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Blackwater Grizzly Bear and Moose Habitat Suitability Modelling Assessment Report

BW Gold

23 December 2021

LAYPERSON SUMMARY

The Blackwater Gold Project is a gold and silver mine held by Artemis Gold Inc., southwest of Vanderhoof British Columbia (BC). The Project has an Environmental Assessment Certificate but has not yet begun construction. Field studies to assess potential impacts to wildlife were conducted during the Environmental Assessment (EA) in 2012-2013 and 2017. As part of the EA, habitat suitability maps were made to understand the habitat quality on and surrounding the mine site. Field surveys were conducted in 2021 to test the accuracy of these models; surveys included field plots using standardized provincial survey methods.

Generally, the ratings from the field were not similar for the subset of the model ratings from the EA. Differences in ratings were noticed for grizzly bear denning habitat in a western portion of the mine site, which has high quality grizzly bear denning sites that were not indicated on suitability maps. For moose, the original models did not differentiate between spring, summer and fall and rated cumulatively for the growing season; updated models for these seasons need to be created, with the anticipation that most areas are low to moderate suitability. Additionally, wetlands throughout the Project Site require updates to improve accuracy of wetland types and extents.

For both moose and grizzly bear, the comparisons of field and modelling data were also used to assess the existing mitigations from the Wildlife Mitigation and Monitoring Plan (WMMP) and the Master Mitigation Table (Appendix A). The grizzly bear denning area, identified from Traditional Knowledge and field studies in the west of the mine site (northwest side of Mt. Davidson) will be avoided during the denning period and monitored by remote camera to detect wildlife activity during the construction period. The area will either be maintained in its current state (avoidance), or will be cleared outside of the sensitive denning period and restored and reclaimed at the end of the mine life. Mitigation updates for details of the bear denning area will be included in the next draft of the WMMP in early 2022 and provided to Environment and Climate Change Canada, The Agency, and Aboriginal Groups prior to the beginning of Project construction.

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The habitat suitability maps will be updated during spring 2022 to include more accurate wetlands mapping and moose spring and fall suitability will be used to target locations where mitigations will be applied. Applicable areas (with a moderately high suitability rating or higher) will be noted for avoidance during sensitive seasons, i.e. clearing and construction work will be avoided in these areas and time periods. If work is required, pre-clearing surveys are conducted for sensitive features such as bear dens, and employee training and awareness programs include notices for using caution when working in these areas to avoid human-wildlife interactions.

The updated habitat suitability maps and details for implementing these mitigations will be incorporated into the Wildlife Mitigation and Monitoring Plan (WMMP) and provided to stakeholders prior to the start of Project construction during Q1 of 2022.

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1. INTRODUCTION

The Blackwater Gold Project (the Project) is a gold and silver open pit mine located in central British Columbia (BC), approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver. New Gold Inc. (New Gold) received Environmental Assessment Certificate (EAC) #M19-01 on June 21, 2019 under the 2002 *Environmental Assessment Act* (BC EAO 2019c) and a Decision Statement (DS) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2019). In August 2020, Artemis Gold Inc. (Artemis) acquired the mineral tenures, assets and rights in the Blackwater Project that were previously held by New Gold Inc.

Baseline field studies prior to the EAC were conducted in 2012-2013 and 2017. Habitat suitability models (HSM) for moose and grizzly bear were created and included in the Environmental Impact Statement (EIS)/Application. These models developed habitat ratings across the Project Site for each species by season, based on ecosystem abiotic and biotic attributes and background information on grizzly bear and moose populations. Applying these maps in the EIS/Application provided identification of suitable locations for wildlife and insight to how species populations may be affected by habitat loss or altercation. Models were created following the Resources Information Standard Committee (RISC) defined *Wildlife Habitat Rating Standards* (RISC 1999).

Additional wildlife field studies were conducted in 2021 to fulfil provincial condition 23.d to the existing moose and grizzly bear habitat suitability models, update those models and propose new mitigations if warranted.

1.1 Project Condition

The EAC condition 23.d specifies requirements for updates of moose and grizzly bear information within the Wildlife Mitigation and Monitoring Plan (WMMP), and developed as a report showing:

EAC Condition		Concordance
"23.d) the means by which information from the habitat suitability mapping for the Project Site will be confirmed or updated for the use of the Project Site by grizzly bears and moose prior to Construction at the Project Site, and in consultation with Aboriginal Groups. This must include:		This report evaluates the habitat suitability for moose and bears and describes next steps to update the mapping and mitigation measures.
	i) consideration of habitat identified through the Terrestrial Ecosystem Mapping of the Project Site contained in the Application and identification of the habitat types requiring further assessment;	Sections 2.1 and 2.2
	ii) identification of methods to be used to acquire the information, including consideration of applicable Resources Information Standards Committee guidance documents and other information made available to the Holder;	Section 2.1
	iii) the role of Aboriginal Group monitors or members of Aboriginal Groups in gathering the information;	Section 2.1
	iv) after the information is gathered, an assessment of the adequacy of the mitigation measures proposed in the Mitigations Table required under Condition 43 in addressing the effects of the Project, in light of the new information gathered;	Sections 3.1.2 and 3.2.2
	v) if the assessment indicates that additional mitigation is required, the development of new or additional mitigations in a manner consistent with the BC EMP, and documentation of how the BC EMP was applied;	Section 4

	vi) how the effectiveness of the mitigation measures identified in paragraphs iv) and v) will be monitored; and	Section 4
	vii) the development of a technical report and a report for a lay audience that documents the activities and outcomes required under paragraphs d)i) to vi). The report must be provided to Aboriginal Groups at least 60 days prior to the start of Construction at the Project Site"	This report

The information in this report is considered part of the 2021 pre-construction baseline study, and will provide mitigation and management recommendations to be incorporated into the WMMP prior to construction.

1.2 Objectives

The objectives for the moose and bear habitat suitability report are:

- Identify portions of the Project Site with moose and grizzly bear habitat which are not adequately captured by HSMs developed during the EA.
- Describe the necessary updates to better account for suitable moose and grizzly bear habitat in the Project Site, to be incorporated in the WMMP.
- Assess and update mitigation measures for grizzly bear and moose, to be incorporated in the WMMP.

2. METHODS

Field verification surveys were conducted to identify areas of the Project Site (mine site, mine access roads, freshwater supply pipeline, and airstrip, as defined in the EAC) in need of further assessment for moose and grizzly bear suitability. These data were then used to assess gaps in the existing habitat suitability models using ArcMap spatial analysis and geoprocessing extensions to overlay and compare 2015 model results with 2021 field data.

2.1 Field Surveys

Survey locations were stratified across the Biogeoclimatic units in the Project Site (Figure 2.1-1). Terrestrial Ecosystem Mapping (TEM) was conducted for the EIS/Application and is being updated in 2021 and 2022. Field surveys for TEM were conducted on the mine site in summer 2021 following standard provincial field survey methods. Aerial photography was taken in August, September, and October 2021, but was hampered by thick smoke from forest fires and low cloud. Aerial imagery is scheduled to be flown again in spring 2022.

The Project Site falls within the Engelmann Spruce Subalpine Fir (ESSF) and Sub-boreal Spruce (SBS) Biogeoclimatic units (Figure 2.1-1). The majority of the mine site falls within the ESSF mv1 unit, with areas of parkland at higher elevation in ESSF mvp and ESSF xvp1. The SBS units occur across lower elevation portions of the Project Site such as the access road, including mostly SBS mc3, with less SBS mc2 and SBS dk (Figure 2.1-1).

Field verification surveys for habitat suitability were conducted from June 8 – June 19, 2021 along the Project Site and transmission line areas. Field survey protocols followed the *Wildlife Habitat Rating Standards* (RISC 1999; EAC condition 23d.ii). Surveys were conducted by a Qualified Professional and an Indigenous land user. Survey teams included representatives from Ulkatcho First Nation and Lhoosk'uz Dené Nation.

Survey locations were assessed for abiotic and biotic ecosystem variables, and rated for moose and grizzly bear habitat suitability using a six-class system from nil to very high. Habitat ratings were further refined in the field based on the plot-in-context, distance to species specific habitat features, and distance to disturbance.

Both species were rated on four season models (spring, summer, fall, winter). Wildlife sign was also recorded at each site to document relative level of use of the site.

