line provided by First Mining Gold, April 2024.

First Mining Gold

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SPRINGPOLE GOLD PROJECT

Local Study Area and Project Development Area for Boreal Caribou

Datum: NAD83
Projection: UTM Zone 15N

N W E S

0 5 10 20 30 40 50 Kilometres

PROJECT N°: ONS2104

FIGURE: 6.13-1

SCALE: 1:240,000

DATE: September 2024

280000 320000 360000 400000 440000 480000 520000 560000 600000 640000 680000 720000 760000 800000 840000 880000

5840000 5800000 5760000 5720000 5680000 5640000 5600000 5560000

Spirit Range
Ozhiski Range
Kinloch Range
Berens Range
Sydney Range
Churchill Range
Brightsand Range

MANITOBA
ONTARIO

MacDowell Lake
Poplar Hill First Nation
Pikangikum First Nation
Cat Lake First Nation
Birch Lake
Springpole Project Site
Springpole Lake
Trout Lake
Red Lake
Red Lake
Gullrock Lake
Slate Falls Nation
Lake St. Joseph
Mishkeegogamang Ojibway Nation
Pakwash Lake
Ear Falls
Lac Seul
Wabauskang First Nation
Lac Seul
Lac Seul First Nation
Asubpeeschoseewagong Anishinabek First Nation
Sioux Lookout
Ojibway Nation of Saugeen
Savant Lake
Arnstrong
Lake Nipigon

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LEGEND

- Proposed Mine Features
- First Nation Reserve (labelled with name)
- Town
- Existing Road
- Existing Transmission Line
- Regional Population Study Area
- Regional Habitat Study Area
- Caribou Range Boundary (labelled with name)

NOTES:
- Topographic information extracted from ESRI Basemap service.

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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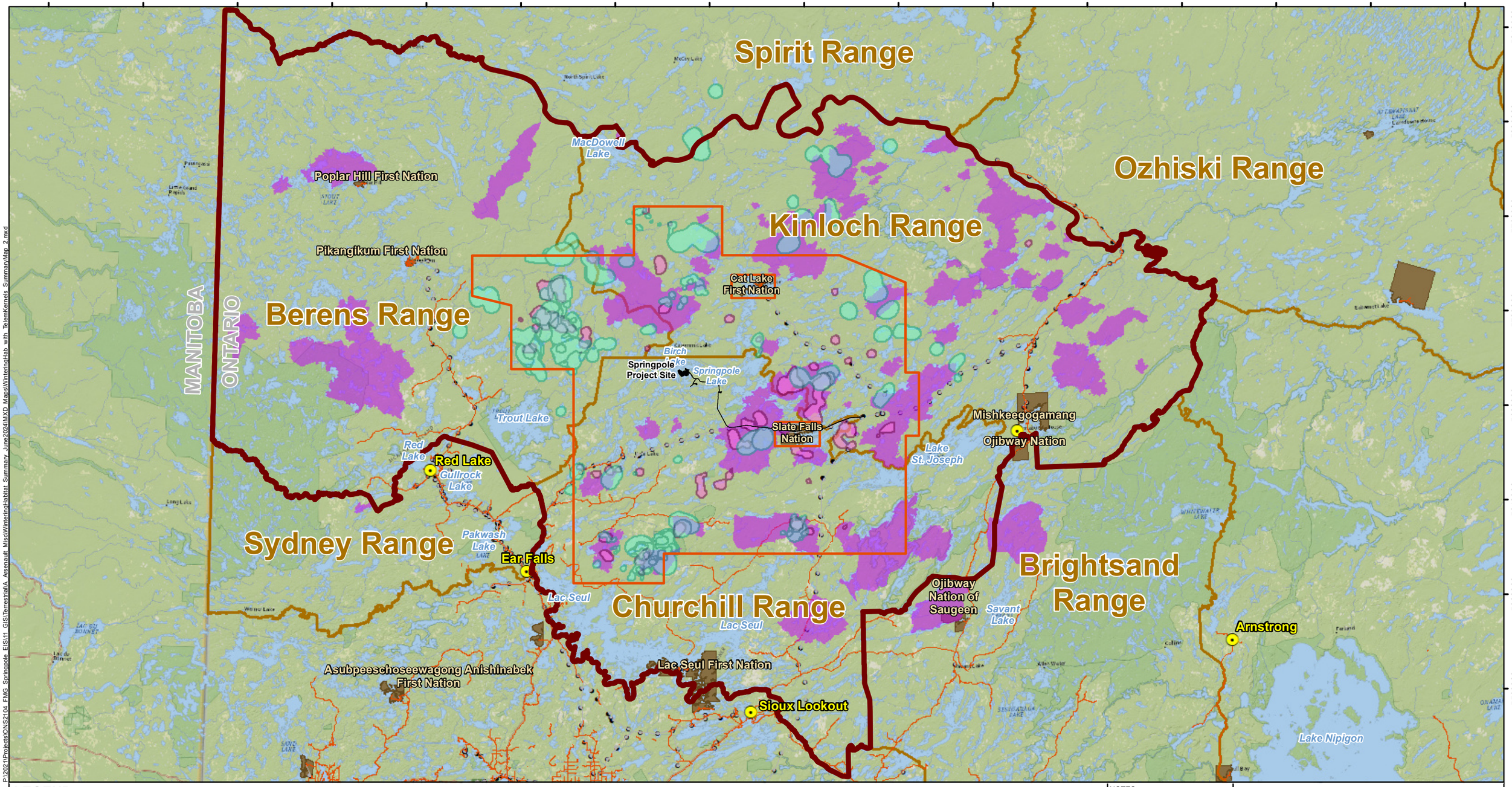
SPRINGPOLE GOLD PROJECT

Boreal Caribou Regional Study Areas

PROJECT N°: ONS2104 | **FIGURE: 6.13-2**

SCALE: 1:1,526,800 | DATE: June 2024



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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Regional Population Study Area (RPSA)
- Aerial Survey Study Area (2024)
- Wintering Areas for 2023-2024 - 65% adaptive kernel contours for 45 collared caribou
- Relative High Caribou Evidence Density from Winter Aerial Surveys (2021 – 2024)
- Caribou GHD Category 1 Winter Use Areas (MECP, 2024)

NOTES:
- Topographic information extracted from LIO, MNRF.
- Aerial survey was conducted between Feb. 17 and Feb. 25, 2024
- Over-wintering kernels are based on telemetry locations between December and end of March

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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SPRINGPOLE GOLD PROJECT

Category 1 Winter Habitat (2024) relative to Winter Boreal Caribou Distribution from Aerial Surveys (2021-2024) and Satellite telemetry (2023-2024)

PROJECT N°: ONS2104	**FIGURE: 6.13-3**
SCALE: 1:1,526,800	DATE: June 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5760000 5720000 5680000 5640000

MacDowell Lake

Poplar Hill First Nation

Pikangikum First Nation

Kinloch Range

Berens Range

Cat Lake First Nation

Cat Lake

Springpole Project Site

Birch Lake

Springpole Lake

Trout Lake

Slate Falls Nation

Mishkeegogamang Ojibway Nation

Lake St. Joseph

Red Lake

Red Lake

Gullrock Lake

Sydney Range

Churchill Range

Brightsand Range

Pakwash Lake

Ear Falls

Lac Seul

KEY MAP

Area Enlarged

500 km

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LEGEND

- Proposed Mine Features
- Proposed Airstrip
- Transmission Line
- Mine Access Road
- 100 km Buffer from Mine Site Project Features (permitted caribou capture area)
- Telemetry Fix Locations
- Caribou Capture/Collaring Location
- Mortality Locations
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Waterbody

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 25 50 100 150 200 250 Kilometres

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SPRINGPOLE GOLD PROJECT

Satellite Telemetry Collar Deployment and Data (to early April 2024)

PROJECT N°: ONS2104

FIGURE: 6.13-4

SCALE: 1:885,000

DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

Berens Range
Kinloch Range
Sydney Range
Churchill Range
Brightsand Range

Birch Lake
Springpole Lake
Trout Lake
Slate Falls Nation
Mishkeegogamang Ojibway Nation
Lake St. Joseph
Red Lake
Red Lake
Gullrock Lake
Pakwash Lake
Ear Falls
Lac Seul
Lac Seul
Lac Seul
Savant Lake
Ojibway Nation of Saugeen
Wabauskang First Nation
Lac Seul First Nation
Asubpeeschoseewagong Anishinabek First Nation
Sioux Lookout

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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Main Road
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody
- Anthropogenic and Fire Habitat Disturbance Areas (500 m buffer from anthropogenic sources)

Main Sources of Anthropogenic Habitat Disturbance and Fire Disturbance Areas

- Building/Structure/Dam/Tower
- Drillhole
- Recreation Point
- Roads (Secondary and Resource)
- Railway
- Utility Line
- Aggregate Authorized (active)
- Waste Management Site
- Airport/Aerodrome
- Cabin
- Forest Harvested Area
- Mining Leases and Patents
- Agriculture/Infrastructure (land use-land cover)
- Tourist Establishment Area
- Fire Disturbance Area

NOTES:
- Topographic information extracted from LIO, MNRF.

