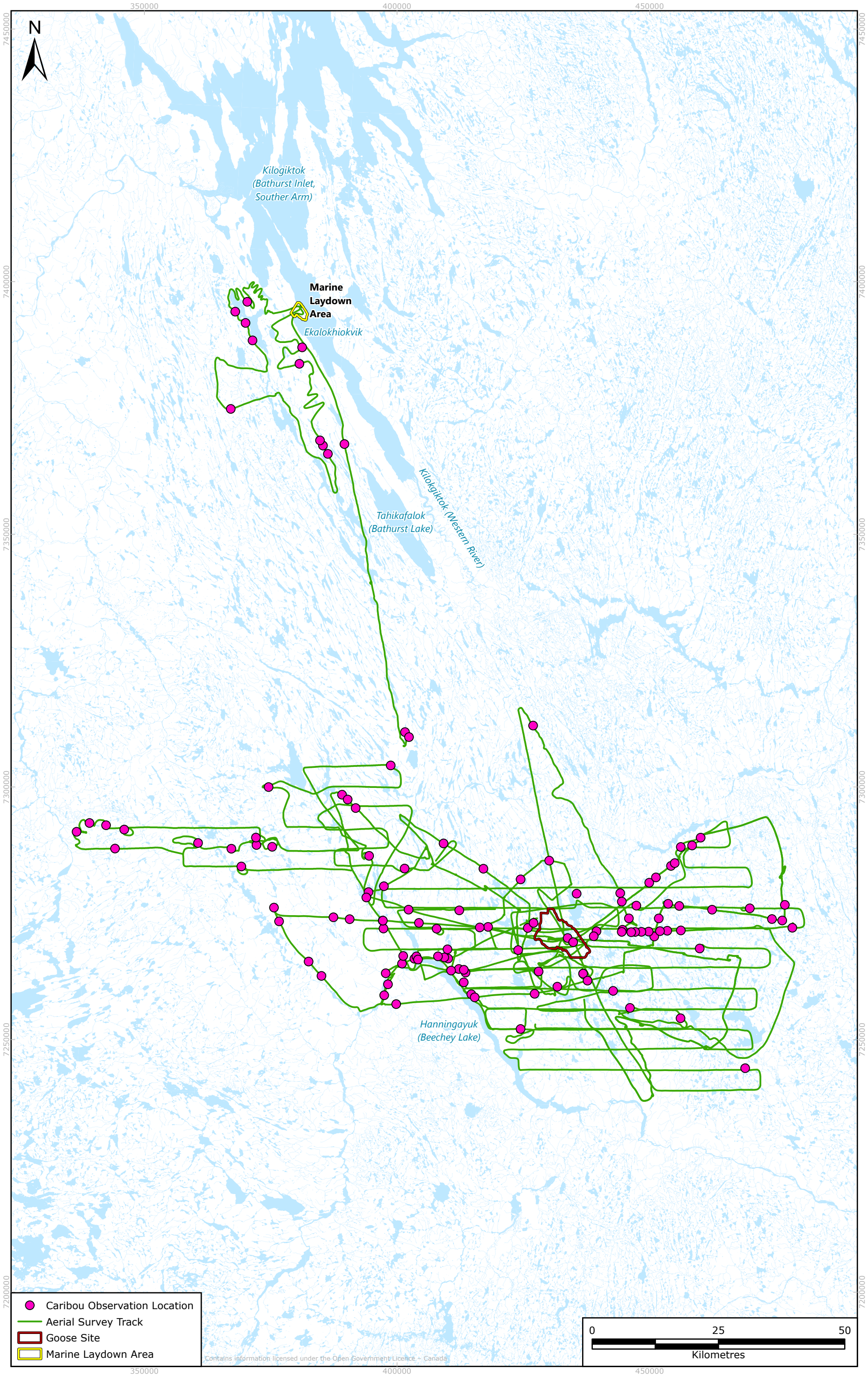
FIGURE 3.5-1 AERIAL GROUP SIZE THRESHOLD CARIBOU OBSERVATIONS, 2024



ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-637b

DATE: 03/18/2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:700,000 when printed at 11x17

Detection Probability

How detection probability or surveyor bias might affect the group size threshold was evaluated by simulating different scenarios that varied detection probability based on group size. These scenarios included equal detection probability across groups and different degrees of reduced detection probability for smaller groups. The same threshold calculation process as in Section 3.2 was then repeated to determine the group size threshold where 75% of the "true" population were accounted for. Using lower detection probabilities for small groups led to smaller average thresholds, ranging from 799 to 1,061 individuals (Table 3.5-2). Notably, a group size threshold of 600 would have ensured 75% of individuals were accounted for across scenarios (i.e., the lower confidence limit was not lower than 600 in any scenario).

3.5.2.3 VALIDATION

To validate the group size threshold, another bootstrapping simulation was conducted to calculate the number of times a group size threshold of 600 would account for 75% of individuals across 100,000 iterations. In 100,000 simulations, a group size threshold of 600 accounted for 75% of individuals in 99.8% of instances (Table 3.5-3). It was then possible to assess the actual proportion of individuals likely to receive mitigation at different group size thresholds. A group size threshold of 600 would result in an average of 91.6% of individuals receiving mitigation. Activating mitigation measures for groups smaller than 600 would increase the number of individuals subject to mitigation, though the threshold of 600 caribou already exceeds the required proportion of 75%. At the current threshold used at the Back River Mine (25 caribou), 99.4% of individuals are anticipated to receive mitigation.

3.5.2.4 SUMMARY

Caribou groups of 600 or more individuals provides a conservative group size threshold to protect 75% or more individual caribou near the Mine, while the existing threshold of 25 caribou protected 99.4% individual caribou near the Mine. Similarly, at a group size threshold of 50 caribou, 99.4% of individuals are anticipated to receive mitigation, while at a group size threshold of 100 caribou, 98.8% of individuals are anticipated to receive mitigation (Table 3.5-3). Therefore, as 99.4% of individuals are anticipated to receive mitigation using a groups size threshold of 25, no changes to the group size thresholds presented in the approved WMMP Plan (B2Gold 2024a) for caribou are proposed at this time.

3.6 CARIBOU BEHAVIOUR MONITORING

The objective of behaviour monitoring is to test the FEIS prediction that caribou may be disturbed by activities at the Back River Mine, principally noise. This program will determine what behavioural responses caribou display in reaction to potential stressors (e.g., aircraft, vehicles, blasting), as described in Section 7.3.2.2 of the WMMP Plan (B2Gold 2024a).