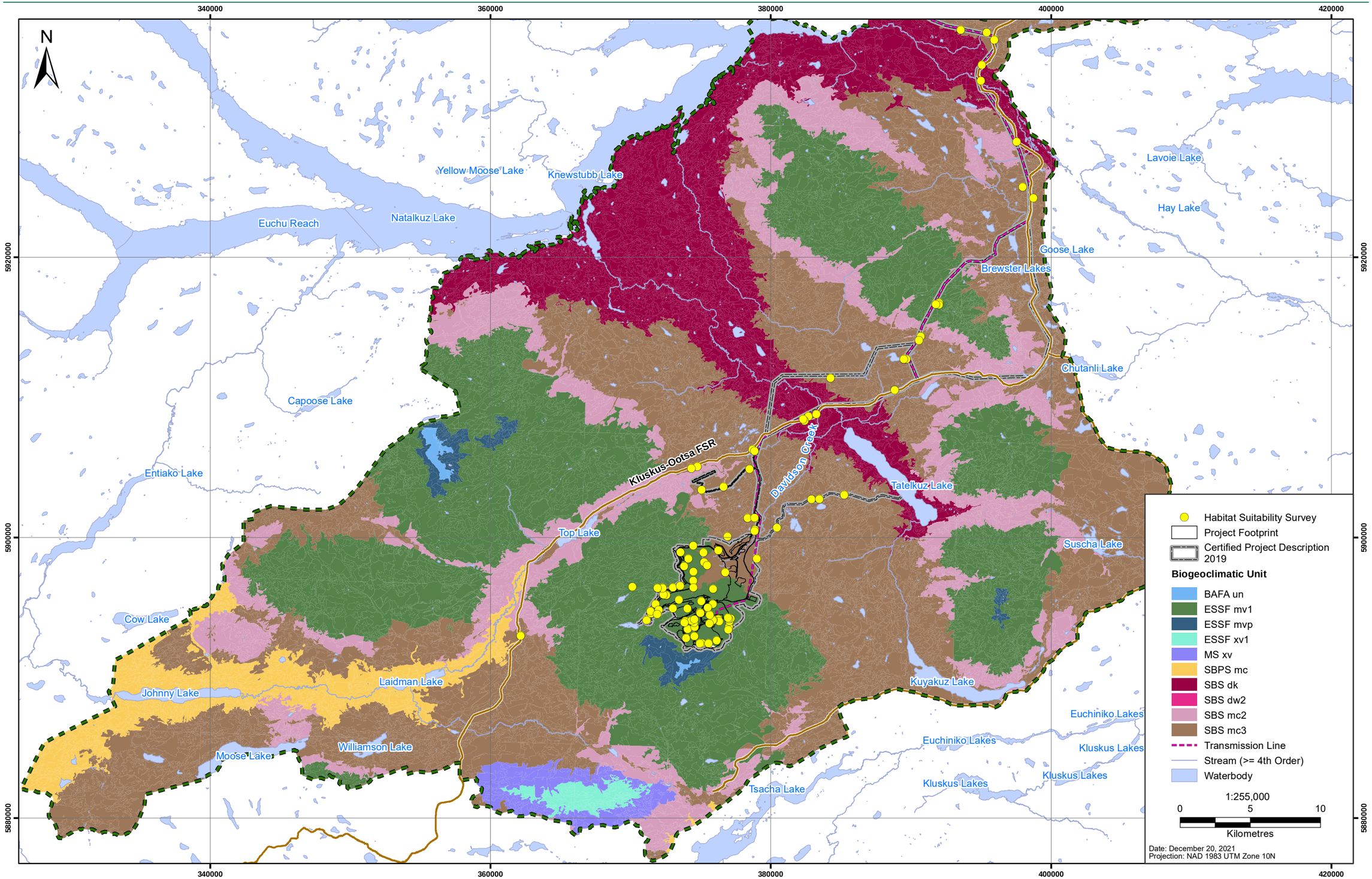


Figure 2.1-1: Habitat Suitability Field Survey Locations (2021) across Biogeoclimatic Units in the Project Site

2.2 Model Assessment

Spatial inventories of wildlife habitat are developed through the interpretation of data derived from ecosystem maps, other biophysical information considered important for grizzly bears and moose, such as slope, aspect, and distance to disturbance. Mapping wildlife habitat identifies areas that contain suitable habitat, provides a basis to evaluate the effects of development on wildlife habitat, and allows for the potential loss or alteration of these habitats to be placed into a local and regional context.

The current models for grizzly bear and moose were assessed compared to field surveys conducted in 2021 to determine the adequacy of the maps. For grizzly bear, Food (FD) habitat rating was assessed in Fall, and Security Habitat (SH) and Thermal Habitat (TH) suitability were assessed in Winter. For moose, FD, SH and TH plot types were assessed in the winter season. These are very important habitats for these species and were the most comparable of the two data-sets.

The 2021 field mapping results were extracted from an excel database and reformatted to match the 2015 data attributes. This database was imported into ArcMap. Model polygons that contained the 2021 plots were extracted and both the 2015 and 2021 data sets were attributed to the polygon subset. The attributes were exported to excel and analysed. The comparable data was then summarized and the differences in ratings calculated.

3. RESULTS

3.1 Grizzly Bear

3.1.1 Bear Habitat Models

The EIS/Application baseline studies did not directly survey the grizzly bear population due to low grizzly bear densities in the Project and regional areas of the grizzly bear population units. Instead, reconnaissance surveys for dens and signs, wildlife cameras and incidental detections across the Project area were used to determine baseline presence and distribution of grizzly bears. Documentation of important habitat within the Local Study Area (LSA) was done using TEM surveys, and validation of developed habitat suitability ratings for grizzly bears were done in the Regional Study Area (RSA) using Predictive Ecosystem Mapping (PEM).

Through the TEM and PEM a variety of ecosystem types were identified and were each assigned habitat ratings that represent habitat quality and effectiveness related to mine infrastructure. The quantitative rating of the of the identified ecosystem types were based on current habitat values across life history stages and season for grizzly bears that are consistent with similar models that have been used, tested, and assessed across BC through population estimates and research.

Habitat ratings were assigned in a six-class system in four seasons (spring, summer, late summer/fall, and winter denning) with life requisites for feeding, security, and thermal habitats.

3.1.1.1 Spring

Grizzly bear spring habitat is rated moderate to very low in the Project Site (Figure 3.1-1). Portions of moderately high suitability are located north of the mine access road (intersecting the proposed transmission line route), between Chedakuz and Davidson creeks and on the west end of Tatelkuz lake. The most suitable areas are typically wetlands or avalanches tracts which provide early-sprouting spring vegetation or bulbs for grizzly bears to forage after emerging from hibernation.

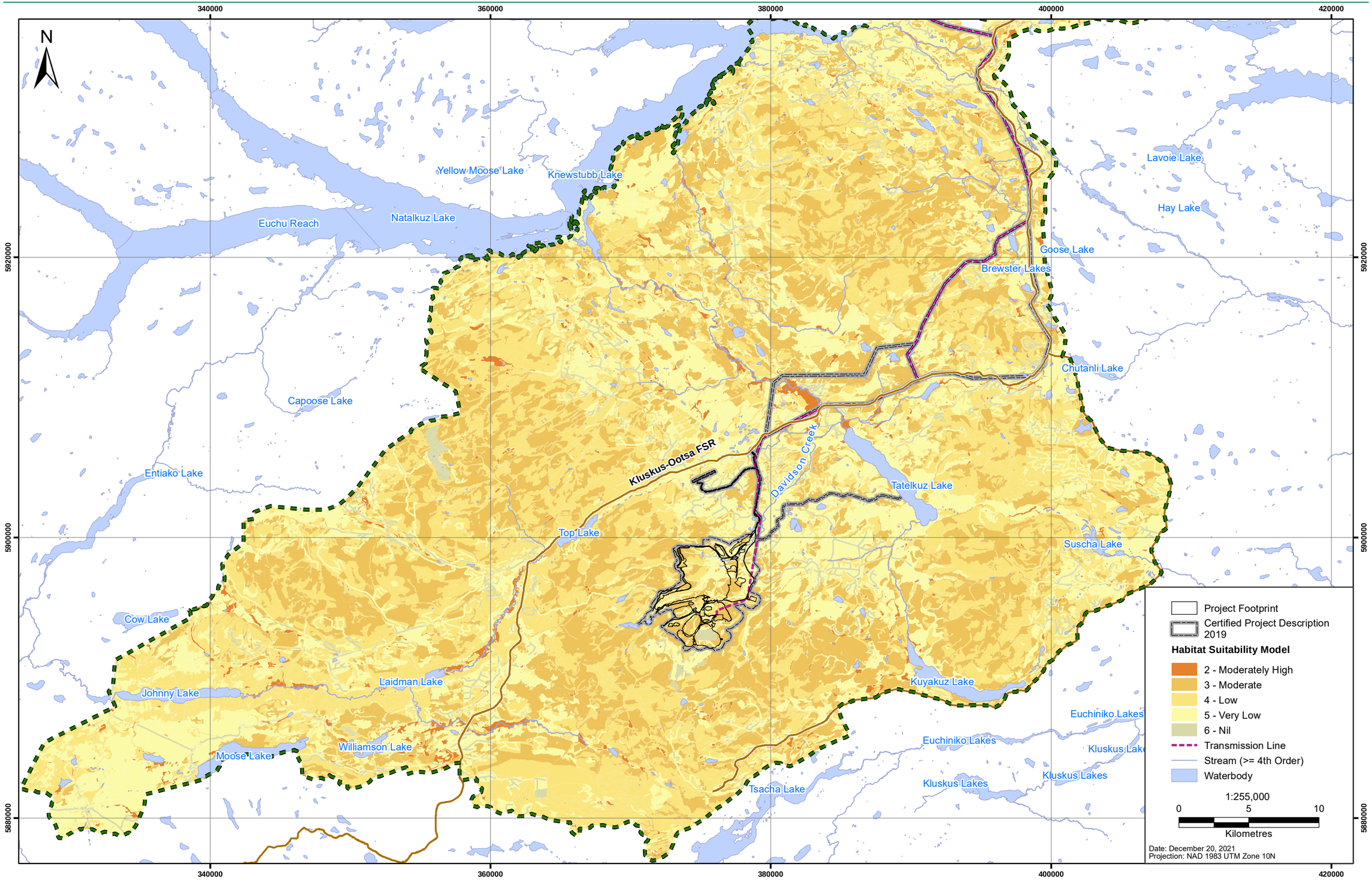


Figure 3.1-1: Grizzly Bear Spring Habitat Suitability Rating (EA)