0 25 50 100 150 200 250 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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SPRINGPOLE GOLD PROJECT

Anthropogenic (+500m buffer) and Natural Disturbance in Churchill Range

PROJECT N°: ONS2104 | **FIGURE: 6.13-5**

SCALE: 1:855,000 | DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

- Trout Lake FMU Forest Resource Inventory (FRI)
- FRI current to 2019
- Provided by Domtar Inc. in March 2023
- Approx. 32% of the area of Churchill Caribou Range

- Cat Lake Forest Resource Inventory (FRI)
- FRI current to 2014
- Provided by Ontario MNRF in September 2023
- Approx. 2.1% of the area of Churchill Caribou Range

- Far North Land Cover (No FRI available)
- Land Cover current to 2011
- Downloaded from Land Information Ontario (GeoHub) in 2022
- Approx. 2.6% of the area of Churchill Caribou Range

Berens Range
Sydney Range
Churchill Range
Kinloch Range
Brightsand Range

Birch Lake
Springpole Lake
Trout Lake
Red Lake
Red Lake
Gullrock Lake
Pakwash Lake
Ear Falls
Lac Seul
Lac Seul
Lac Seul
Lac Seul
Slate Falls Nation
Lake St. Joseph
Mishkeegogamang
Ojibway Nation
Wabauskang First Nation
Asubpeeschoseewagong Anishinabek First Nation
Lac Seul First Nation
Sioux Lookout
Ojibway Nation of Saugeen

- Caribou Forest FMU Forest Resource Inventory (FRI)
- FRI current to 2020
- Provided by Ontario MNRF in September 2023
- Approx. 15% of the area of Churchill Caribou Range

- Whiskey Jack FMU Forest Resource Inventory (FRI)
- FRI current to 2016
- Downloaded from Land Information Ontario (GeoHub) in 2022
- Approx. 0.7% of the area of Churchill Caribou Range

- Lac Seul FMU Forest Resource Inventory (FRI)
- FRI current to 2021
- Provided by Ontario MNRF in September 2023
- Approx. 46% of the area of Churchill Caribou Range

- Wabigoon FMU Forest Resource Inventory (FRI)
- FRI current to 2012
- Downloaded from Land Information Ontario (GeoHub) in 2022
- Approx. 0.9% of the area of Churchill Caribou Range

- English River FMU Forest Resource Inventory (FRI)
- FRI current to 2015
- Downloaded from Land Information Ontario (GeoHub) in 2022
- Approx. 0.7% of the area of Churchill Caribou Range

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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody

Churchill Caribou Range Land Cover and Forest Resource Inventory Coverage Areas

- Caribou Forest FMU Forest Resource Inventory (FRI)
- English River FMU Forest Resource Inventory (FRI)
- Lac Seul FMU Forest Resource Inventory (FRI)
- Trout Lake FMU Forest Resource Inventory (FRI)
- Wabigoon FMU Forest Resource Inventory (FRI)
- Whiskey Jack FMU Forest Resource Inventory (FRI)
- Cat Lake Forest Resource Inventory (FRI)
- Far North Land Cover (No FRI available)

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 25 50 100 150 200 250 Kilometres

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SPRINGPOLE GOLD PROJECT

Summary Map of Churchill Caribou range Land cover and Forest Resource Inventory Coverage Areas

PROJECT N°: ONS2104 | **FIGURE: 6.13-6**

SCALE: 1:855,000 | DATE: September 2023

400000 440000 480000 520000 560000 600000 640000 680000 720000

5760000 5720000 5680000 5640000

Spirit Range
MacDowell Lake
Ozhiski Range
Poplar Hill First Nation
Pikangikum First Nation
Kinloch Range
Cat Lake First Nation
Cat Lake
Berens Range
Birch Lake
Springpole Lake
Trout Lake
Slate Falls Nation
Mishkeegogamang Ojibway Nation
Lake St. Joseph
Red Lake
Red Lake
Gullrock Lake
Sydney Range
Pakwash Lake
Ear Falls
Lac Seul
Lac Seul
Churchill Range
Brightsand Range

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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Waterbody
- Nursery/Calving Areas for 2023 - 65% adaptive kernel contours for 47 collared caribou (brighter yellow areas indicate greater amount of nursery area overlap)
- Category 1 - High Nursery Use (MECP GHD data, 2024)

NOTES:
- Topographic information extracted from LIO, MNRF.
- Nursery kernels are based on telemetry locations between May 1st and September 15th

0 25 50 100 150 200 250 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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SPRINGPOLE GOLD PROJECT

Category 1 GHD Calving and Nursery Habitat with 2023 Satellite Telemetry Calving Kernels

PROJECT N°: ONS2104 | **FIGURE: 6.13-7**

SCALE: 1:900,000 | DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

Berens Range
Sydney Range
Churchill Range
Kinloch Range
Brightsand Range

Trout Lake
Red Lake
Red Lake
Gullrock Lake
Pakwash Lake
Ear Falls
Lac Seul
Lac Seul
Lac Seul
Lac Seul First Nation
Wabauskang First Nation
Asubpeeschoseewagong Anishinabek First Nation
Sioux Lookout
Birch Lake
Springpole Lake
Slate Falls Nation
Lake St. Joseph
Mishkeegogamang Ojibway Nation
Savant Lake
Ojibway Nation of Saugeen

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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody

Caribou Habitat Summary *

- Category 1 – High Nursery Use
- Category 1 – High Winter Use
- Category 1 – High Nursery Use and Winter Use
- Category 2 - Seasonal Range
- Category 3 - Remaining Areas within Range

Various Sources of Category 1 Delineations

- MECP GHD (2024) Nursery High Use Area
- Nursery 65% probability of occurrence kernel data from telemetry fixes (2023)
- Predicted calving/nursery areas from RSF model (R. Rempel 2024)
- MECP GHD (2024) Winter High Use Area
- Wintering 65% probability of occurrence kernel data from telemetry fixes (2023-2024)
- High Density Observation Areas (winter aerial surveys 2021-2024)

NOTES:
* Caribou habitat areas are derived from a combination of MECP (2024) GHD data, 65% probability of occurrence kernel data from telemetry fixes (2023-2024), categorized high density areas delineated from observation data collected during winter aerial surveys (2021 to 2024), modelled category 2 and category 3 land coverage model within Churchill Range, and predicted calving/nursery areas from RSF model (R. Rempel 2024)

Datum: NAD83
Projection: UTM Zone 15N

0 25 50 100 150 200 250 Kilometres

N W E S

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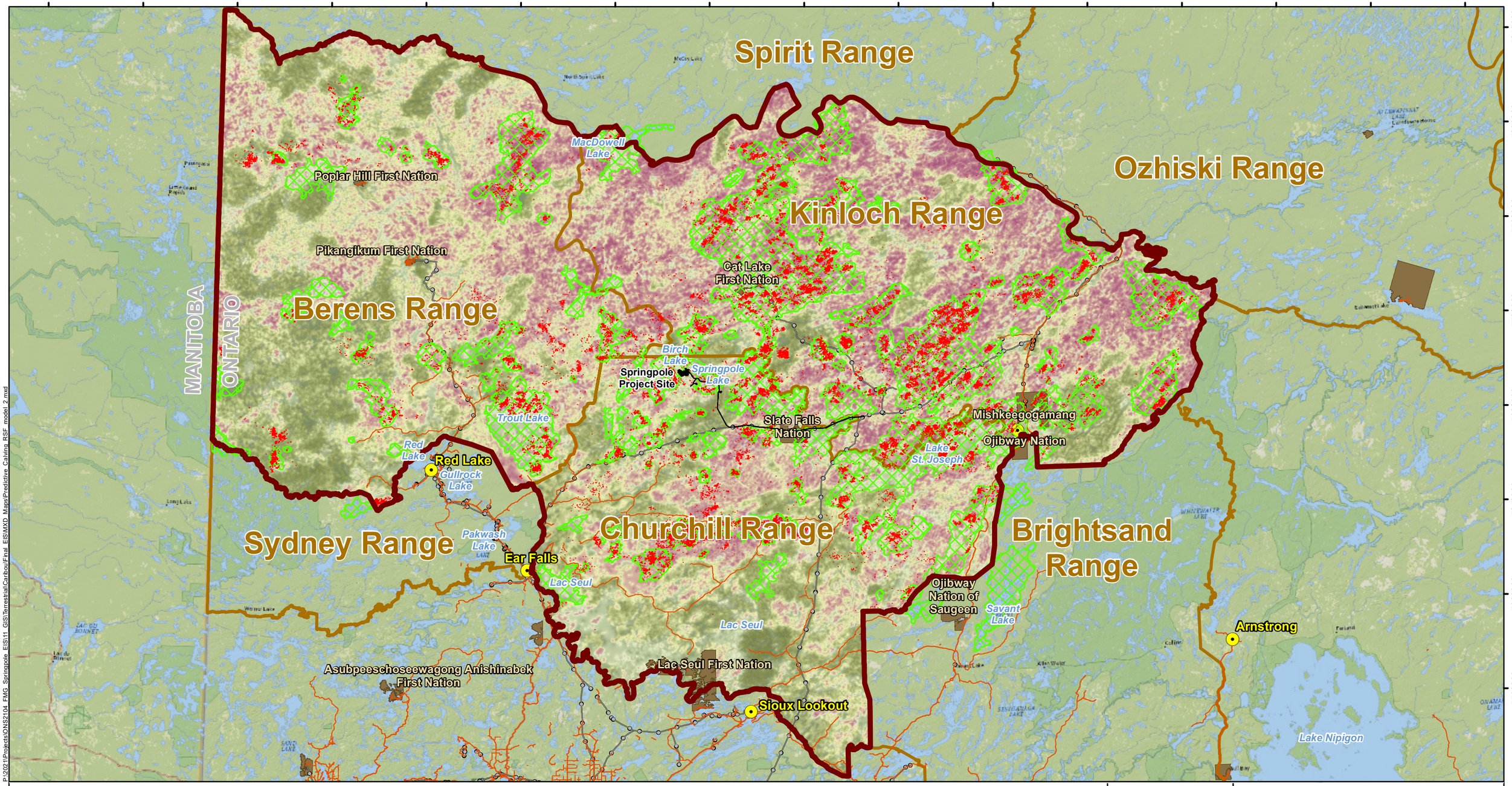
SPRINGPOLE GOLD PROJECT

Category 1, 2 and 3 Habitat Summary for Churchill Range

PROJECT N°: ONS2104	**FIGURE: 6.13-8**
SCALE: 1:855,000	DATE: September 2024



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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary
- Telemetry data used in RSF model (NHIC data and FMG collaring program data)
- Category 1 - High Nursery Use (MECP GHD data, 2024)