TABLE 3.5-2 SUMMARY OF GROUP SIZE THRESHOLD VALUES FROM SIMULATED DATASETS WHEN DETECTION PROBABILITY DEPENDS ON GROUP SIZE

Detection Probability Scenario	Mean Group Size Threshold	Median Group Size Threshold	Minimum Group Size Threshold	Maximum Group Size Threshold	Group Size Threshold Standard Deviation	Lower Quantile (2.5%)	Upper Quantile (97.5%)
Very Low Detection of Small Groups	799	800	350	1600	112	600	900
Low Detection of Small Groups	992	900	600	2100	203	800	1600
Slightly Lower Detection of Small Groups	1050	900	350	4200	353	600	2100
Equal Detection of All Groups	1061	900	350	4700	404	600	2100

TABLE 3.5-3 EFFECTIVENESS OF DIFFERENT GROUP SIZE THRESHOLDS BASED ON 100,000 SIMULATIONS FOR EACH CANDIDATE THRESHOLD VALUE

Group Size Threshold	Percentage of Simulations with >75% of Individuals Receiving Mitigation	Number of Simulation with <75% of Individuals Receiving Mitigation (Out of 100,000)	Percentage of Individuals Receiving Mitigation
1	100%	0	100%
10	100%	0	99.6%
25	100%	0	99.4%
50	100%	0	99.4%
100	100%	0	98.8%
200	100%	0	98.1%
400	99.9%	78	92.9%
600	99.8%	222	91.6%

3.6.1 METHODS

Behaviour surveys consisted of scan surveys every 3 minutes over a 30-minute survey period. Details recorded in each survey interval include a tally of individuals (or a subset of the group for groups >50 animals) exhibiting each behaviour type from the list of standardized behaviours (e.g., feeding, lying down, standing, alert, walking, and trotting/running) and any potential stressors or disturbances, including vehicles, aircraft, or predators. Location, time, distance from caribou to the observer, dominant group composition, temperature, wind speed, weather observations, and road structure values (height/slope) were also recorded, where applicable.

Caribou behaviour surveys were conducted in accordance with the Caribou Behaviour Monitoring SOP (B2Gold 2024j).

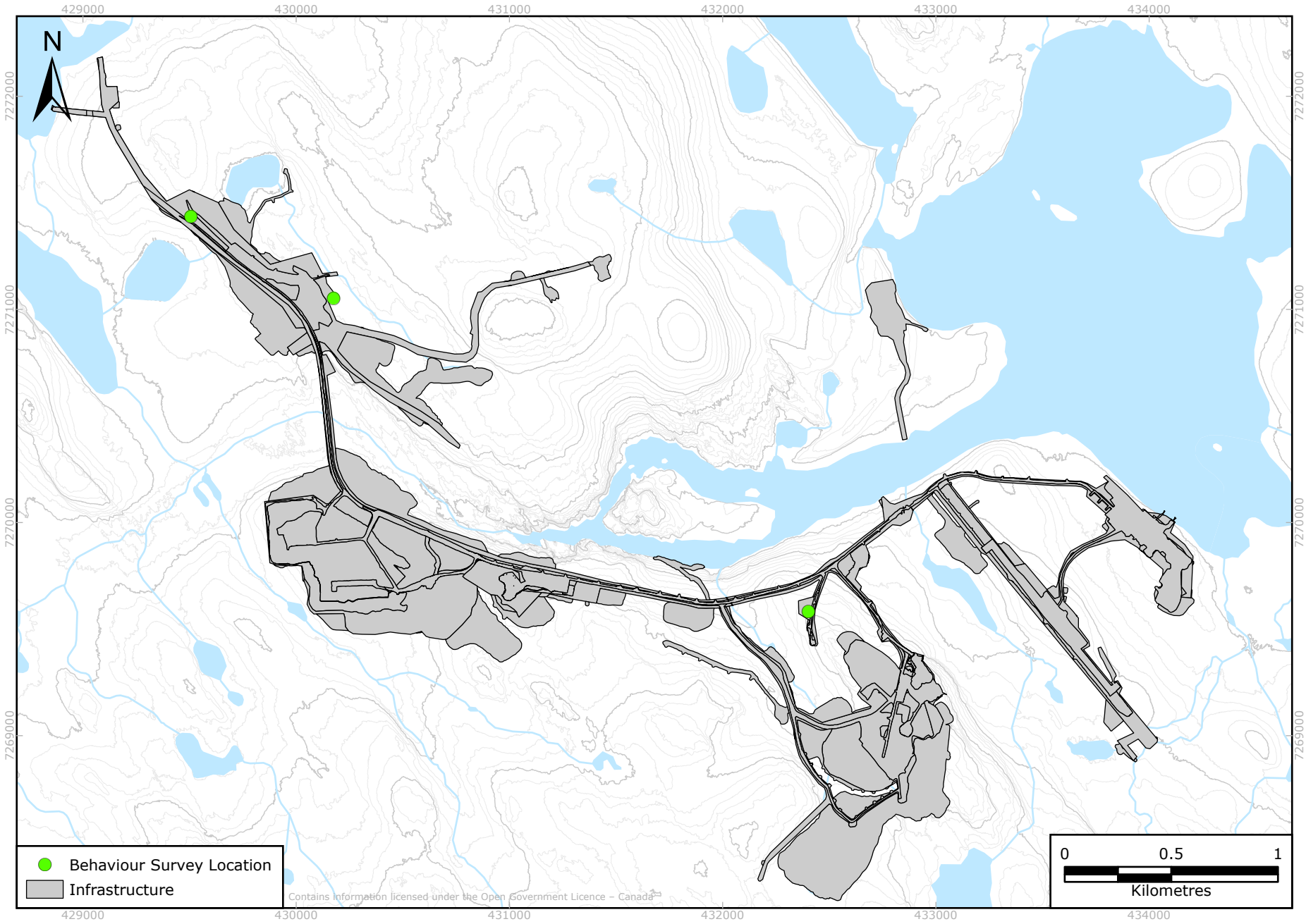
3.6.2 RESULTS AND DISCUSSION

A total of 13 caribou behaviour surveys were completed in 2024. Three caribou behaviour surveys were completed in 2024 at the Mine between August 2 and October 1 (Figure 3.6-1; Table 3.6-1). The remaining 10 caribou behaviour surveys were completed along the WIR between April 2 and May 1, 2024 (Figure 3.6-2). Group sizes surveyed at the Mine site ranged from two to 20 individuals and potential disturbances were recorded during one of the surveys. Two of the three groups consisted of two male caribou, and one group consisted of 20 mixed male and female caribou. Distances from caribou to the observers ranged from 50 to 1,000 m (Table 3.6-1).