3.1.1.2 Summer

Summer habitat for grizzly bear is rated primarily as moderate throughout the Project Site, with smaller portions of habitat rated from very low to moderately high (Figure 3.1-2). The airstrip is the only Project Site components which intersect moderately high rated summer habitat areas, though the RSA contains moderately high rated habitat along waterbodies and waterways, and mid-elevation slopes.

3.1.1.3 Fall

Grizzly bear fall habitat suitability is rated as moderate throughout the majority of the Project Site (Figure 3.1-3). The mine site, airstrip, and access road intersect with portions of moderately high rated fall habitat; these occur primarily along mid to higher elevation slopes and wetland habitats, including a small portion in the northwest of the mine site. The RSA includes a greater amount of moderate to moderately high rated grizzly bear habitat compared to other seasons, with moderately high rated habitat in mid to higher elevation sections throughout the RSA.

3.1.1.4 Winter Denning

Habitat suitability for grizzly bear winter denning varies from nil to moderately high in the Project Site. The mine site is primarily rated moderate to moderately high, but falls to very low suitability along the northeast portion of the mine site and through the fresh water pipeline, the airstrip, and the access road. Suitable grizzly bear denning habitat is associated with well drained slopes along higher elevation alpine, subalpine, and montane habitats.

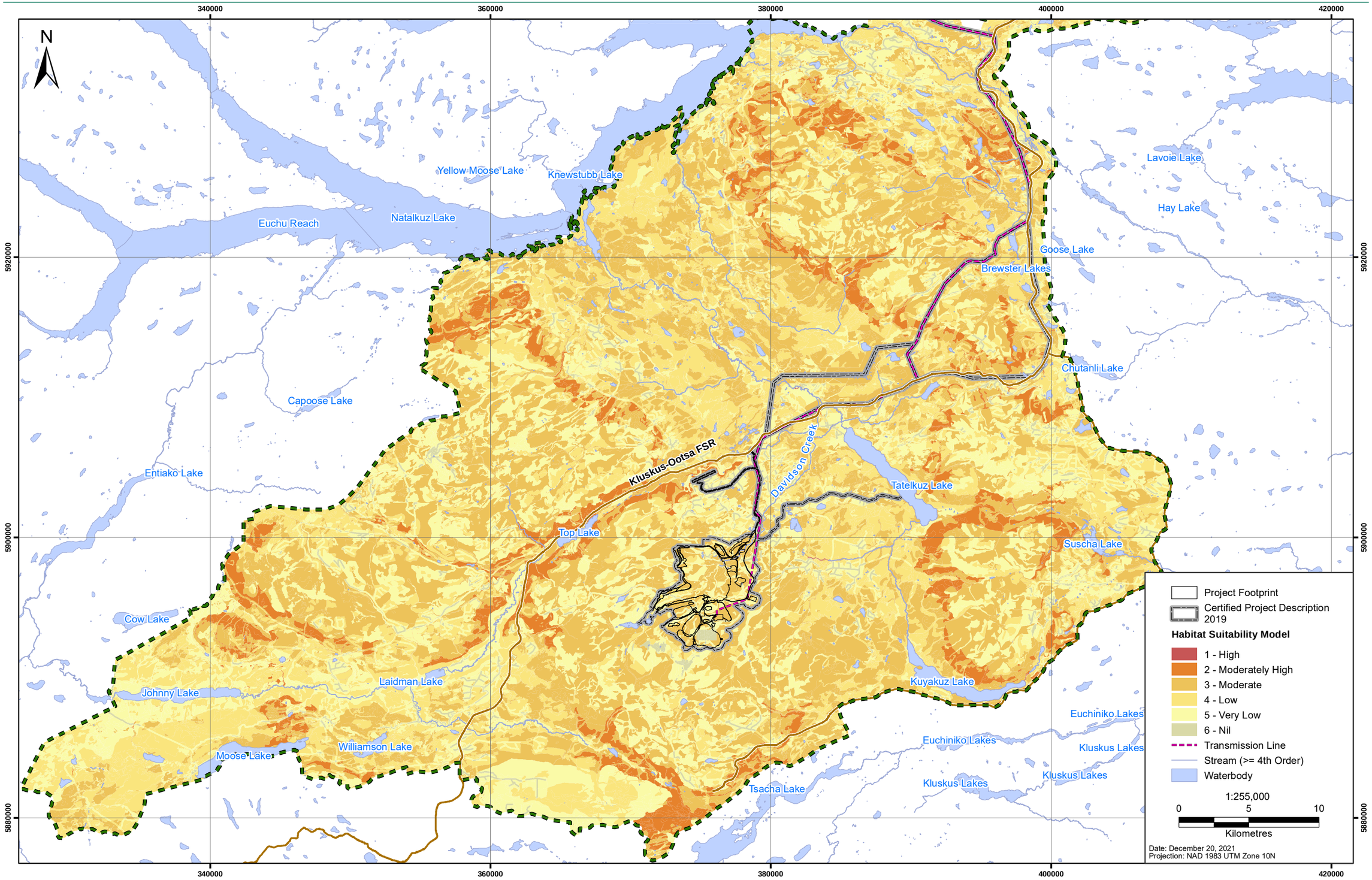


Figure 3.1-2: Grizzly Bear Summer Habitat Suitability Rating (EA)