Calving Period (May and June) - Predicted Probability of Occurrence

- High Probability of Occurrence
- Low Probability of Occurrence

NOTES:
- Topographic information extracted from LIO, MNRF.
-

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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WSP

SPRINGPOLE GOLD PROJECT

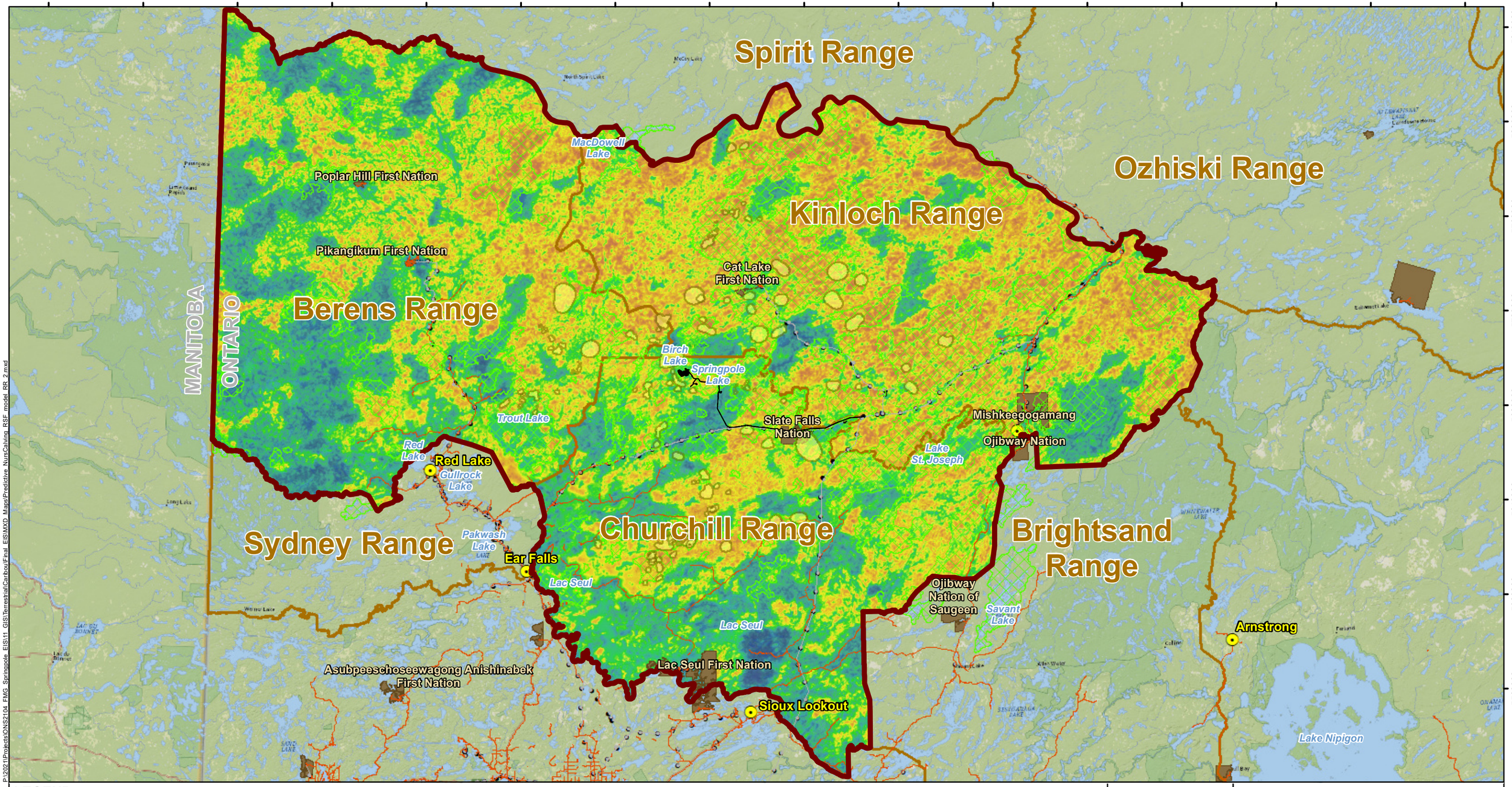
Predictive Calving RSPF Model and Category 1 GHD Nursery Kernels

PROJECT N°: ONS2104

FIGURE: 6.13-9

SCALE: 1:1,526,800

DATE: September 2024



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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary
- Category 1 - High Nursery Use (MECP GHD data, 2024)
- Nursery Areas for 2023 - 65% adaptive kernel contours for 47 collared caribou (brighter yellow areas indicate greater amount of nursery area overlap)

Nursery/Calving Period - Predicted Probability of Occurrence

- High Probability of Occurrence
- Low Probability of Occurrence

NOTES:
- Topographic information extracted from LIO, MNRF.
-

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Predictive Category 1 Calving RSPF model and Category 1 GHD Nursery Areas

PROJECT N°: ONS2104	**FIGURE: 6.13-10**
SCALE: 1:1,526,800	DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

Berens Range

Kinloch Range

Sydney Range

Brightsand Range

Birch Lake

Springpole Lake

Trout Lake

Slate Falls Nation

Mishkeegogamang Ojibway Nation

Lake St. Joseph

Red Lake

Red Lake

Gullrock Lake

Pakwash Lake

Ear Falls

Lac Seul

Lac Seul

Lac Seul

Savant Lake

Wabauskang First Nation

Ojibway Nation of Saugeen

Lac Seul First Nation

Asubpeeschoseewagong Anishinabek First Nation

Sioux Lookout

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LEGEND

- Proposed Mine Site Features
- Town
- Existing Main Road
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody
- Far North Land Cover (no FRI available for Refuge Habitat Model)
- Effects Assessment Impact Area (direct + indirect
- Caribou Refuge Habitat (conventional northwest model, MNR)

NOTES:
- Topographic information extracted from LIO, MNRF.

Datum: NAD83
Projection: UTM Zone 15N

0 25 50 100 150 200 250 Kilometres

First Mining Gold

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SPRINGPOLE GOLD PROJECT

Boreal Caribou Habitat Effects Assessment Refuge Habitat Landscape Model Results

PROJECT N°: ONS2104 | **FIGURE: 6.13-11**

SCALE: 1:855,000 | DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

Berens Range

Sydney Range

Churchill Range

Kinloch Range

Brightsand Range

Birch Lake

Springpole Project Site

Springpole Lake

Trout Lake

Red Lake

Red Lake

Gullrock Lake

Pakwash Lake

Ear Falls

Lac Seul

Lac Seul

Lac Seul

Lac Seul

Slate Falls Nation

Lake St. Joseph

Mishkeegogamang Ojibway Nation

Savant Lake

Ojibway Nation of Saugeen

Wabauskang First Nation

Asubpeeschoseewagong Anishinabek First Nation

Lac Seul First Nation

Sioux Lookout

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LEGEND

- Proposed Mine Site Features
- Town
- Existing Main Road
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody

Caribou Habitat Summary for Category 2 and 3

- Category 2 - Seasonal Range
- Category 3 - Remaining Areas within Range

NOTES:
- Topographic information extracted from LIO, MNRF.
- Modelled category 2 and category 3 land coverage model within Churchill Range (R. Rempel, 2024)

0 25 50 100 150 200 250 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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SPRINGPOLE GOLD PROJECT

Category 2 and Category 3 Habitat within Churchill Range

PROJECT N°: ONS2104

FIGURE: 6.13-12

SCALE: 1:855,000

DATE: September 2024

544000 548000 552000 556000 560000 564000 568000 572000

5696000

5692000

5688000

5684000

Birch Lake

Springpole Lake

Gull Lake

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LEGEND

- Points used in KDE+ Cluster Analysis (telemetry locations within 500 m of alternative and trajectory crossing locations)
- Collared Caribou Trajectory Lines (Feb. 2023 to Apr. 2024)
- Preferred Mine Access Road Alternative
- Identified Substantial Cluster Locations along Alternative
- Identified Most Substantial Cluster Location along Alternative
- Proposed Mine Site Features
- Existing Road / Resource Road
- Waterbody

NOTES:
- Topographic information extracted from LIO, NDMNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP 2023.

0 5 10 20 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Activity Locations identified through KDE Analysis for Preferred Mine Access Route

PROJECT N°: ONS2104

FIGURE: 6.13-13

SCALE: 1:75,000

DATE: September 2024

552000 560000 568000 576000 584000 592000 600000 608000 616000 624000 632000

5696000 5688000 5680000 5672000 5664000

Springpole Lake

Gull Lake

Slate Falls Nation

Bamaji Lake

Jeanette Lake

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LEGEND

- Points used in KDE+ Cluster Analysis (telemetry locations within 500 m of alternative and trajectory crossing locations)
- Collared Caribou Trajectory Lines (Feb. 2023 to Apr. 2024)
- Transmission Line Alternative
- Identified Substantial Cluster Locations along Alternative
- Identified Most Substantial Cluster Location along Alternative
- Proposed Mine Site Features
- Existing Road / Resource Road
- First Nation Reserve (labelled with name)
- Waterbody

NOTES:
- Topographic information extracted from LIO, NDMNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP 2023.