TABLE 3.6-1 CARIBOU BEHAVIOUR SURVEYS, 2024

Date	Location	Number of Caribou	Distance from Caribou to Surveyor (m)	Number of Potential Disturbances
April 2	WIR P30 Lake	3	100–300	0
April 17	WIR L15	9	-	0
April 19	WIR P17	501–1000	100–300	3
April 20	WIR P27	19	100–300	2
April 22	WIR P22	13	300–1000	1
April 23	WIR P22	15	300–1000	2
April 24	WIR P25	30	300–1000	2
April 27	WIR P14	>1000	300–1000	2
April 30	WIR L22	>1000	300–1000	1
May 1	WIR P23	15 and 50–100	300–1000	0
August 2	Primary Pond	2	50–150	0
August 6	Old Batch Plant	2	50	10
October 1	Travelled between new emulsion plant and primary pond and ice road laydown	20	1000	0

FIGURE 3.6-1 CARIBOU BEHAVIOUR SURVEY LOCATIONS, 2024



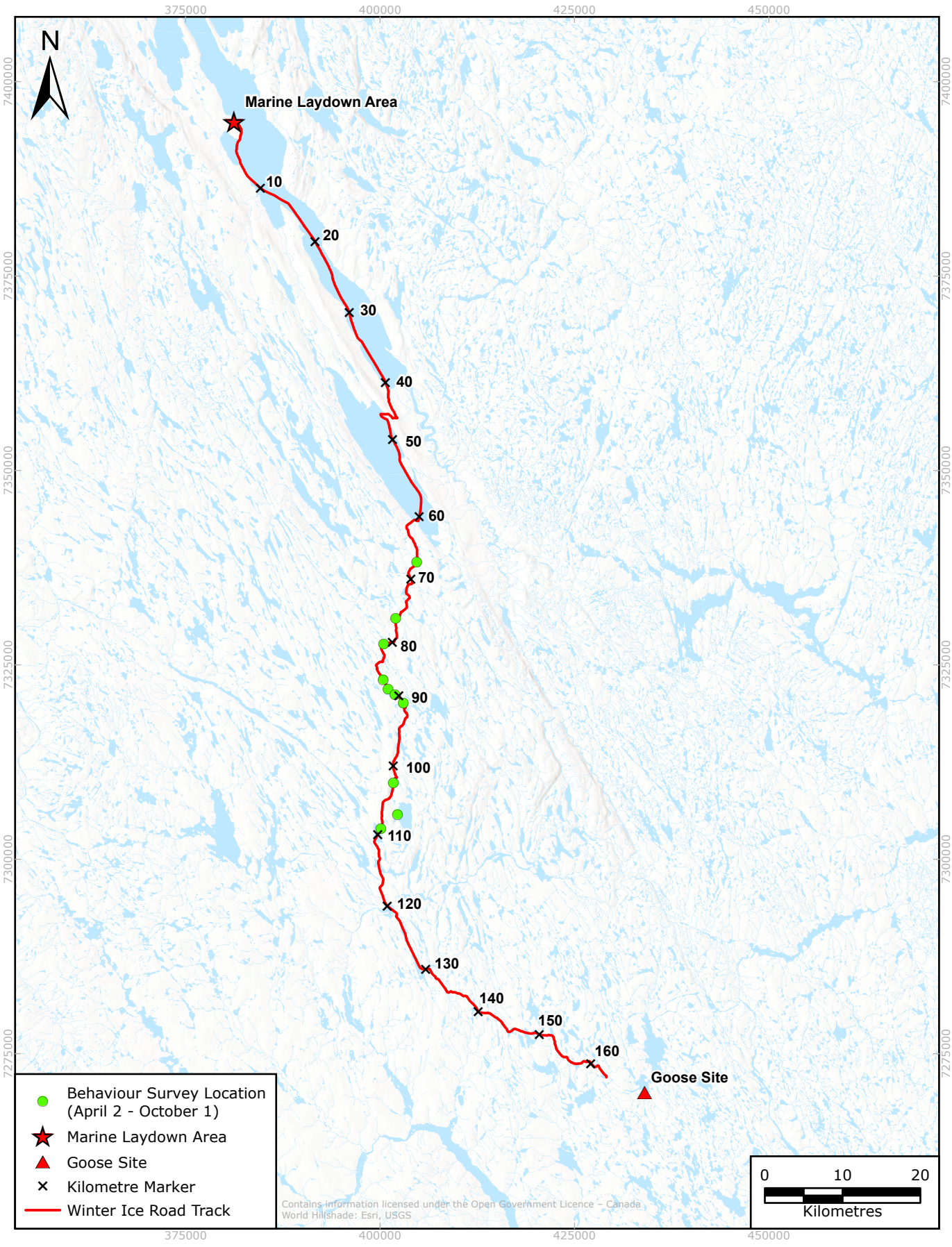
ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-646-01

DATE: 02/05/2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:25,000 when printed at 8.5x11

FIGURE 3.6-2 WIR CARIBOU BEHAVIOUR SURVEY LOCATIONS, 2024



ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-646-02

DATE: 18 March 2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:675,000 when printed at 8.5x11

Along the WIR, caribou groups surveyed ranged in size from three to over 1,000 individuals, and distances from caribou to observers ranged from 100 to 1,000 m (Table 3.6-1). Seven of the 10 surveys included potential disturbance events, which were recorded alongside caribou behaviours. Following potential disturbance events, caribou in all WIR surveys returned to baseline behaviours within three survey intervals (9 minutes or less).

The goal of the behaviour monitoring program is to complete a minimum of 10 behaviour samples per year. In 2024, 14 behaviour surveys were completed, and nine were completed in 2023. Results presented for 2024 are qualitative due to the low sample size (23 samples over 2 years); however, these data will be incorporated with additional data collected in the future to determine potential trends in caribou response to stressors.

3.7 ONSITE CAMERA MONITORING

The objective of the Onsite Camera Monitoring Program is to monitor caribou (and other wildlife) activities around site infrastructure, as described in Section 7.3.1.5 of the WMMP Plan (B2Gold 2024a). Wildlife cameras have been deployed in areas where wildlife may be more likely to interact with facilities and infrastructure or areas not staffed for long period of time, including but not limited to:

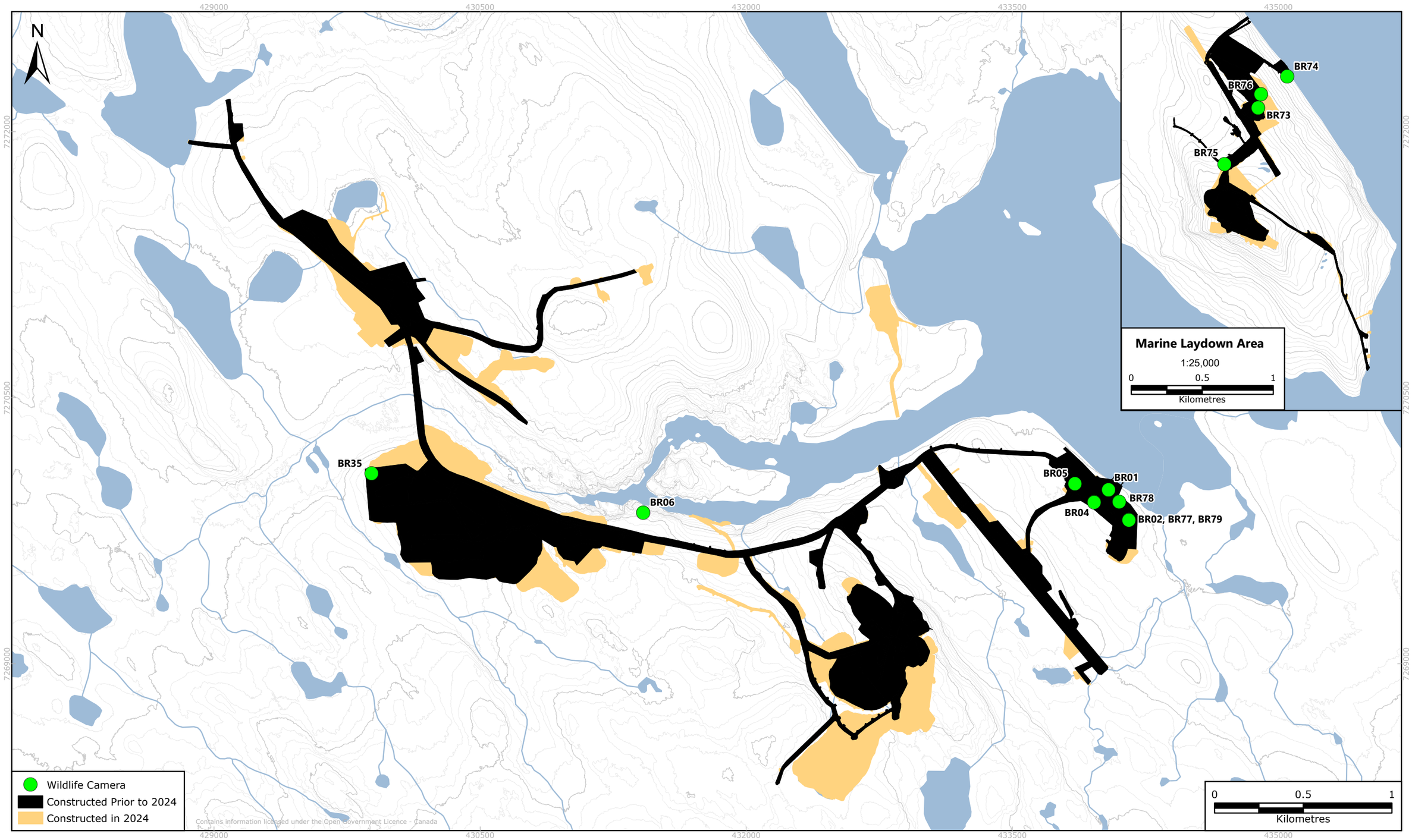
- Camps;
- WIR (crossing locations and control locations);
- Waste Management Facilities;
- Tailing Impoundment Facilities; and
- Areas known to be frequented by wildlife.

Results from this monitoring program may be used to inform adaptive management actions to reduce interactions between wildlife and Mine facilities or infrastructure.

3.7.1 METHODS

Nine wildlife cameras were deployed around the Goose Camp, and four were deployed at the MLA in 2024 (Figure 3.7-1). All cameras deployed in 2023 remained through 2024 (Table 3.7-1), except for BR03 (Major Drilling sump) which was not deployed in 2024. An additional three cameras were deployed in 2024 (BR35, BR77, and BR79). Cameras BR77 and BR79 were deployed near BR02 at the Goose Camp waste incinerator in response to incidental observations of a wolverine in the area (see Section 2.6). Cameras were regularly serviced to ensure continued operation throughout the year. These 13 onsite cameras were deployed in addition to the 14 WIR cameras (Section 3.3.1.2) and 59 regional monitoring cameras (Section 3.8.1).

FIGURE 3.7-1 ONSITE CAMERA MONITORING LOCATIONS, 2024



ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-654-01

DATE: 02/20/2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:20,000 when printed at 11x17

TABLE 3.7-1 WILDLIFE CAMERA DEPLOYMENT INFORMATION AT GOOSE CAMP AND THE MLA

Camera ID	Start Date	End Date	Location
BR01[1, 2]	December 29, 2023	January 5, 2024	Exploration kitchen (replaced by BR78)
BR02[1]	January 5, 2024	April 19, 2024	Waste management (incinerator) 1
BR04[1]	October 1, 2024	December 30, 2024	Grey water discharge
BR05[1]	May 13, 2024	November 22, 2024	Hazmat berm
BR06[1, 2]	August 15, 2023	June 30, 2024	Southwest shore of Goose Lake
BR35	April 22, 2024	April 26, 2024	New camp at Goose
BR73[1]	January 9, 2024	November 1, 2024	MLA—Back of kitchen
BR74[1]	January 9, 2024	December 10, 2024	MLA—Desalination cell
BR75[1]	January 29, 2024	October 25, 2024	MLA—Incinerator
BR76[1]	January 29, 2024	February 4, 2024	MLA—Mechanic shop
BR77	April 7, 2024	December 30, 2024	Waste management (incinerator) 2
BR78[1]	April 21, 2024	December 23, 2024	Exploration kitchen
BR79	April 21, 2024	December 30, 2024	Waste management (incinerator) 3

Notes:
[1] Previously deployed in 2023.
[2] Deployed in 2023 but data was not yet available for the 2024 WMMP Report and was included in this report.

Full data from BR01 and BR06 were not available for processing at the time of the 2023 WMMP report, but remained deployed and continuously collecting data; images from these cameras from both 2023 and 2024 were included in this report. Cameras were deployed with a clear field of view and set to capture both motion-triggered and timed (every 30 minutes) photos. Cameras were regularly checked to ensure SD card capacity and battery levels were appropriate for continuous function. Camera locations were selected to include areas with the potential to attract wildlife, high likelihood of interaction with wildlife, or areas of previous incidences of wildlife interaction with infrastructure (B2Gold 2024i).

3.7.2 RESULTS AND DISCUSSION

Cameras were functional throughout 2024 and recorded images of wildlife. There were eight species detected at Goose camp and seven species at MLA, for a total of nine species in 2024 (Table 3.7-2 and Table 3.7-3). Camera BR76 located at the MLA mechanic shop did not record any wildlife in 2024.