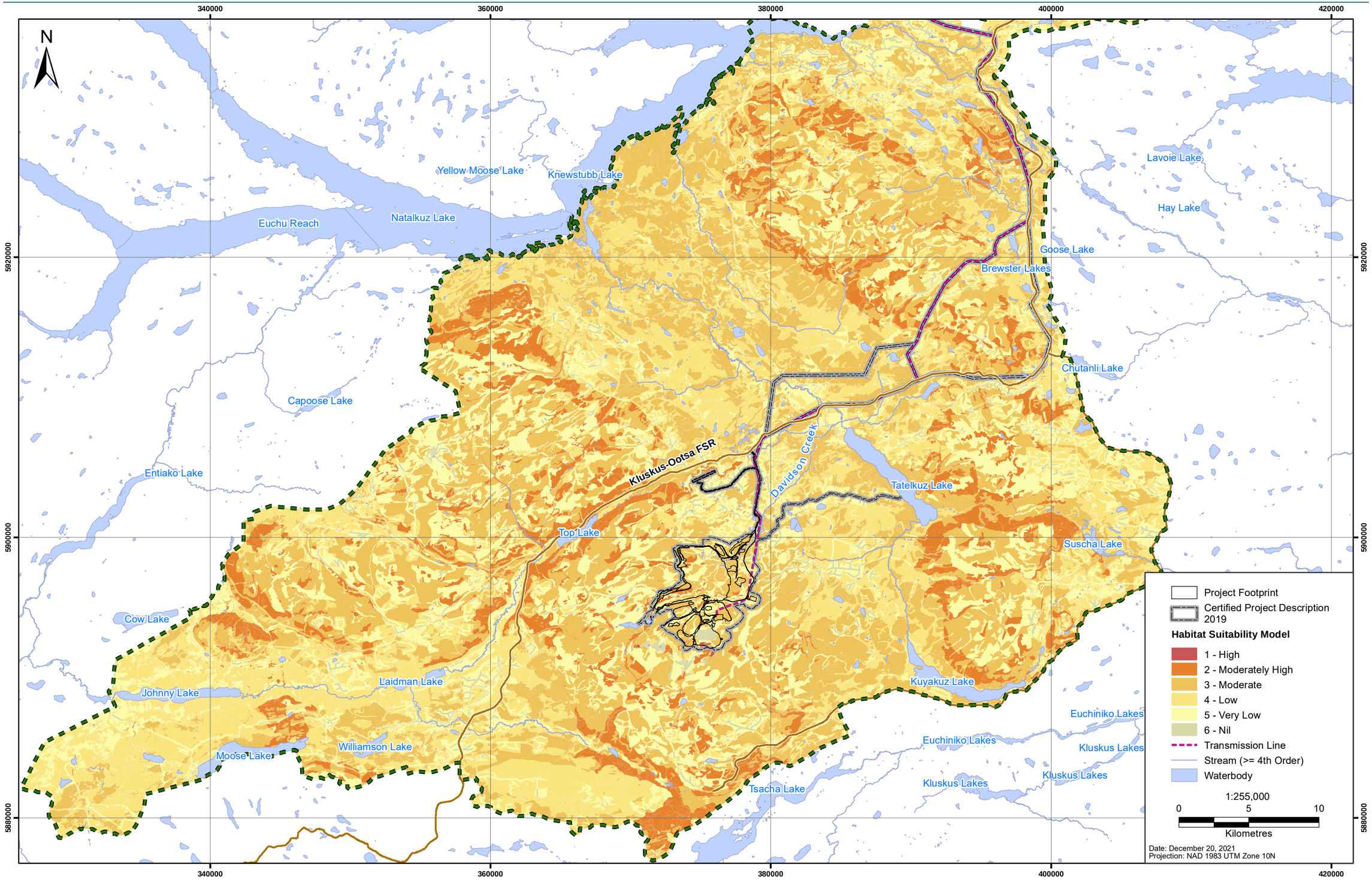


Figure 3.1-3: Grizzly Bear Fall Habitat Suitability Rating (EA)

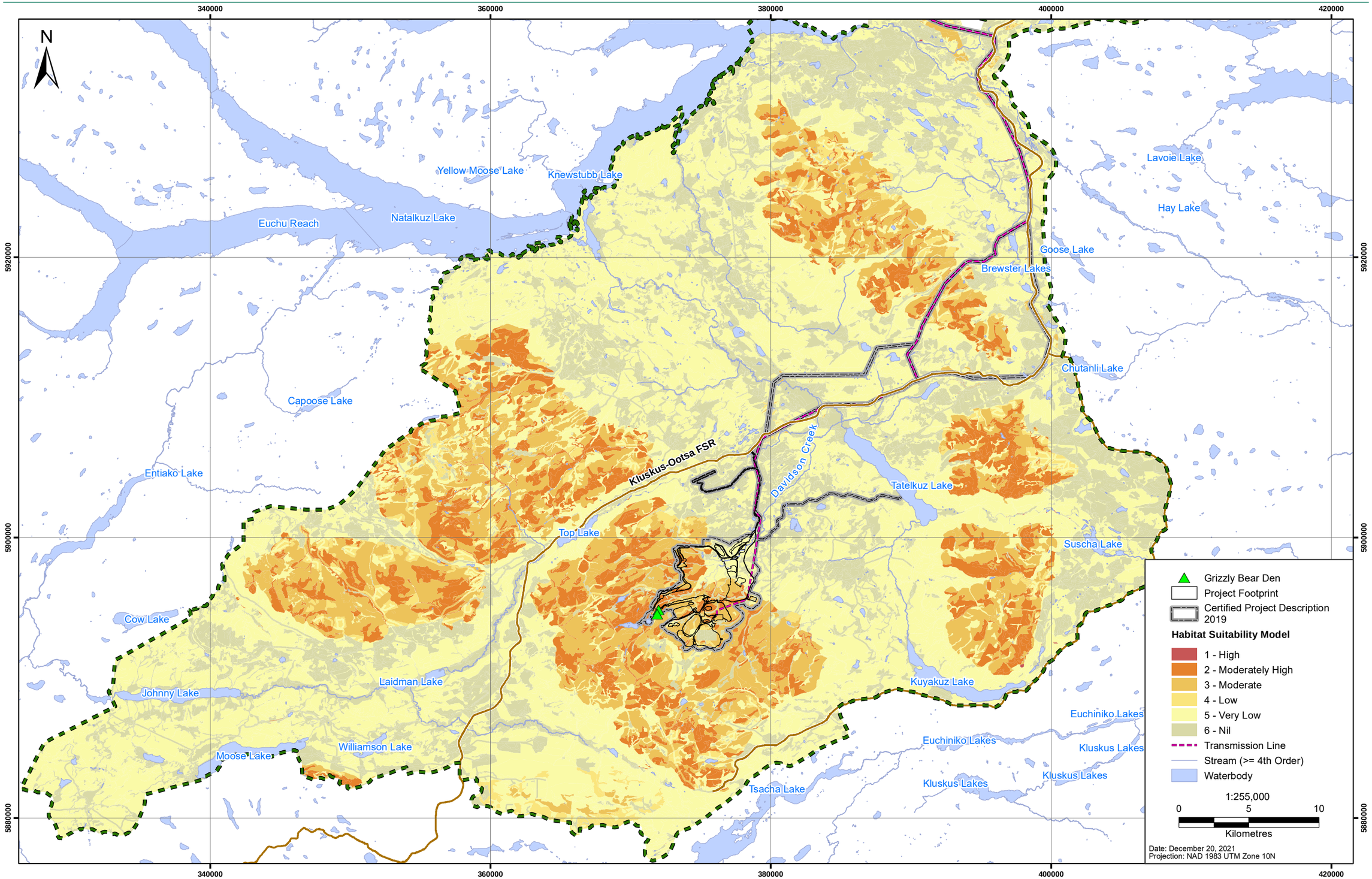


Figure 3.1-4: Grizzly Bear Winter Denning Habitat Suitability Rating (EA)

3.1.2 Assessment of the Bear Habitat Models

The assessment of grizzly bear habitat models found two inconsistencies:

- Habitat values in the mapping were generally both over-rated and under-rated compared to 2021 field values; and
- Field surveys reported an area of very high quality bear denning habitat that was not captured in the HSM.

3.1.2.1 Habitat Ratings

The grizzly bear habitat model accuracy assessments found that more than half of the modelled polygons were assessed lower in value and almost 25% were assessed as higher in value than the 2021 field assessment results. Twelve of the 97 polygons assessed were valued equally (Table 3.1-1).

These results are likely due to the ecosystem mapping that provided the base for the suitability mapping and not the model itself. The habitat models are based on TEM and PEM, and other factors derived from digital elevation models, trim and current infrastructure mapping. PEM in particular does not accurately map many habitat features that indicate habitat suitability, such as terrain. The 2021 field plots were all ground based and because of this the results are more accurate.

Table 3.1-1. 2015 and 2021 Habitat Ratings Comparison for Grizzly Bear

Plot Type_Season	SH_W	TH_W	FD_F
Total Number plots where 2015 HSR = 2021 HSR	**12**	**12**	**12**
2015 HSR 1 value point less than 2021	13	13	13
2015 HSR 2 value points less than 2021	14	14	14
2015 HSR 3 value points less than 2021	15	15	15
2015 HSR 4 value points less than 2021	16	16	16
Total Number plots where HSR for 2015 is lower than 2021	**58**	**58**	**58**
2015 HSR 1 value point more than 2021	18	18	18
2015 HSR 2 value points more than 2021	2	2	2
2015 HSR 3 value points more than 2021	3	3	3
2015 HSR 4 value points more than 2021	4	4	4
Total Number plots where HSR for is higher than 2021	**27**	**27**	**27**
Total Number of plots	97	97	97

SH: Security Habitat, TH: Thermal Habitat, FD: Food; W: Winter Season, F: Fall Season

3.1.2.2 Bear Denning Area

The EAC/Application included Traditional Knowledge (TK) about grizzly bear denning that was not captured in the habitat suitability models for winter/denning:

> *"According to Lhoosk'uz Dene representatives, grizzly bears may use the hillsides of Mount Davidson for denning, particularly the western sides (Lhoosk'z Dene trapline holder pers. comm., 2013)."*

Field surveys in 2012 reported 2 grizzly bear dens in an area on the northwest side of Mt. Davidson in a boulder field (Photo 3.1-1).

Likewise, field surveys in 2021 identified 2 additional grizzly bear dens in the same area, in the boulder field to the northwest of Mt. Davidson (Photos 3.1-2 and 3.1-3).

This boulder field, identified by TK, supports 100% of the grizzly bear dens that have been reported during field studies. However, the boulder field is not represented on terrestrial maps or habitat maps for the winter/denning period.



Photo 3.1-1 Grizzly bear den recorded on the north-west side of Mt. Davidson, 2012.