Datum: NAD83
Projection: UTM Zone 15N

0 10 20 40 60 Kilometres

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SPRINGPOLE GOLD PROJECT

Activity Locations identified through KDE Analysis for Preferred Transmission Line

PROJECT N°: ONS2104 | **FIGURE: 6.13-14**

SCALE: 1:210,000 | DATE: September 2024

280000 320000 360000 400000 440000 480000 520000 560000 600000 640000 680000 720000 760000 800000 840000 880000

5840000 5800000 5760000 5720000 5680000 5640000 5600000 5560000

Spirit Range
Ozhiski Range
Kinloch Range
Berens Range
Sydney Range
Churchill Range
Brightsand Range
Nipigon Range

MANITOBA
ONTARIO

MacDowell Lake
Poplar Hill First Nation
Pikangikum First Nation
Cat Lake First Nation
Birch Lake
Springpole Lake
Springpole Project Site
Trout Lake
Slate Falls Nation
Red Lake
Gullrock Lake
Red Lake
Lake St. Joseph
Mishkeegogamang Ojibway Nation
Pakwash Lake
Ear Falls
Lac Seul
Ojibway Nation of Saugeen
Savant Lake
Arnstrong
Asubpeeschoseewagong Anishinabek First Nation
Lac Seul First Nation
Sioux Lookout
Lake Nipigon

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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary

Brownian Bridge Movement Model Results for Calving (May 7 – Jul. 14)

- Occurrence Probability of 75% (higher use)
- Occurrence Probability of 95%
- Occurrence Probability of 99%
- Occurrence Probability of 99.9% (lower use)

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI
- Collared caribou telemetry data used in BBMM analysis (2023-2024)

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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First Mining Gold

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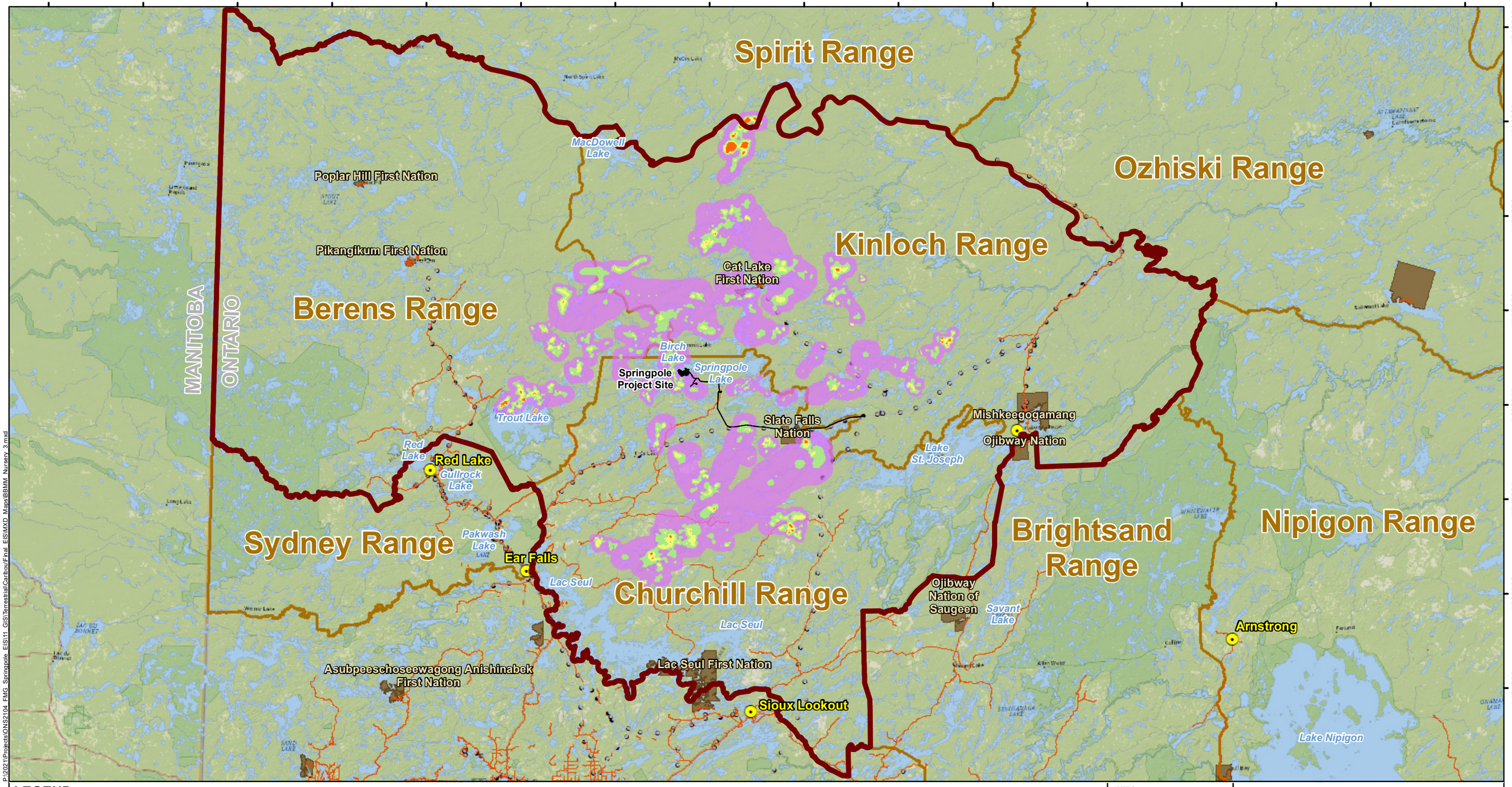
SPRINGPOLE GOLD PROJECT

Brownian Bridge Movement Model - Calving

PROJECT N°: ONS2104 | **FIGURE: 6.13-15**

SCALE: 1:1,526,800 | DATE: September 2024



LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary

Brownian Bridge Movement Model Results for Nursery (May 1 – Sep. 15)

- Occurrence Probability of 75% (higher use)
- Occurrence Probability of 95%
- Occurrence Probability of 99%
- Occurrence Probability of 99.9% (lower use)

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI
- Collared caribou telemetry data used in BBMM analysis (2023-2024)

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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SPRINGPOLE GOLD PROJECT

Brownian Bridge Movement Model - Nursery

PROJECT N°: ONS2104 | **FIGURE: 6.13-16**

SCALE: 1:1,526,800 | DATE: September 2024

280000 320000 360000 400000 440000 480000 520000 560000 600000 640000 680000 720000 760000 800000 840000 880000

5840000 5800000 5760000 5720000 5680000 5640000 5600000 5560000

Spirit Range
Ozhiski Range
Kinloch Range
Berens Range
Sydney Range
Churchill Range
Brightsand Range
Nipigon Range

MANITOBA
ONTARIO

MacDowell Lake
Poplar Hill First Nation
Pikangikum First Nation
Cat Lake First Nation
Birch Lake
Springpole Lake
Springpole Project Site
Trout Lake
Slate Falls Nation
Mishkeegogamang Ojibway Nation
Lake St. Joseph
Red Lake
Gullrock Lake
Red Lake
Pakwash Lake
Ear Falls
Lac Seul
Ojibway Nation of Saugeen
Savant Lake
Arnstrong
Asubpeeschoseewagong Anishinabek First Nation
Lac Seul First Nation
Sioux Lookout
Lake Nipigon

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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary

Brownian Bridge Movement Model Results for Post-calving (Jul. 15 – Nov. 14)

- Occurrence Probability of 75% (higher use)
- Occurrence Probability of 95%
- Occurrence Probability of 99%
- Occurrence Probability of 99.9% (lower use)

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI
- Collared caribou telemetry data used in BBMM analysis (2023-2024)

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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SPRINGPOLE GOLD PROJECT

Brownian Bridge Movement Model - Post Calving

PROJECT N°: ONS2104 | **FIGURE: 6.13-17**

SCALE: 1:1,526,800 | DATE: September 2024

280000 320000 360000 400000 440000 480000 520000 560000 600000 640000 680000 720000 760000 800000 840000 880000

5840000 5800000 5760000 5720000 5680000 5640000 5600000 5560000

Spirit Range
Ozhiski Range
Kinloch Range
Berens Range
Sydney Range
Churchill Range
Brightsand Range
Nipigon Range

MANITOBA
ONTARIO

MacDowell Lake
Poplar Hill First Nation
Pikangikum First Nation
Cat Lake First Nation
Birch Lake
Springpole Project Site
Springpole Lake
Trout Lake
Slate Falls Nation
Mishkeegogamang Ojibway Nation
Lake St. Joseph
Red Lake
Red Lake
Gullrock Lake
Pakwash Lake
Ear Falls
Lac Seul
Ojibway Nation of Saugeen
Savant Lake
Arnstrong
Asubpeeschoseewagong Anishinabek First Nation
Lac Seul First Nation
Sioux Lookout
Lake Nipigon

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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary

Brownian Bridge Movement Model Results for Early Winter (Nov. 15 – Jan. 20)

- Occurrence Probability of 75% (higher use)
- Occurrence Probability of 95%
- Occurrence Probability of 99%
- Occurrence Probability of 99.9% (lower use)

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI
- Collared caribou telemetry data used in BBMM analysis (2023-2024)