Caribou were only recorded at the MLA, predominately during summer months, with one detection during spring migration, and one detection during fall migration (images from May 30, 2024, to September 28, 2024, in Table 3.7-4; see Table 3.4-1 for season definitions). There were no detections of caribou during calving or during winter or fall rut (Table 3.7-4). The most common location caribou were detected was camera BR73, near the MLA kitchen. Camera BR73 recorded caribou around camp facilities and feeding on nearby vegetation. Caribou were also detected at one other camera, BR74, near the desalination cell, on two occasions. Camera BR74 recorded caribou travelling through the area without interaction or feeding.

TABLE 3.7-2 WILDLIFE CAMERA DETECTIONS AT GOOSE, AUGUST 2023 TO DECEMBER 2024

Species	Scientific Name	Camera Location[1]									Total
		BR01	BR02	BR04	BR05	BR06	BR35	BR77	BR78	BR79	
Mammals											
Arctic Fox	*Vulpes lagopus*	-	1	4	-	-	1	-	2	4	12
Arctic Hare	*Lepus arcticus*	-	1	7	2	-	1	2	40	5	58
Red Fox	*Vulpes vulpes*	-	1	2	1	-	-	1	-	9	14
Small Mammal	-	-	-	-	-	-	-	1	1	-	2
Wolverine	*Gulo gulo*	-	5	-	-	1	-	-	-	-	6
Birds											
Common Raven	*Corvus corax*	2	32	-	-	-	-	31	7	68	140
Unspecified Ptarmigan	*Lagopus* sp.	-	-	-	-	-	-	-	3	3	6
Bird (Other)	-	4	-	-	2	14	-	-	2	-	22

Note:
[1] See Table 3.7-1 for camera location descriptions.

TABLE 3.7-3 WILDLIFE CAMERA DETECTIONS AT MLA, AUGUST 2023 TO DECEMBER 2024

Species	Scientific Name	Camera Location[1]			Total
		BR73	BR74	BR75	
Mammals					
Arctic Fox	*Vulpes lagopus*	1	-	1	2
Arctic Hare	*Lepus arcticus*	-	-	1	2
Caribou	*Rangifer tarandus*	21	2	-	23
Small Mammal	-	1	-	-	1
Birds					
Common Raven	*Corvus corax*	14	2	32	16
Unspecified Ptarmigan	*Lagopus* sp.	3	-	-	11
Bird (Other)	-	-	4	-	50

Note:
[1] See Table 3.7-1 for camera location descriptions.

TABLE 3.7-4 WILDLIFE CAMERA DETECTIONS OF CARIBOU, MAY TO SEPTEMBER 2024

Camera ID	Date	Number of Caribou	Behaviour
BR73	July 17	1	Walking
	July 20	1	Walking
	July 20	1	Walking
	July 22	1	Walking
	July 23	3	Walking
	July 24	1	Walking
	July 25	1	Walking
	July 25	1	Walking
	July 27	1	Walking
	July 27	1	Interacting with infrastructure
	July 29	1	Feeding
	August 1	1	Feeding
	August 4	1	Walking
	August 11	1	Walking
	August 19	3	Walking
	August 22	1	Walking
BR74	May 30	2	Walking
	September 28	1	Walking

Onsite camera monitoring in place by B2Gold Nunavut was effective at monitoring caribou activities around site infrastructure. One caribou was recorded interacting with infrastructure at the onsite monitoring cameras in 2024, where a caribou was observed in proximity to a staff member. The caribou appeared calm and unphased by the interaction from approximately 5 m away. All other caribou were recorded passing through or feeding on the tundra nearby. No adaptive management measures were triggered by this program.

Full results from cameras are available in Appendix F. An example image is provided in Photos 3.7-1 to 3.7-3.

3.8 REGIONAL CAMERA MONITORING

The objective of the regional camera monitoring program is to evaluate if caribou and other wildlife are avoiding the Mine site, as described in Section 8.3.2.2 of the WMMP Plan (B2Gold 2024a). Analysis was completed in 2024, and data will continue to be collected annually from cameras, with further analysis scheduled for 2027 (every 3 years).

Photo 3.7-1 Caribou at onsite monitoring camera BR73, behind MLA site kitchen.

Photo 3.7-2 Male caribou at onsite monitoring camera BR74, behind MLA site kitchen.

Photo 3.7-3 Caribou feeding at onsite monitoring camera BR73, behind MLA site kitchen.

3.8.1 METHODS

3.8.1.1 STUDY DESIGN

To evaluate Zone of Influence (ZOI) type effects, 59 cameras were deployed in July 2023 in three zones at varying distances from the Mine site, following a design implemented at other mines in Nunavut: the treatment zone (0 to 2 km), the ZOI (2 to 10 km), and the control zone (>10 km). Following closure of the WIR in 2024, 11 additional cameras remained deployed to provide additional data (10 in the control zone, one in the treatment zone). Baseline studies for the Back River Mine (2012 to 2015) were conducted with 60 cameras along five transects; locations from the baseline studies were noted prior to deployment in 2023 to align where possible and to allow future comparison (Rescan 2013a, 2014).

To improve independence, cameras were not in line of sight of each other and were deployed a minimum of 2 km apart wherever possible (mean separation 3,742 m; range of 606 m to 10,040 m). Camera separation distances within ZOI and control zones were similar to treatment cameras to minimize differences due to clustering, although some clustering of treatment cameras was unavoidable while retaining independence between sites. Cameras were oriented to ensure the area within 40 m in front of the camera was clear so that cameras were equal in their trigger zone and field of view.

Camera programming and deployment methods followed the Remote Camera Monitoring SOP (B2Gold 2024i), including the use of a standardized wooden tripod weighted with rocks, capturing motion triggered and hourly timed photos, and use of metal security boxes to reduce the likelihood of wildlife damage (Photo 3.8-1).

Photo 3.8-1 Remote camera setup using a wooden tripod and security box.

3.8.1.2 DATA PROCESSING

All photos were pre-processed by an artificial intelligence (AI) algorithm to automatically sort photos into four categories: animals, vehicles, humans, and blank images (Beery et al. 2019; Fennell et al. 2022). Trained personnel then reviewed all photos as classified by the AI algorithm and confirmed all detections of wildlife, including any missed by the AI algorithm.

Photos were tagged at the 30-minute independent detection level for each species. An independent detection is an event where an individual or group triggers the camera, resulting in either one or multiple photos. Because one detection might have multiple individuals recorded across photos, the number of animals recorded for each detection event is the largest number of individuals visible in any one photo during the event, or an estimate of the total number of individuals across photos. To ensure consistency, a detection event was defined as a time lag of at least 30 minutes between photos of the same species, which was applied to group individual photos into independent detection events.