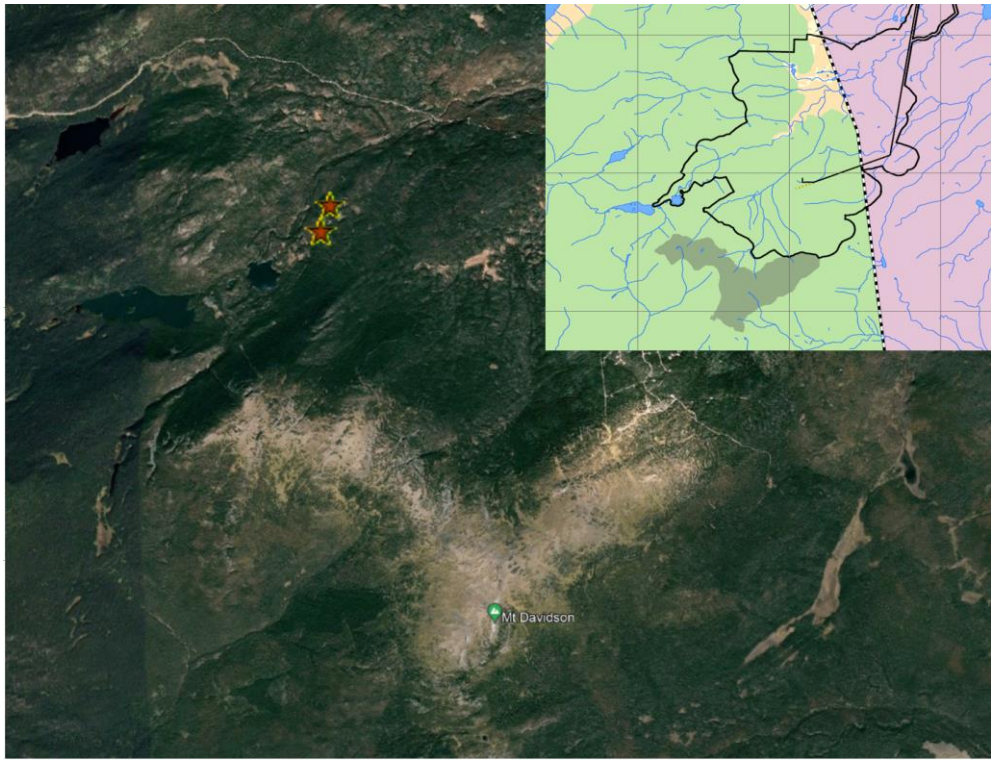


Photo 3.1-2 Field map of grizzly bear dens recorded on the northwest side of Mt. Davidson, 2021. Inset is project footprint.



Photo 3.1-3 Grizzly bear den recorded on the northwest side of Mt. Davidson, 2021.



Photo 3.1-4 Detail of Grizzly bear den recorded on the northwest side of Mt. Davidson, 2021.

3.1.3 Mitigation Assessment

The EIS/Application used habitat suitability information to assess the potential Project impacts on grizzly bears; a quantitative approach was used to determine potential habitat loss and alteration within the regional study area and a qualitative approach was used to assess increase in mortality risk within the grizzly bear population unit. Road densities and the cumulative impacts from mountain pine beetle, forestry, and wildfires were assessed as qualitative measures of mortality rate and population changes. The EIS/Application predicted potential Project effects for habitat loss and mortality (vehicle collisions).

Mitigations for grizzly bear are described in the Wildlife Mitigation and Monitoring Plan (WMMP) and incorporate all measures all measures listed in BW Gold's Mitigation Table, which addresses EAC Condition 43 and was approved by the EAO in November 2020 (Appendix A). The majority of mitigation measures for grizzly bears are shared with other wildlife species through minimization of Project effects, such as implementing employee training and awareness programs, establishing a wildlife sightings reporting system, maintaining conservative speed limits on Project roads and establishing right of way protocols to protect wildlife near roads, waste management protocols to reduce potential wildlife attraction, and protocols for avoiding or reclaiming sensitive habitat features. The full list of mitigation measures for grizzly bear are defined in the WMMP.

Key mitigations specific to grizzly bear are listed in the WMMP (Section 3) including:

- Avoid construction during the sensitive period from October 1 – March 31 (WMMP Section 3.3, MFLNRO 2014).
    - If construction cannot be avoided during the sensitive period, pre-construction surveys will be conducted for grizzly bear denning habitat. All probable denning sites will be marked with an appropriate buffer, determined by a Qualified Professional based on the activity taking place and site-specific characteristics.
- Use caution and where possible avoid work in highly suitable grizzly bear habitats according to the corresponding season (e.g., avoid salmon-spawning streams in fall) (WMMP Section 4.6.2).
    - Maintain sufficient distance from bears so as not to disrupt their activities (MFLNRO 2014) (WMMP Section 4.6.2).
- Monitor key grizzly bear areas with wildlife cameras to confirm effectiveness of mitigation measures: kokanee salmon spawning streams, and known bear denning areas and den sites found during pre-clearing surveys (WMMP Section 4.6.3).
- In addition to general employee training regarding wildlife, implement a Bear Awareness Program, including notification and response procedures.

These mitigations generally incorporate the entire Project Site and all work areas, but habitat suitability modelling can help guide areas requiring heightened caution or avoidance according to each season.

Field verification of grizzly bear HSMs indicated that the models underestimate the denning habitat in the project area, with more than half of the verification assessment polygons rated lower than the field verification assessments for this life requisite (EAC Condition 23d.iv). Both Traditional Knowledge and field surveys identified an area on the northwest face of Mt. Davidson where grizzly bears preferentially den. This large boulder field is not represented on terrestrial mapping or habitat suitability mapping for winter/denning. This area of grizzly bear denning is on the southwest edge of the project footprint.

To address this denning area, the terrestrial mapping and habitat mapping will be updated and the boulder field/denning area will be added to the next version of the WMMP in Q1 2022 prior to Project construction. Specific mitigation will also be added to the WMMP for this area. The area will either be maintained in its current state (avoidance), or will be cleared outside of the sensitive denning period (minimization) and restored and reclaimed at the end of the mine life, following the BC *Environmental Mitigation Procedures* (BC MOE 2014; EAC Condition 23d.v).

3.2 Moose

3.2.1 Moose Habitat Models

Development of moose HSMs for the EIS/Application were very similar to methods for grizzly bear; documentation of important habitat were done using a combination of TEM and PEM data. Ecosystem types were assigned habitat ratings that represent habitat quality and effectiveness related to mine infrastructure. Additionally, winter ungulate surveys across the project area were used to determine baseline presence and distribution of moose. The quantitative rating of the of the identified TEM and PEM ecosystem types were based on habitat values across life history stages and season for moose that are consistent with similar models that have been used, tested, and assessed across BC through population estimates and research.

Habitat suitability modelling was completed for the growing and winter season, with a six-class rating system including life requisites for feeding, security, and thermal. The growing season is less limiting for moose when compared to the winter season, with more availability of high quality feeding habitats and lower stress on appropriate thermal cover compared to winter.

3.2.1.1 Spring

Existing habitat suitability modelling from the EIS/Application includes a two-season model for moose, rather than a four-season model, and therefore does not include moose spring habitat. Spring moose habitat suitability mapping will be added as part of pre-construction baseline study during Q1 2022.

Highly suitable moose spring habitat includes wetland habitats and areas with early growing sedges/forbes and deciduous growth such as willows and alders. The majority of the Project Site is in higher elevations which do not host many of these productive spring wetlands. Suitability for moose spring habitat is therefore anticipated to be low or moderate throughout most of the Project Site.

3.2.1.2 Summer

Moose summer habitat is rated primarily as moderate throughout the mine site, but is low to very low throughout the other portions of the Project Site (waterline, airstrip, and access road). Portions of habitat rated moderately high are scattered in the RSA, surrounding larger wetlands and waterways such as Fawnie Creek and Chedakuz Creek.