FIRST MINING GOLD

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SPRINGPOLE GOLD PROJECT

Brownian Bridge Movement Model - Early Winter

Datum: NAD83
Projection: UTM Zone 15N

N W E S

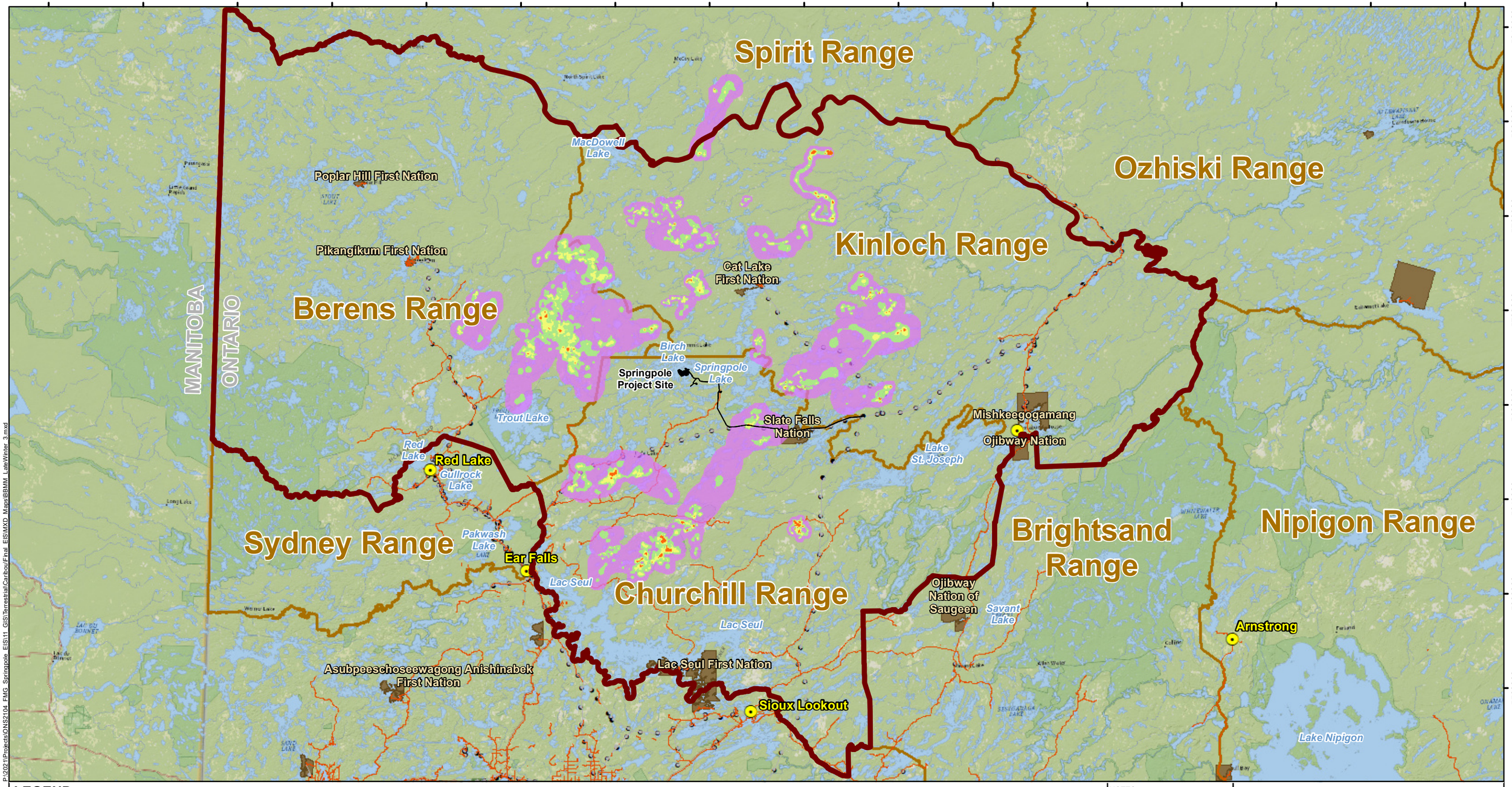
PROJECT N°: ONS2104

FIGURE: 6.13-18

SCALE: 1:1,526,800

DATE: September 2024

0 25 50 100 150 200 250 300 350 400 450 Kilometres



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LEGEND

- Proposed Mine Features
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary

Brownian Bridge Movement Model Results for Late Winter (Jan. 20 – Mar. 5)

- Occurrence Probability of 75% (higher use)
- Occurrence Probability of 95%
- Occurrence Probability of 99%
- Occurrence Probability of 99.9% (lower use)

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI
- Collared caribou telemetry data used in BBMM analysis (2023-2024)

0 25 50 100 150 200 250 300 350 400 450 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

First Mining Gold

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SPRINGPOLE GOLD PROJECT

Brownian Bridge Movement Model - Late Winter

PROJECT N°: ONS2104 | **FIGURE: 6.13-19**

SCALE: 1:1,526,800 | DATE: September 2024

400000 440000 480000 520000 560000 600000 640000 680000 720000

5680000 5640000 5600000 5560000

Berens Range

Sydney Range

Churchill Range

Kinloch Range

Brightsand Range

Birch Lake

Springpole Lake

Trout Lake

Red Lake

Red Lake

Gullrock Lake

Pakwash Lake

Ear Falls

Lac Seul

Lac Seul

Lac Seul

Lac Seul First Nation

Slate Falls Nation

Lake St. Joseph

Mishkeegogamang Ojibway Nation

Savant Lake

Ojibway Nation of Saugeen

Wabauskang First Nation

Asubpeeschoseewagong Anishinabek First Nation

Sioux Lookout

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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Churchill Range Boundary (labelled with name)
- Waterbody
- Caribou Telemetry – Spring Focal Node Areas used in Analysis

Circuitscape Connectivity Analysis Results (Spring)

- High Flow/Connectivity
- Low Flow/Connectivity

NOTES:
- Topographic information extracted from LIO, MNRF.

0 25 50 100 150 200 250 Kilometres

Datum: NAD83
Projection: UTM Zone 15N

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SPRINGPOLE GOLD PROJECT

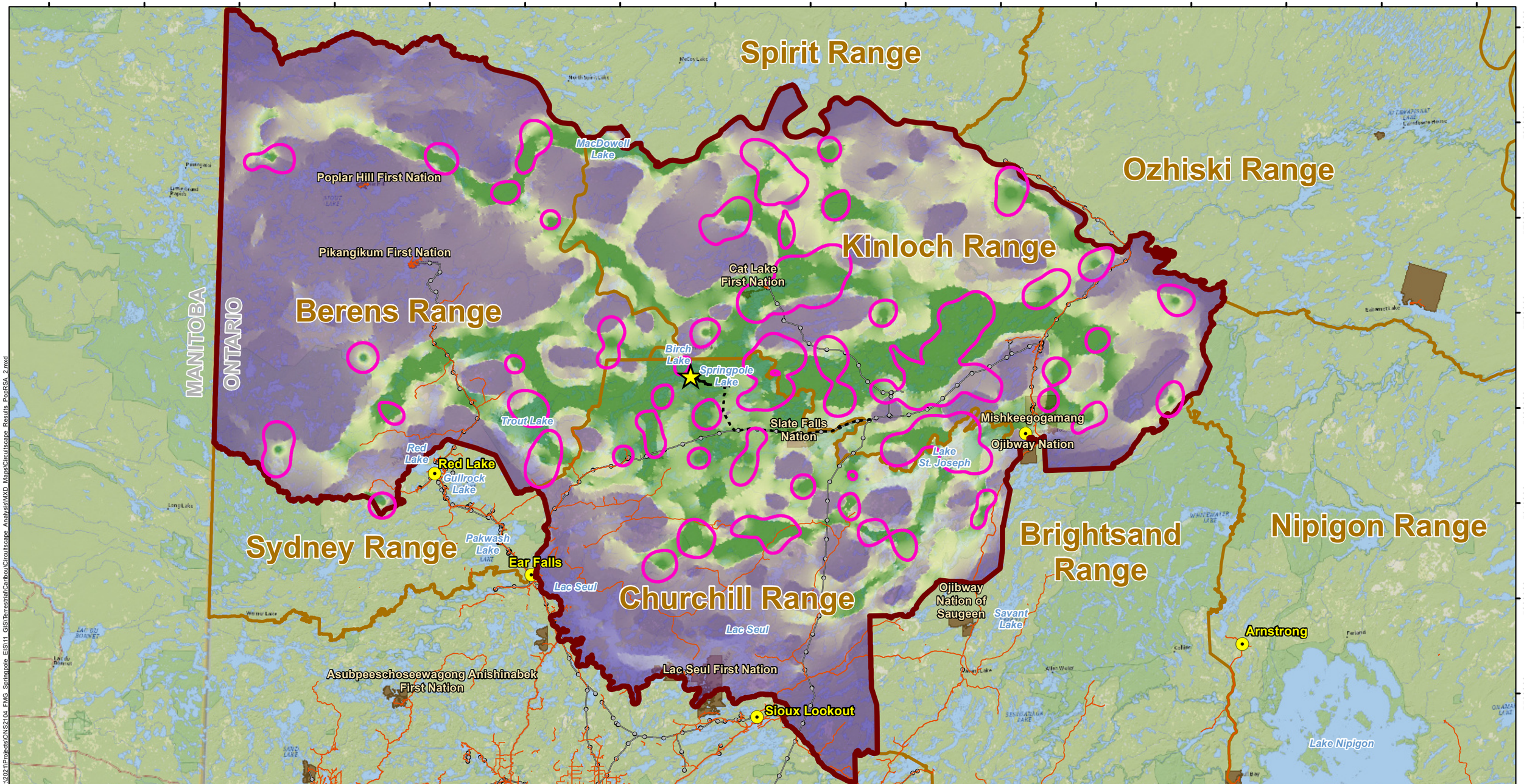
Circuitscape Model Results Churchill Range

PROJECT N°: ONS2104

FIGURE: 6.13-20

SCALE: 1:855,000

DATE: August 2024



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LEGEND

- Springpole Project Location
- Transmission Line
- Mine Access Road
- Town
- Existing Road
- Existing Transmission Line
- First Nation Reserve (labelled with name)
- Caribou Range Boundary (labelled with name)
- Caribou Regional Population Study Area (RPSA) Boundary
- Caribou Telemetry – Spring Focal Node Areas used in Analysis

Circuitscape Connectivity Analysis Results (Spring)

- High Flow/Connectivity
- Low Flow/Connectivity

0 25 50 100 150 200 250 300 350 400 450 Kilometres

NOTES:
- Topographic information extracted from LIO, MNRF and ESRI

Datum: NAD83
Projection: UTM Zone 15N

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SPRINGPOLE GOLD PROJECT

Circuitscape Model Results Population RSA

PROJECT N°: ONS2104 | **FIGURE: 6.13-21**

SCALE: 1:1,526,800 | DATE: August 2024

535000 550000 565000 580000 595000 610000 625000

5705000 5690000 5675000 5660000

Birch Lake
Zionz Lake
Fawcett Lake
Gull Lake
Seagrave Lake
Kezik Lake
Fry Lake
SLATE FALLS NATION
Bamaji Lake
Perrigo Lake
Jeanette Lake

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LEGEND

- Proposed Mine Feature
- Project Development Area
- Local Study Area for Caribou
- Regional Study Area for Caribou
- First Nation Reserve
- Noise Impact Zone of Influence (June 2024 model) *
- Existing Road
- Existing Winter Road
- Existing Transmission Line
- Watercourse
- Waterbody