Data recorded for each wildlife detection event included:

- The time of the first photo;
- The species of wildlife;
- The number of individuals in the group;
- The behaviour of the animals; and
- For events where multiple photos were captured, the duration of the motion-trigger event.

3.8.1.3 ANALYSIS

An initial exploratory analysis was conducted to visualize the data, screen for errors, and determine the appropriate method for analysis. Two methods were used to test the effects of distance from infrastructure at the Mine on wildlife occurrence: occupancy models and generalized linear mixed models (GLMMs). To account for decreased camera operability during the winter, including partially obscured fields of view for a number of cameras, data used to fit caribou models under both frameworks were filtered to exclude the period from November 6 to April 14. This prevented artificial inflation of zeros (weeks with no detection) in the data while also corresponding to the period caribou were observed on cameras.

Full analytical methods are provided in Appendix G, with a summary overview provided here.

Occupancy Models

Occupancy models were used to test the effects of the categorical zones around the Mine (treatment, ZOI, and control) as well as continuous distance from Mine infrastructure at the weekly scale. Single-season occupancy models were used to estimate the probability of a species occupying a camera site during a week, while also accounting for the fact that a species may have occurred at the site, but was not detected, and covariates that might affect either occupancy or detection.

For each species with enough detections, three models were tested: 1) a null model; 2) a model where occupancy probability is based on the categorical zone of each camera; and 3) a model where occupancy probability depends on the continuous distance from the Mine. Selection of the best model was done using the Widely Applicable Information Criterion (WAIC; Watanabe 2010), where models within two WAIC are considered equally explanatory of the data.

Generalized Linear Mixed Models

Generalized linear mixed models (GLMMs) were used to analyze the differences in detection events for each species on a weekly basis. Potential explanatory variables for species occurrence at a camera within a given week included: categorical zones around the Mine (treatment, ZOI, and control), continuous distance from infrastructure, and vegetative productivity as measured using 16-day Normalized Difference Vegetation Indices (NDVI) at a 250 m scale around each camera using the MODIS MOD13Q1 product (Didan 2021). A model incorporating a combination of the latter two variables (continuous distance and NDVI) was also included. A random effect was included for the unique camera location to account for repeated measures at each camera, and a negative binomial distribution was specified to account for overdispersion in the response variable.

Model selection was conducted via the Akaike Information Criterion (AIC). AIC is a number that is helpful for comparing models, as it includes measures of both how well the model fits the data and how complex the model is (simpler is usually better). The top models were identified as having a low AIC and were within a 2-unit difference in AIC ($\Delta AIC \leq 2$) of the top ranked model (i.e., the model with the lowest AIC; Burnham & Anderson 2004). This is the industry standard for identifying models that are essentially “equally good” at explaining the data. The marginal coefficient of determination (pseudo R^2) for each model was also calculated providing an interpretation of the variance explained by the fixed effects in the model (i.e., models with values closer to one are more explanatory of the response; Nakagawa et al. 2017).

All analyses were conducted using program R version 4.4.2 (R Core Team 2024). GLMM analyses were conducted using the package lme4 (Bates et al. 2015), and occupancy analyses were conducted using the package spOccupancy (Doser et al. 2022). NDVI was extracted for each site-week using the modisfast R package (Taconet and Moiroux 2024).

Where sufficient detections were not available to achieve model convergence for a species, descriptive summary results are provided.

3.8.2 RESULTS AND DISCUSSION

3.8.2.1 CAMERA STUDY

In total, 59 wildlife cameras were deployed in July 2023, with 11 additional cameras added to the program following closure of the WIR in May 2024 (Figure 3.8-1). Cameras were left out to ensure a complete year of data collection (except for the WIR cameras, which were left for 3 months). Data cards were retrieved and cameras serviced in July 2024, with all cameras remaining deployed in the field to continue collecting data. Photo cards from two cameras were not collected, as one camera was damaged by wildlife, and another was lost or stolen. Cameras were deployed in three zones throughout the RSA: 20 within the treatment zone, 19 within the ZOI, and 31 in the control zone. Camera locations were similar to those from the baseline study wherever possible to allow future comparison between years and to improve analytical power.

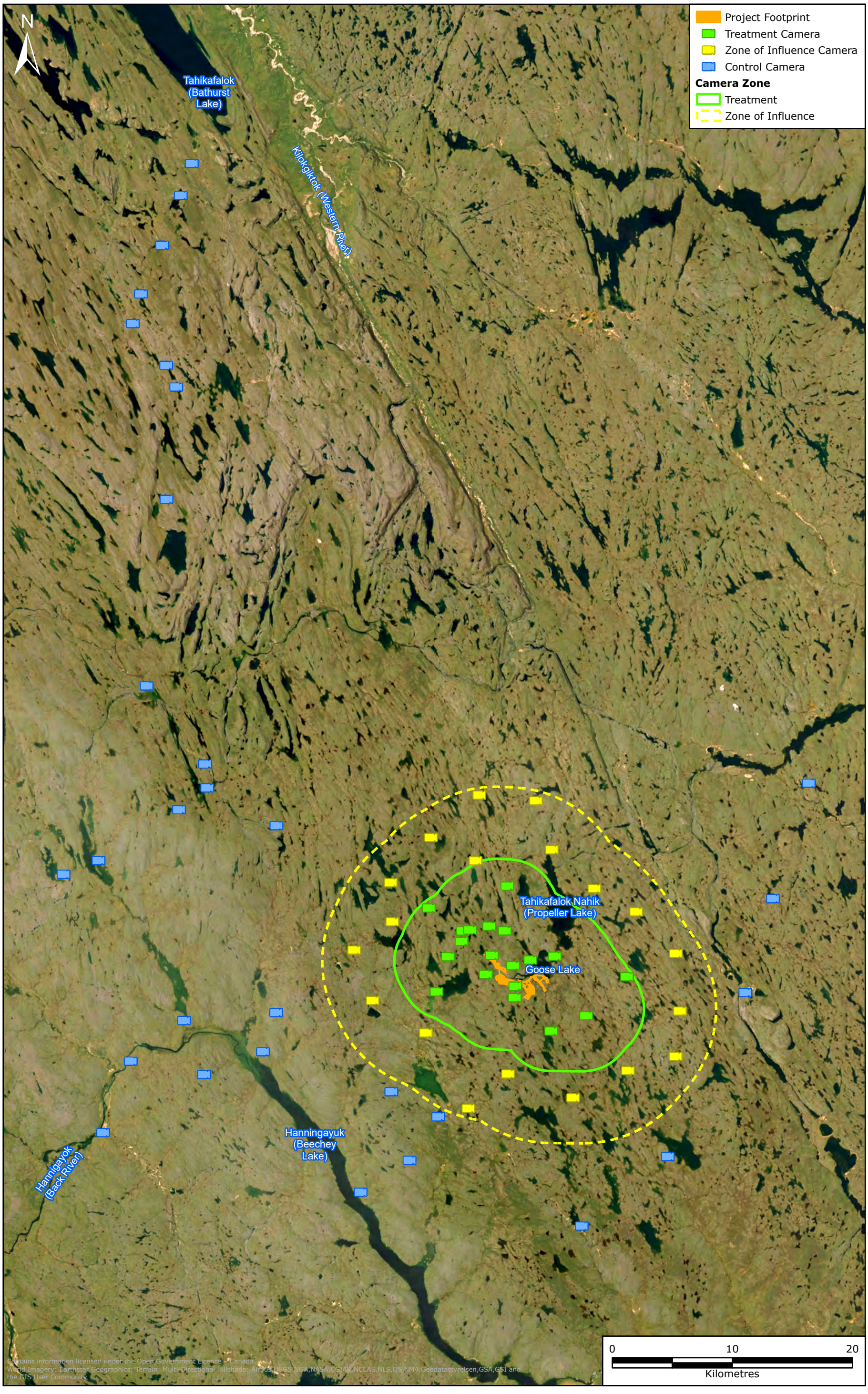
Cameras operated for a median of 363 days (mean 267, minimum 3, maximum 366). Camera non-operability throughout the deployment period was most commonly attributed to depleted batteries (n=7), grizzly bear damage (n=5), and muskox damage (n=2). Intermittent periods of drifting snow during the winter resulted in short outages and reduced field of view at some cameras. Over 1 million photos were collected and processed, resulting in 2,021 identifiable detection events recorded.