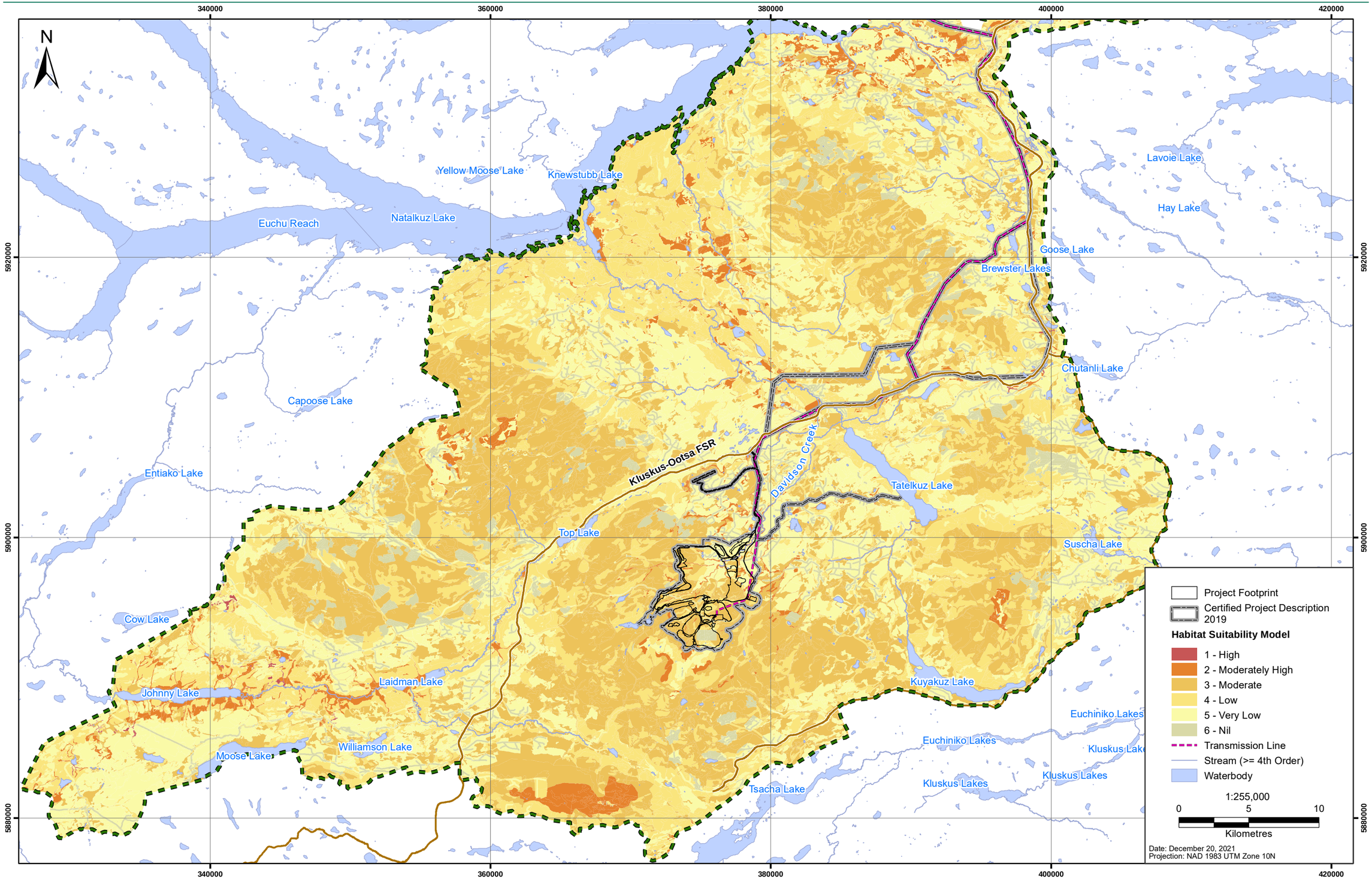


Figure 3.2-1: Moose Growing Season (Summer) Habitat Suitability Rating (EA)

3.2.1.3 Fall

Existing habitat suitability modelling from the EIS/Application includes a two-season model for moose, rather than a four-season model, and therefore does not include moose fall habitat. Fall moose habitat suitability mapping will be added as part of pre-construction baseline study.

Highly suitable moose fall habitat includes forested areas bordering openings with abundant deciduous vegetation such as willows and alder. Given the higher elevations across the Project Site, suitability for moose fall habitat is anticipated to be moderate throughout most of the area.

3.2.1.4 Winter

The Project Site mostly encompasses low to moderate rated winter habitat for moose; the access road, airstrip, and waterline cover low or very low rated habitat, while the mine site is a mix of low to moderate. One portion in the north of the mine site and near the access road is rated moderately high for winter moose. The RSA is overall low suitability for winter moose habitat, with small portions of moderately high habitat, including just east of the mine site and in the north and west at Fawnie and Chedakuz creeks.

3.2.2 Assessment of Moose Habitat Models

The assessment of the moose habitat models found two inconsistencies:

- The moose models in the EIS/Application used two seasons (winter and growing). Moose habitat requirements are well known in BC, making the four season approach (spring, summer, fall and winter) standard. Four season models therefore allow data to be compared across the province; and
- The TEM generally over-reports the area of wetlands, and therefore of high quality growing season values.

3.2.2.1 Habitat Ratings

The moose habitat model accuracy assessments found that more than half of the modelled polygons compared were assessed higher in value and almost 25% were assessed as lower in value than the 2021 field assessment results. Ten of the 105 polygons assessed were valued equally (Table 3.2-1).

These results are likely due to the ecosystem mapping (TEM and PEM) that provided the base for the suitability mapping and not the model itself. Additionally, the wetlands were overestimated for the area and in turn increased the suitability of habitat for moose. The 2021 field plots were all ground based and because of this the results are more accurate.

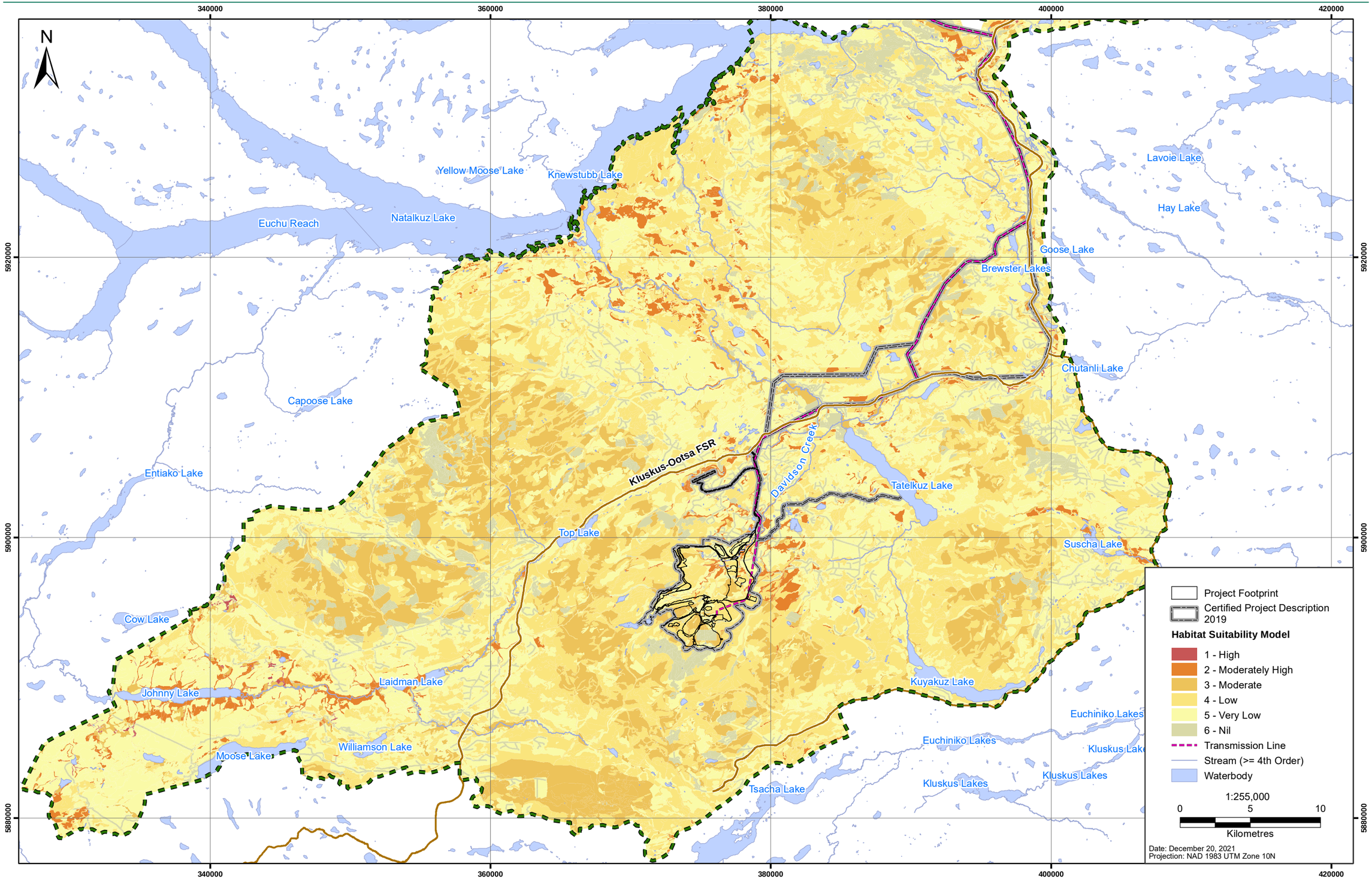


Figure 3.2-2: Moose Winter Season Habitat Suitability Rating (EA)

Table 3.2-2. 2015 and 2021 Habitat Ratings Comparison for Moose

Plot Type_Season	FD_W	SH_W	TH_W
Total Number plots where 2015 HSR = 2021 HSR	**10**	**10**	**10**
2015 HSR 1 value point less than 2021	11	11	11
2015 HSR 2 value points less than 2021	1	1	1
2015 HSR 3 value points less than 2021	1	1	1
2015 HSR 4 value points less than 2021	14	14	14
Total Number plots where HSR for 2015 is lower than 2021	**27**	**27**	**27**
2015 HSR 1 value point more than 2021	14	14	14
2015 HSR 2 value points more than 2021	17	17	17
2015 HSR 3 value points more than 2021	18	18	18
2015 HSR 4 value points more than 2021	19	19	19
Total Number plots where HSR for is higher than 2021	**68**	**68**	**68**
Total Number of plots	105	105	105

SH: Security Habitat, TH: Thermal Habitat, FD: Food; W: Winter Season

3.2.2.2 Two Season Models

The moose models in the EIS/Application used only two seasons (winter and growing). Moose habitat requirements are well known in BC, therefore a four season approach (spring, summer, fall and winter) is typically applied. To better represent moose use of the mine site and RSA, the models should be updated to a four season approach.