0 5 10 20 30 40 50 Kilometres

NOTES:
- Topographic information extracted from LIO, NDMNRF.
- Proposed site plan provided by Ausenco, drawing number 104496-GX-03000-31344-003, Rev 1. 26 June 2023 and modified by WSP July 2023.
* Outer boundary of 40 dBA contours within continuous noise areas (mine site and access road)

Datum: NAD83
Projection: UTM Zone 15N

N W E S

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SPRINGPOLE GOLD PROJECT

Noise Impact Zone of Influence during Operations

PROJECT N°: ONS2104 | **FIGURE: 6.13-22**

SCALE: 1:225,000 | DATE: October 2024

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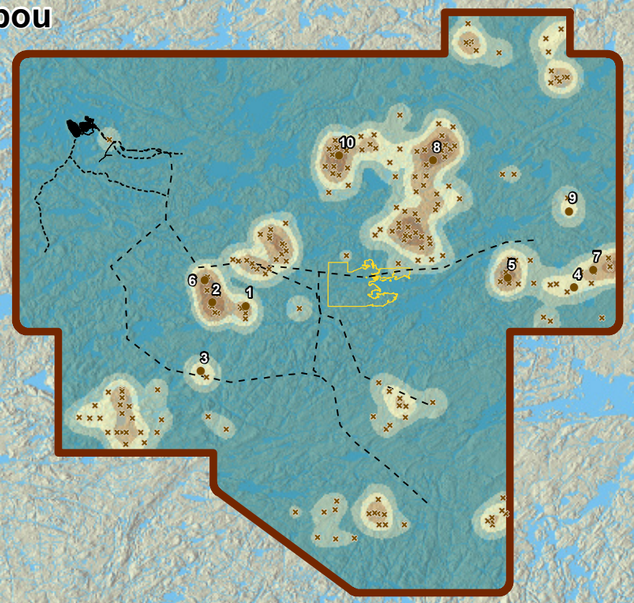
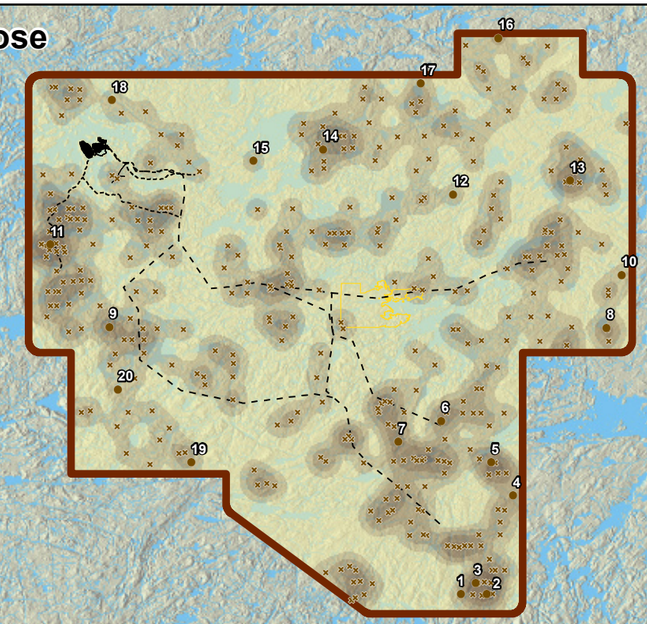
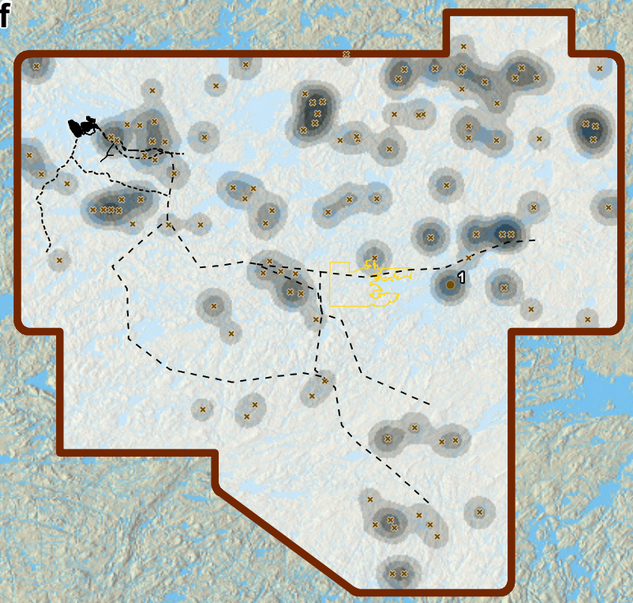
Caribou



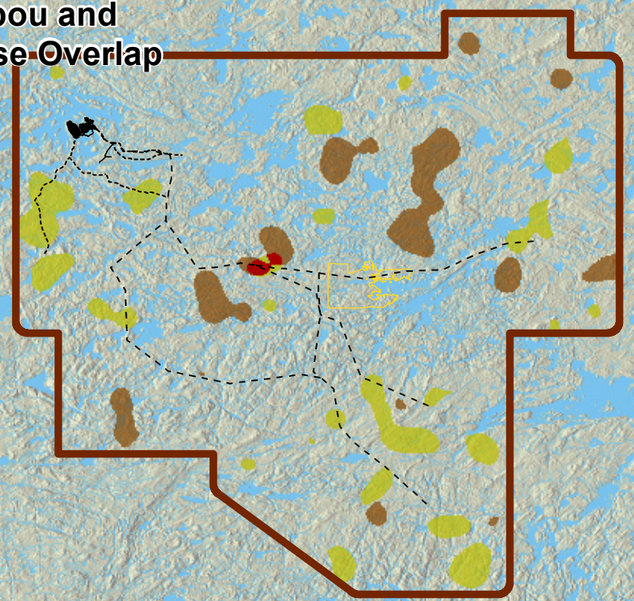
Moose



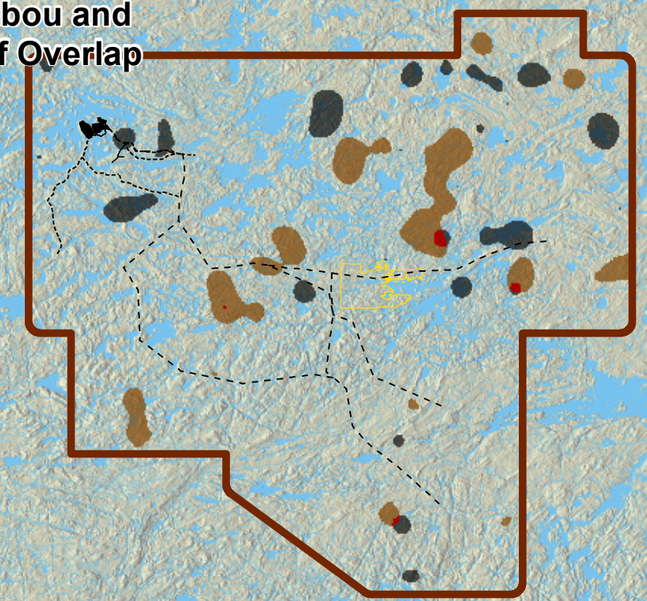
Wolf



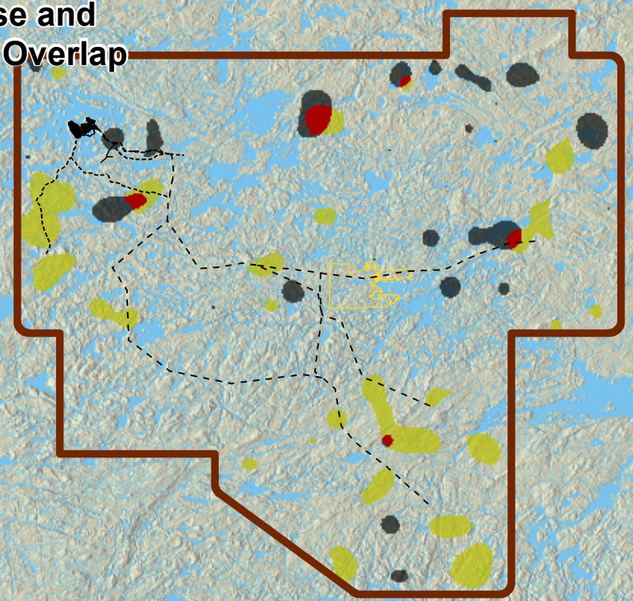
Caribou and Moose Overlap



Caribou and Wolf Overlap



Moose and Wolf Overlap



LEGEND

- Proposed Mine Site, Access Road alternatives and Transmission Line alternatives
- Aerial Survey Study Area (2021)
- Slate Falls First Nation

Observation Summary (2021 Aerial Survey)

- Tracks Observed
- Animal Sighting (labelled with ID)

General Relative Caribou Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Caribou Density Areas

General Relative Moose Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Moose Density Areas

General Relative Wolf Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Wolf Density Areas

- Areas of Relatively High Density Overlap

0 50 100 150 200 250 Kilometres

NOTES:
- Background topographic map extracted from ESRI online basemap services
- 2021 Field track and observation data used to generate relative density surfaces.
- Point data was weighted by observation count information and/or number of tracks.

Datum: NAD83
Projection: UTM Zone 15N

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Caribou-Moose-Wolf relative density kernels, 2021.

PROJECT N°: ONS2104 | **FIGURE: 6.13-23**

SCALE: 1:988,000 | DATE: March 2024

Caribou

Moose

Wolf

Caribou and Moose Overlap

Caribou and Wolf Overlap

Moose and Wolf Overlap

Whitestone Lake
Williams Lake
Trout Lake
Lake St. Joseph
Lac Seul

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LEGEND

- Proposed Mine Site, Access Road alternatives and Transmission Line alternatives
- Aerial Survey Study Area (2022)
- First Nation Community

Observation Summary (2022 Aerial Survey)

- Tracks Observed
- Animal Sighting (labelled with # animals observed)
- Observed Caribou Kill Site

General Relative Caribou Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Caribou Density Areas

General Relative Moose Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Moose Density Areas

General Relative Wolf Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Wolf Density Areas

Areas of Relatively High Density Overlap

0 80 160 240 320 400 Kilometres

NOTES:
- Background topographic map extracted from ESRI online basemap services
- 2022 Field track and observation data used to generate relative density surfaces.
- Point data was weighted by observation count information and/or number of tracks.