Table 3.8-1 provides a summary of the species detected across all cameras throughout the deployment period, including the number of independent detections as well as the estimated number of individual animals observed. Table 3.8-2 shows the monthly number of caribou detections at all Regional Camera Monitoring locations combined. Results for muskox are discussed in Section 4.4, and carnivores are discussed in Section 5.5. Caribou were detected more frequently than any other species. Figure 3.8-2 presents the spatial distribution of caribou detections across all Regional Monitoring Cameras in 2023 and 2024.

3.8.2.2 STATISTICAL ANALYSIS

Full statistical analysis results are provided in Appendix G, with an overview summary provided here.

FIGURE 3.8-1 REGIONAL CAMERA MONITORING LOCATIONS, 2024



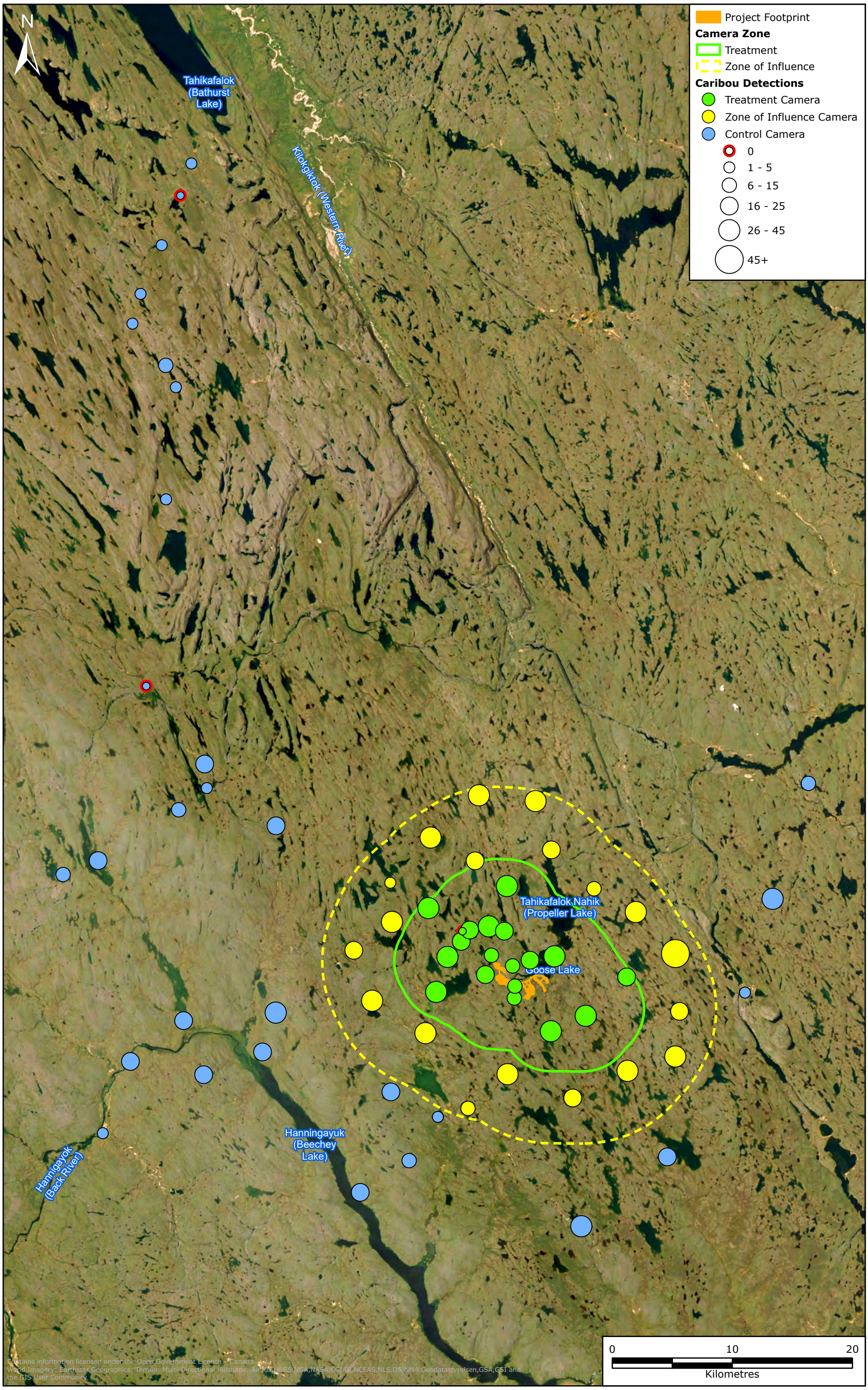
ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-656-01

DATE: 02/26/2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:300,000 when printed at 11x17

FIGURE 3.8-2 CARIBOU DETECTIONS AT REGIONAL MONITORING CAMERAS, 2023 TO 2024



ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-656-02

DATE: 02/27/2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:300,000 when printed at 11x17