3.2.2.3 Wetland Mapping

The EIS/Application used TEM to identify wetlands in the mine site. This type of mapping can include up to three habitat types in each habitat polygon. The percent cover of each habitat type is given as a "decile" from 1 to 10 (10% to 100%) of the polygon.

When mapping the growing season (spring, summer, and fall) for moose, higher quality habitat included whether wetlands were present or not in a polygon. This likely over-estimated the amount of high quality habitat for moose during the growing season.

3.2.3 Mitigation Assessment

The EIS/Application used habitat suitability information to assess the potential project impacts on moose; a quantitative approach was used to determine potential habitat loss and alteration within the regional study area and a qualitative approach was used to assess increase in mortality risk, changes in movement patterns, and changes in population dynamics. The EIS/Application predicted potential Project effects for habitat loss, change in movement patterns, and mortality (vehicle collisions).

Mitigations for moose are described in the Wildlife Mitigation and Monitoring Plan (WMMP) and incorporate all measures listed in BW Gold's Mitigation Table, which addresses EAC Condition 43 (Appendix A). The majority of mitigation measures for moose are shared with other wildlife species through minimization of Project effects, such as implementing employee training and awareness programs, a wildlife sightings reporting system, conservative speed limits on Project roads, right of way protocols to protect wildlife near roads, and a no hunting policy. The key mitigations which are specific to moose include (WMMP Section 4.4.2):

- Avoiding specific moose habitat features, such as salt licks. This is enacted through documenting known salt licks (via field surveys and observations from Qualified Professionals, and the employee incidental sightings reporting program) and

implementing buffers to functionally retain salt licks for moose and other ungulates (WMMP Section 4.4.2);

- Minimizing new access for harvesters and wolves along roads by limiting sightlines along new access roads (e.g., curving the road, allowing roadside vegetation to grow up, and limiting the width of the cleared right of way), where allowable for the safe operation of the road (WMMP Section 4.4.2); and
- Minimizing the potential for moose-vehicle collisions through management of traffic and vehicle access, management of wildlife activity on and near roads, and management of road conditions to prevent wildlife attraction (WMMP Section 3.6).
- Monitoring the moose population via winter surveys, in order to detect potential changes in distribution or population levels (WMMP Section 4.4.3).

These mitigations generally incorporate the entire Project Site and all work areas, but habitat suitability modelling can help guide areas requiring heightened caution or avoidance according to each season, and prioritize areas for reclamation. Adding spring, summer and fall HSMs for moose will help refine the guidance for these areas across the year. Field verification of moose HSMs indicated that habitat for this species is likely over estimated for the growing season in wetland habitats, and the cumulative season approach may underestimate important seasonal habitats used for food, security and thermal requisites (EAC condition 23d.iv).

The Construction Environmental Management Plan (CEMP) should include the updated areas of wetlands so that clearing mitigations can be focused in those areas. The employee awareness program will include notice of these higher suitability areas during the appropriate season, and areas near roadways or other work sites will have signage posted.

4. NEXT STEPS

The analysis in this document concludes that the existing habitat suitability models could be improved for moose and grizzly bear on the Project Site.

Updated habitat mapping is planned for the mine site based on new TEM data collected in 2021-2022. This will include:

- Updating the wetland mapping on the mine site in the TEM;
- Updating the grizzly bear mapping to include the boulder field/denning area on the north-west side of Mt. Davidson;
- Updating the moose models to include four seasons; and
- Updating the moose models to include the updated wetland mapping.

The Wildlife Mitigation and Monitoring Plan (WMMP) will be updated in Q1 2022 to include:

- The maps of the boulder field/denning area on the north-west side of Mt. Davidson;
- Specific mitigation for the boulder field/denning area in Q1 2022, including:
  - Physical avoidance, if possible.
  - Temporal avoidance during the denning period.
  - Mitigation to reduce disturbance during the denning period (i.e., established buffer zones, employee training/awareness).

  - Monitoring using cameras of identified den locations.
- Maps of wetland areas to highlight the mitigation for both grizzly bear and moose in these high quality habitats.

Mapping updates involving TEM will be implemented in spring 2022, when additional aerial data are available for the RSA. Mitigation updates for details of the bear denning area will be included in the next draft of the WMMP in early 2022 and provided to Environment and Climate Change Canada, The Agency, and Aboriginal Groups prior to the beginning of Project construction.

5. REFERENCES

BC MFLNRO. 2014. *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (Interim Guidance)*. Prepared for British Columbia Ministry of Forests, Lands, and Natural Resource Operations North Area by A. Roberts, Ecological Consulting Smithers, BC.

BC MOE. 2014. *Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures).* British Columbia Ministry of Environment: Victoria, BC.

RISC. 1999. *British Columbia Wildlife Habitat Ratings Standards, version 2.0*. Prepared by Ministry of Environment, Lands and Parks, Resources Inventory Branch for Terrestrial Ecosystem Task Force, Resources Inventory Committee (RIC): Victoria, BC.

APPENDIX A MASTER MITIGATION TABLE FOR GRIZZLY BEAR AND MOOSE, NOVEMBER 2020

Grizzly Bear	
1	Locate the transmission line in disturbed areas, as will be described in the CEMP
2	Use existing roads and follow existing linear disturbances to support transmission line construction, as will be described in the CEMP
3	Use helicopters to support transmission line construction in steep areas, as will be described in the CEMP
4	Avoid clearing and development of berry and kokanee areas, as will be described in the CEMP
5	Monitor Kokanee spawning streams
6	Minimize the mine site footprint and avoid large scale clearing of old-growth and mixed wood forest and riparian areas, as will be described in the CEMP
7	Minimize sensory disturbance due to noise and light in areas adjacent to the mine site and airstrip, including the use of noise abatement technology, equipment placement, regular equipment maintenance, and enforcement of speed limits
8	Restore disturbed habitats at mine closure or develop habitats capable of supporting grizzly bears as described in the RCP (Section 2.6 of the Application/EIS) and WMMP (draft plan provided in Section 12.2.1.18.4.6 of the Application/EIS) and avoid using species that attract bears
9	Avoid riparian areas and old growth forests, as will be described in the CEMP
10	Implement the WMMP (Section 12.2.1.18.4.6), including wildlife awareness information in regular mine safety and environmental inductions, including a Bear Awareness Program
11	Implement best management practices for road surface maintenance to allow good vehicle line of sight and control to reduce potential collisions with grizzly bears
12	Minimize attraction of wildlife to roadsides using adaptive management measures, including avoiding the use of road salts, removing carrion, and selection of appropriate revegetation species along Project-controlled access roads, pursuant to the WMMP (draft plan provided in Section 12.2.1.18.4.6 of the Application/EIS)
13	Select re-vegetation species that minimize attraction of wildlife to roadsides to reduce potential for vehicle collisions and predation as described in the WMMP (draft plan provided in Section 12.2.1.18.4.6 of the Application/EIS)
14	During the early years of Operations, deactivate and decommission access roads that are constructed to support transmission line construction to limit predator movements and vision along the line
15	An access management plan will be developed for the project, with consideration of grizzly bear predator activity
16	Implement a LSVMRP (draft plan provided in Section 12.2.1.18.4.4 of the Application/EIS), including minimizing ground disturbance and damage to vegetation
17	Follow BC's mitigation hierarchy when developing the mitigation plan for Grizzly Bear
18	Implement a RCP (draft plan provided in Section 2.6 of the Application/EIS), including seeding and progressive reclamation of exposed slopes to improve slope stability
19	Wildlife will be given the right-of-way by mine vehicles along all roads associated with the mine, and site orientation will include measures for avoidance of vehicle/wildlife encounters