Datum: NAD83
Projection: UTM Zone 15N

N W E S

First Mining Gold

WSP

SPRINGPOLE GOLD PROJECT

Caribou-Moose-Wolf relative density kernels, 2022.

PROJECT N°: ONS2104 | **FIGURE: 6.13-24**

SCALE: 1:1,675,000 | DATE: March 2024

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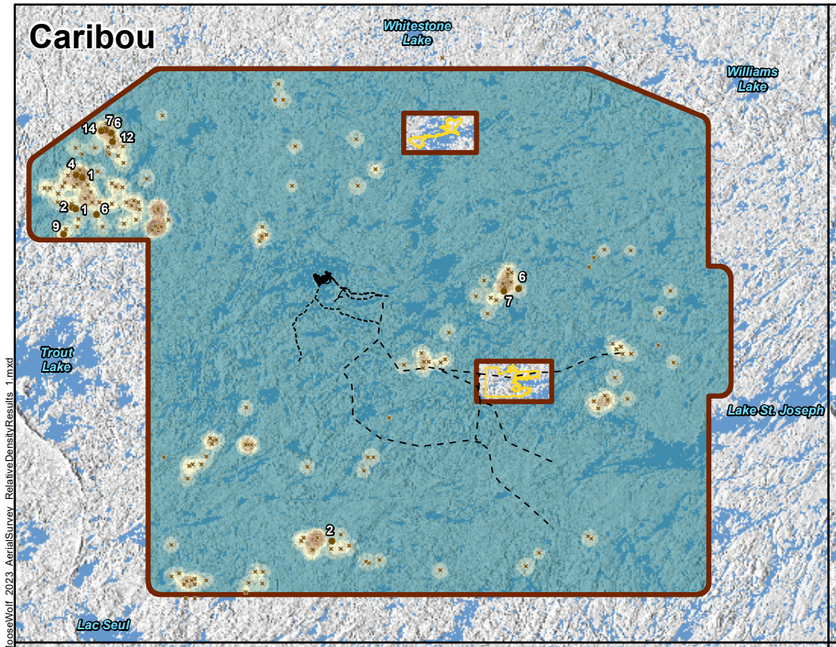
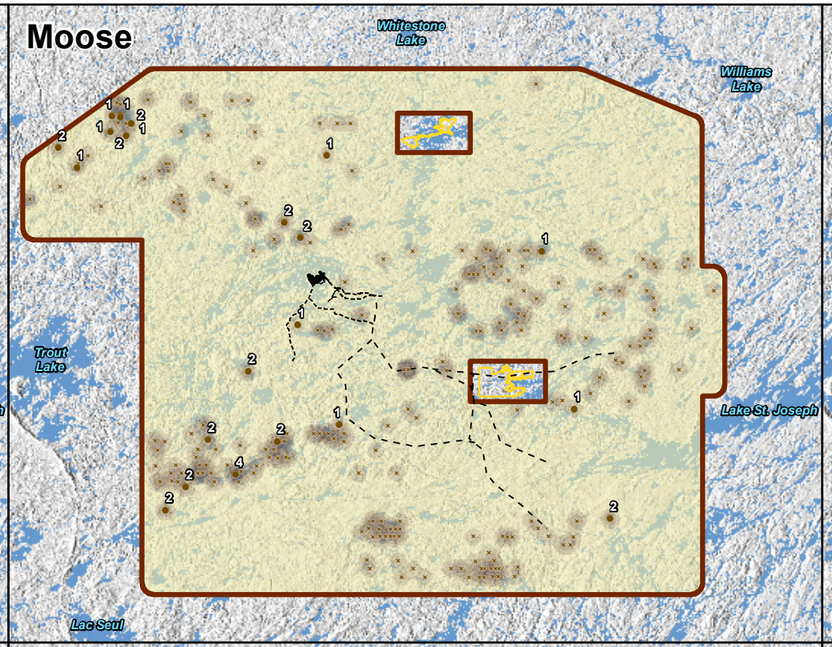
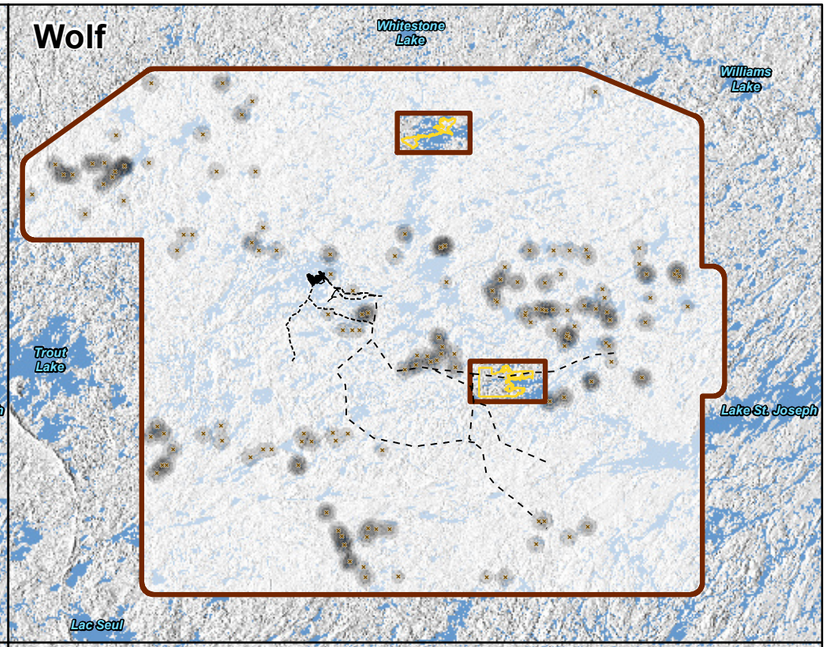
Caribou



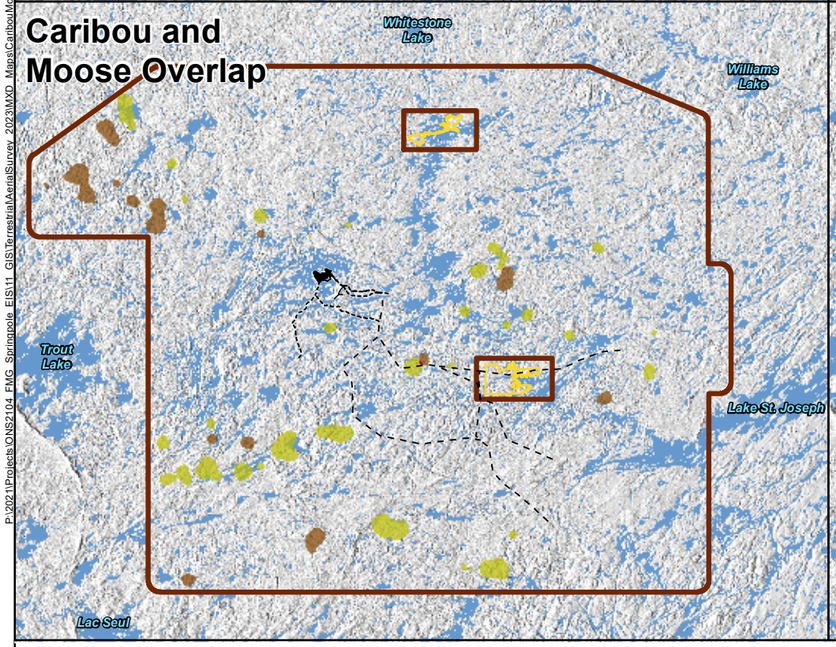
Moose



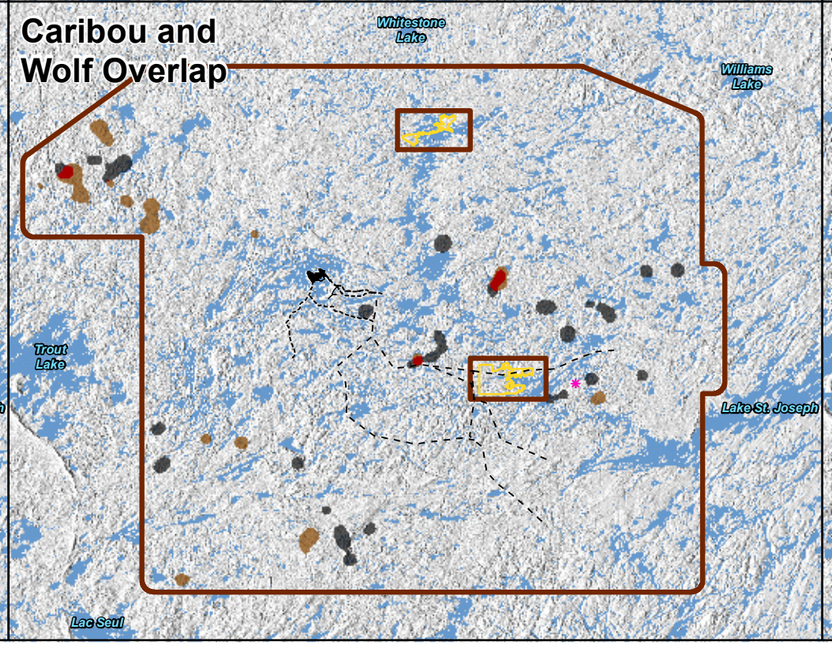
Wolf



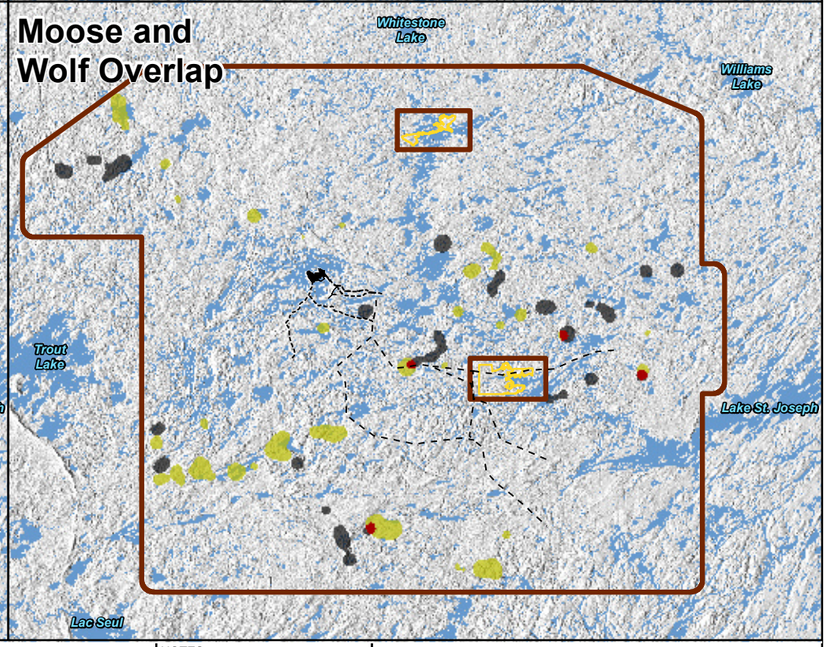
Caribou and Moose Overlap



Caribou and Wolf Overlap



Moose and Wolf Overlap



LEGEND

- Proposed Mine Site, Access Road alternatives and Transmission Line alternatives
- Aerial Survey Study Area (2023)
- First Nation Community

Observation Summary (2023 Aerial Survey)

- Tracks Observed
- Animal Sighting (labelled with # animals observed)

General Relative Caribou Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Caribou Density Areas

General Relative Moose Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Moose Density Areas

General Relative Wolf Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Wolf Density Areas

- Areas of Relatively High Density Overlap

0 75 150 225 300 375 Kilometres

NOTES:
- Background topographic map extracted from ESRI online basemap services
- 2023 Field track and observation data used to generate relative density surfaces.
- Point data was weighted by observation count information and/or number of tracks.

Datum: NAD83
Projection: UTM Zone 15N

FIRST MINING GOLD

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SPRINGPOLE GOLD PROJECT

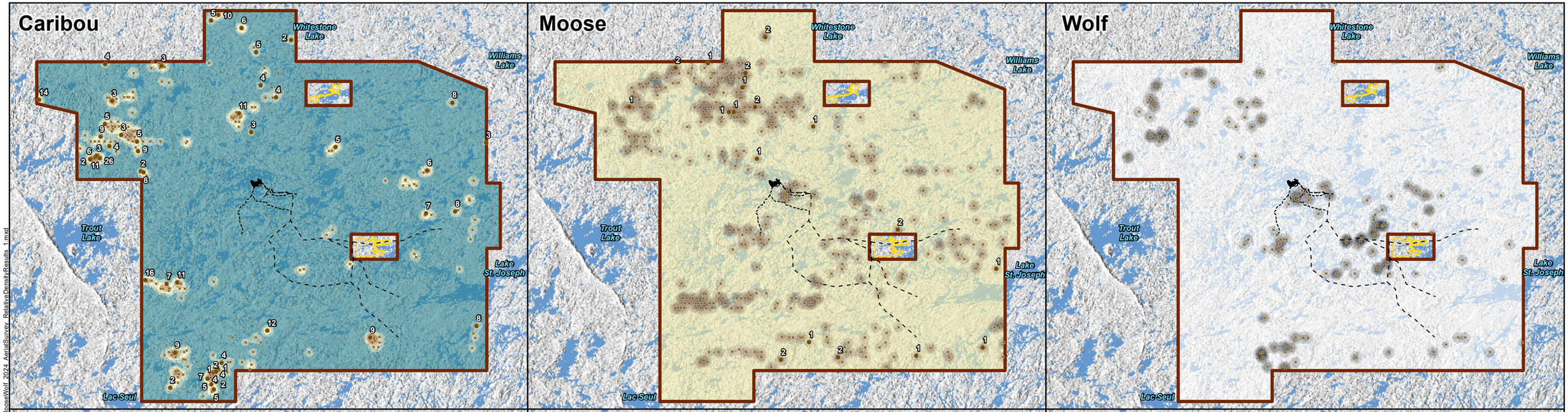
Caribou-Moose-Wolf relative density kernels, 2023.

PROJECT N°: ONS2104

FIGURE: 6.13-25

SCALE: 1:1,500,000

DATE: March 2024



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LEGEND

- Proposed Mine Site, Access Road alternatives and Transmission Line alternatives
- Aerial Survey Study Area (2024)
- First Nation Community

Observation Summary (2024 Aerial Survey)

- Tracks Observed
- Animal Sighting (labelled with # animals observed)

General Relative Caribou Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Caribou Density Areas

General Relative Moose Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Moose Density Areas

General Relative Wolf Density

- Low
- Medium Low
- Medium
- Medium High
- High
- Relatively High Wolf Density Areas

- Areas of Relatively High Density Overlap

0 80 160 240 320 400 Kilometres

NOTES:
- Background topographic map extracted from ESRI online basemap services
- 2024 Field track and observation data used to generate relative density surfaces.
- Point data was weighted by observation count information and/or number of tracks.

Datum: NAD83
Projection: UTM Zone 15N

First Mining Gold

WSP

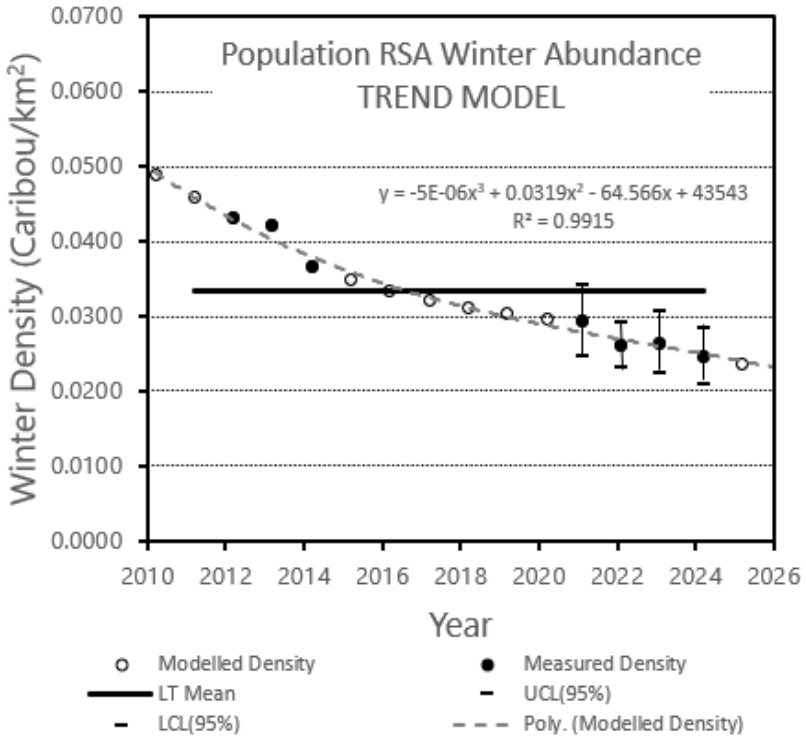
SPRINGPOLE GOLD PROJECT

Caribou-Moose-Wolf relative density kernels, 2024.

PROJECT N°: ONS2104 | **FIGURE: 6.13-26**

SCALE: 1:1,550,000 | DATE: July 2024

Figure 6.13-27: Boreal Caribou Population Trend



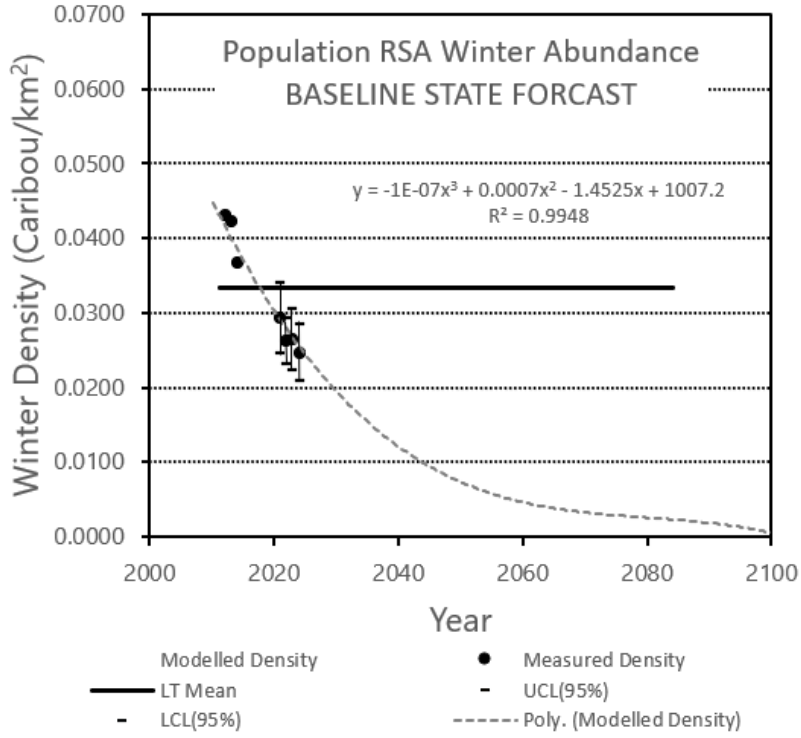


Figure 6.13-28: Boreal Caribou Population Forecast models for all Project alternatives at RSA scales