20	Include wildlife awareness information in regular mine safety and environmental orientations. Topics may include: • Access road use and haulage operating protocols; • Restricted access recreation proscription rules; • No hunting / no fishing policy; • Wildlife observation and interaction reporting procedures; • Bear awareness program; • Waste management procedures; and • Wildlife sensitive locations/timing as applicable
21	Wildlife interactions (e.g., traffic accidents) and nuisance or problem animals will be reported to supervisory personnel as soon as safe to do so. Reporting procedures will be developed before construction of the mine begins
22	Implement the WMMP (Section 12.2.1.18.4.6), including a Bear Awareness Program
23	Implement the TAMP (draft plan provided in Section 12.2.1.18.4.14)
24	Restrict and control road access to the mine site, as described in the TAMP (draft plan provided in Section 12.2.1.18.4.14)
25	Use buses or alternatives to personal transportation to transport workers to the mine site during Construction and Operations to reduce potential for traffic accidents, as will be described in the 'Community Effects Monitoring and Management Plan'
26	No recreation trails will be allowed in sensitive habitat, including grizzly bear or caribou habitat
27	All mine vehicles and mobile equipment, including authorized private vehicles, will be equipped with or escorted by vehicles with two-way radios when travelling along Project-controlled roads. All encounters with wildlife will be recorded and reported to mine environmental and other relevant personnel as soon as safe to do so. This includes any encounters that result in injury or mortality to wildlife. Reports of wildlife frequenting Project-controlled roads will be provided to monitoring committees in accordance with agreed to terms of reference and protocols for follow-up and review of mitigation measure effectiveness.
28	Habituated animals will be deterred for their own safety following a plan provided to the provincial Conservation Officer Service
29	Implement the WMMP (Section 12.2.1.18.4.6), including a Bear Awareness Program
30	Manage snow bank height and create and maintain escape pathways in snow banks at wildlife corridors that intersect Project-controlled roads, as will be described in the Wildlife Monitoring and Management Plan
31	Maintain vegetated buffers adjacent to mine facilities and roads. Exceptions will include areas that will be managed for wildlife and human safety. This will be described in the CEMP.
32	Staff will be made aware of any locations of high animal activity on access roads and the appropriate actions to be taken

33	New Gold will implement an Industrial and Domestic Waste Management Plan (draft plan provided in Section 12.2.1.18.4.11), including the following measures: • Using practices that minimize odours from human-generated wastes; • Implementing a bear awareness program; • Scheduling timely and appropriate waste disposal; • Incinerating putrescible waste as soon as practical, or otherwise not allowing it to accumulate except where in appropriate containers; • Storing wastes in wildlife-proof containers, including trash cans and dumpsters with a bear-resistant design and considerations to contain odours. Waste containers will be repaired and maintained regularly; and • Using fencing or other means to exclude terrestrial wildlife from waste storage areas.
34	Include wildlife awareness information in regular safety and environmental inductions performed by the mine. Awareness to specifically cover beavers, grizzly bear, caribou, moose, and waterbirds
Moose	
1	Locate the transmission line in existing disturbed areas, as will be described in the Final Transmission Line Routing Plan
2	Use existing roads and follow existing linear disturbances to support transmission line construction, as will be described in the CEMP
3	Minimize ground disturbance and damage to vegetation in areas adjacent to footprints by flagging sensitive habitats, as will be described in the CEMP
4	Minimize sensory disturbance due to noise and light, including directional lighting and lighting that is activated by motion detectors, noise abatement technology, equipment placement, regular equipment maintenance, and enforcement of speed limits
5	Reporting any habitat feature (e.g., nest, den, mineral lick) encountered during the course of work activities by mine personnel or contractors to mine environmental staff immediately for follow-up actions as required as will be described in the WMMP.
6	Conducting winter moose and caribou surveys at a suitable scale to monitor the local population for distribution and abundance prior to construction. Survey design will be developed during the permitting phase in consultation with provincial agencies and First Nations communities. Wolf observations will be noted. The surveys will be repeated every 5 years during mine operations to monitor trends. Areas to be surveyed to include the Mine Site, transmission line portion of the RSA (i.e., corresponding to the area used in the habitat loss and alteration analysis) and the Mine Access Road
7	Design linear features to avoid wetlands to the, as will be described in the CEMP
8	Minimize clearance of black spruce forest and maintaining hydrological regimes of wetlands near infrastructure, as will be described in the CEMP
9	Avoid riparian areas and old growth forests, as will be described in the CEMP
10	Minimize the mine site footprint and avoid large scale clearing of old-growth and mixed wood forest and riparian areas, as will be described in the CEMP
11	Maintain or enhance existing drainage connections when designing and installing culverts for cross drainage, and avoid creating outlets that either drain wetlands or constrict the natural outlet during construction, as will be described in the CEMP

12	Include wildlife awareness information in regular mine safety and environmental orientations. Topics may include: • Access road use and haulage operating protocols; • Restricted access recreation proscription rules; • No hunting / no fishing policy; • Wildlife observation and interaction reporting procedures; • Bear awareness program; • Waste management procedures; and • Wildlife sensitive locations/timing as applicable
13	Use vegetation and coarse woody debris and other approaches to form visual barriers on cut lines, trails or other linear features to reduce changes in predator-prey dynamics as will be described in the WMMP
14	A 30 metre vegetation buffer will be used to protect wetland functions, as will be described in the CEMP
15	An access management plan will be developed for the project, with consideration of moose predator activity
16	Minimize attraction of wildlife to roadsides using adaptive management measures, including avoiding the use of road salts, removing carrion, and selection of appropriate revegetation species along Project-controlled access roads, pursuant to the WMMP (draft plan provided in Section 12.2.1.18.4.6 of the Application/EIS)
17	Establish a Traditional Knowledge/ Traditional Land Use (TK/TLU) Committee to monitor project development and provide TK/TLU information to incorporate during final project design, construction, operations, closure and post-closure
18	No recreation trails will be allowed in sensitive habitat, as will be described in the CEMP
19	Conduct moose aerial surveys prior to the commencement of construction, and subsequently every five years until the end of mine operations
20	Include wildlife awareness information in regular mine safety and environmental orientations
21	Restore disturbed habitats at mine closure or develop habitats capable of supporting moose pursuant to the RCP (Section 2.6 of the Application/EIS)
22	Restrict and control road access to the mine site, as described in the TAMP (draft plan provided in Section 12.2.1.18.4.14)
23	All mine vehicles and mobile equipment, including authorized private vehicles, will be equipped with or escorted by vehicles with two-way radios when travelling along Project-controlled roads. All encounters with wildlife will be recorded and reported to mine environmental and other relevant personnel as soon as safe to do so. This includes any encounters that result in injury or mortality to wildlife. Reports of wildlife frequenting Project-controlled roads will be provided to monitoring committees in accordance with agreed to terms of reference and protocols for follow-up and review of mitigation measure effectiveness.
24	Habituated animals will be deterred for their own safety following a pre-approved plan, reviewed by the provincial Conservation officer Service. The plan will be included as part of the Wildlife Monitoring and Management Plan
25	Implement best management practices for road surface maintenance to allow good vehicle line of sight and control to reduce potential collisions with moose
26	Include wildlife awareness information in regular mine safety and environmental inductions
27	Minimize the mine site footprint and avoid large scale clearing of old-growth forest and riparian areas, as will be described in the CEMP

28	Implement adaptive management to manage alternate prey habitat, wolf access or other similar measures, as described in the WMMP (draft plan provided in Section 12.2.1.4.18.6 of the Application/EIS).
29	Participate in the Kluskus FSR industrial road users group over the mine life (all indicators)
30	Include wildlife awareness information in regular safety and environmental inductions performed by the mine. Awareness to specifically cover beavers, grizzly bear, caribou, moose, and waterbirds
31	Use existing roads and follow existing linear disturbances to support transmission line construction, as will be described by the CEMP
32	Staff will be made aware of any locations of high animal activity on access roads and the appropriate actions to be taken
33	Conduct winter moose and caribou surveys prior to construction. The survey design will be developed during permitting in consultation with the Ministry of Forests, Lands and Natural Resource Operations and First Nation communities. The surveys will be repeated every five years to monitor trends during operations. Survey results could be incorporated by the province into regional initiatives
34	Conduct additional fall surveys for moose activity and moose sheds in the Mt. Davidson area
35	New Gold will implement an Industrial and Domestic Waste Management Plan (draft plan provided in Section 12.2.1.18.4.11), including the following measures: • Using practices that minimize odours from human-generated wastes; • Implementing a bear awareness program; • Scheduling timely and appropriate waste disposal; • Incinerating putrescible waste as soon as practical, or otherwise not allowing it to accumulate except where in appropriate containers; • Storing wastes in wildlife-proof containers, including trash cans and dumpsters with a bear-resistant design and considerations to contain odours. Waste containers will be repaired and maintained regularly; and • Using fencing or other means to exclude terrestrial wildlife from waste storage areas.
36	Participate in road safety groups for the use of the Kluskus FSR [Forest Service Road] as hosted by the road owner or primary licence holder