TABLE 3.8-1 SUMMARY OF REGIONAL CAMERA PROGRAM DETECTIONS, JULY 2023 TO JULY 2024

Species	Number of Independent Detections	Number of Animals Detected
Arctic Hare	67	69
Bird	150	885
Caribou	1,341	16,043
Fox (Red or Arctic)	22	22
Grey Wolf	90	117
Grizzly Bear	45	52
Moose	1	1
Muskox	25	85
Ptarmigan	85	318
Raven	8	11
Small Mammal	19	22
Wolverine	8	8

TABLE 3.8-2 MONTHLY CARIBOU DETECTIONS ON REGIONAL MONITORING CAMERAS, 2023 TO 2024

Date	Number of Detections
July 2023	78
August 2023	771
September 2023	246
October 2023	43
November 2023	0
December 2023	0
January 2024	0
February 2024	0
March 2024	0
April 2024	3
May 2024	46
June 2024	35
July 2024	119

Occupancy Models

All three of the candidate occupancy models are within two WAIC, suggesting limited differences in explanatory power between them (Table 3.8-3). Additionally, the Bayesian p-value's derived for each model are low (0.022 to 0.024), reflecting a poor level of explanatory power (values close to 0.5 are considered highly predictive; Gelman 2013). As the two models containing covariates for distance from the Mine were not more predictive than the null model, this modelling approach was deemed uninformative for caribou with the amount of data available after 1 year of sampling. Future occupancy modelling attempts integrating additional years of data may allow further inference as to caribou occurrence related to distance from the Mine.

TABLE 3.8-3 CARIBOU OCCUPANCY MODEL SELECTION PARAMETERS AND FIT STATISTICS

Model Description	WAIC	Bayesian p-Value
Null	1925.77	0.024
Categorical Distance	1926.37	0.022
Continuous Distance	1926.45	0.024

Generalized Linear Mixed Models

Four candidate GLMMs were run for caribou at the weekly scale. Table 3.8-4 summarizes the model selection parameters (AIC) and fit statistic (pseudo R^2) for each candidate model. The results in Table 3.8-4 reflect that the model containing covariates for continuous distance from the Mine and NDVI (vegetative productivity) is more strongly explanatory than any of the other candidate models. The pseudo R^2 value of 0.36 for this model reflects that approximately 64% of the variation in the model remains unexplained after considering these covariates, suggesting that other factors not included in the model may contribute to caribou habitat selection and use.

Table 3.8-5 provides a summary of this model, including the estimated incidence rate for each fixed effect, quantifying the influence of the variable on caribou occurrence at a camera location. Incidence rates reflect the likelihood of a caribou occurring in a given week as each covariate increases. In the case of the top caribou GLMM, an incidence rate less than one suggests that as distance to the Mine increases, caribou are less likely to be observed. Where NDVI values are higher, caribou are more likely to be detected at a site in a given week. Both the continuous distance to infrastructure and NDVI covariates are statistically significant predictors of caribou occurrence (p-values less than 0.05).

Based on these model results, no ZOI was detectable for caribou around the Mine, with increased likelihood of caribou use at sites closer to the Mine. Further, NDVI appears to be a strong predictor of caribou habitat use, reflecting an index of forage availability for this species.

Due to a low number of detections for species other than caribou, statistical models were not able to converge for muskox, grizzly bear, or wolverine. Summary results are provided in the respective species sections below.

TABLE 3.8-4 CARIBOU GENERALIZED LINEAR MIXED MODEL SELECTION PARAMETERS AND FIT STATISTICS

Model Description	AIC[1]	Pseudo R^2 [2]
Continuous Distance + NDVI	3431.23	0.36
NDVI	3451.03	0.31
Continuous Distance	3593.26	0.10
Categorical Distance	3603.70	0.06

Notes:
[1] AIC is used to select the best fitting model, while accounting for model complexity. Lower values are better, with differences of two or more suggesting a difference between model fit.
[2] Pseudo R^2 represents the variance explained by a model, with values closer to one being more strongly explanatory.

TABLE 3.8-5 TOP CARIBOU GENERALIZED LINEAR MIXED MODEL SUMMARY

Effect Type	Covariate	Estimate (incidence rate)	SE	p-Value
Fixed	Intercept	0.55	1.095	<0.001
	Distance to infrastructure	0.65	1.095	<0.001
	NDVI	2.44	1.073	<0.001
Random		**Variance**	**Std. Deviation**	
	Camera site	1.29	1.65	

3.9 REGIONAL COLLAR MONITORING

Regional collar monitoring is conducted to evaluate if caribou are avoiding the Mine site or WIR due to disturbance, as described in Section 7.3.2.4 of the WMMP Plan (B2Gold 2024a). The FEIS and EC Addendum predicted that caribou would avoid the Mine site to some degree and this analysis will test for 1) a change in distribution, and 2) the magnitude of that change should it be detected.

3.9.1 METHODS

Methods are summarized here and detailed in Appendix H.

3.9.1.1 COLLAR DATA

Regional collar data for the Bathurst and Beverly/Ahiak herds were provided via a Data Sharing Agreement with the GNWT, encompassing location data from 1996 to 2024. Data for this analysis were filtered to 2017 onwards and cleaned to remove data with errors including erroneous frequency (i.e., points obtained in rapid succession or with very long gaps), unrealistic incoming/outgoing speeds, unexpected jumps in location, and points following the mortality of an individual caribou.

As different patterns of seasonal movement, and thus different patterns in expected interaction with the Mine are anticipated, regional collar analysis was conducted separately for the Bathurst herd and Beverly/Ahiak herds. Similarly, seasonal differences in both migratory movements and the frequency of caribou occurrence in proximity to the Mine support the use of seasonal models to increase model accuracy. Appropriate seasonal periods were determined by assessing the frequency of proximity to the Mine (Goose or the WIR) throughout the year. This resulted in five analysis datasets: three Beverly/Ahiak ZOI models (spring-Goose, spring-WIR, and summer-Goose) and two Bathurst ZOI models (spring-Goose and spring-WIR). There were limited summer interactions with the Mine by the Bathurst herd and were therefore not included.

Further processing included examining caribou collar locations across each year to determine if individual caribou had the potential to interact with the Mine or WIR. A potential to interact was defined by creating a radius of availability for each GPS fix. This radius indicates possible locations caribou could have moved to between GPS fixes based on the distance moved in the previous GPS step. Each location in the final subset is considered to have been used by caribou. Habitat selection models rely on comparing habitat at used locations with habitat in potentially available but unused locations. For each used location, we randomly sampled six available locations from within the radius of availability buffer. Available locations for each used location are those that were available from the previous GPS fix. This corresponds to other locations the caribou could have chosen to be instead of its current location. This is demonstrated in Figure 3.9-1, where the caribou moved from the black point to the green point between successive fixes. It could have moved to any location within the grey radius of availability buffer, which is represented by the six random point samples shown in red.

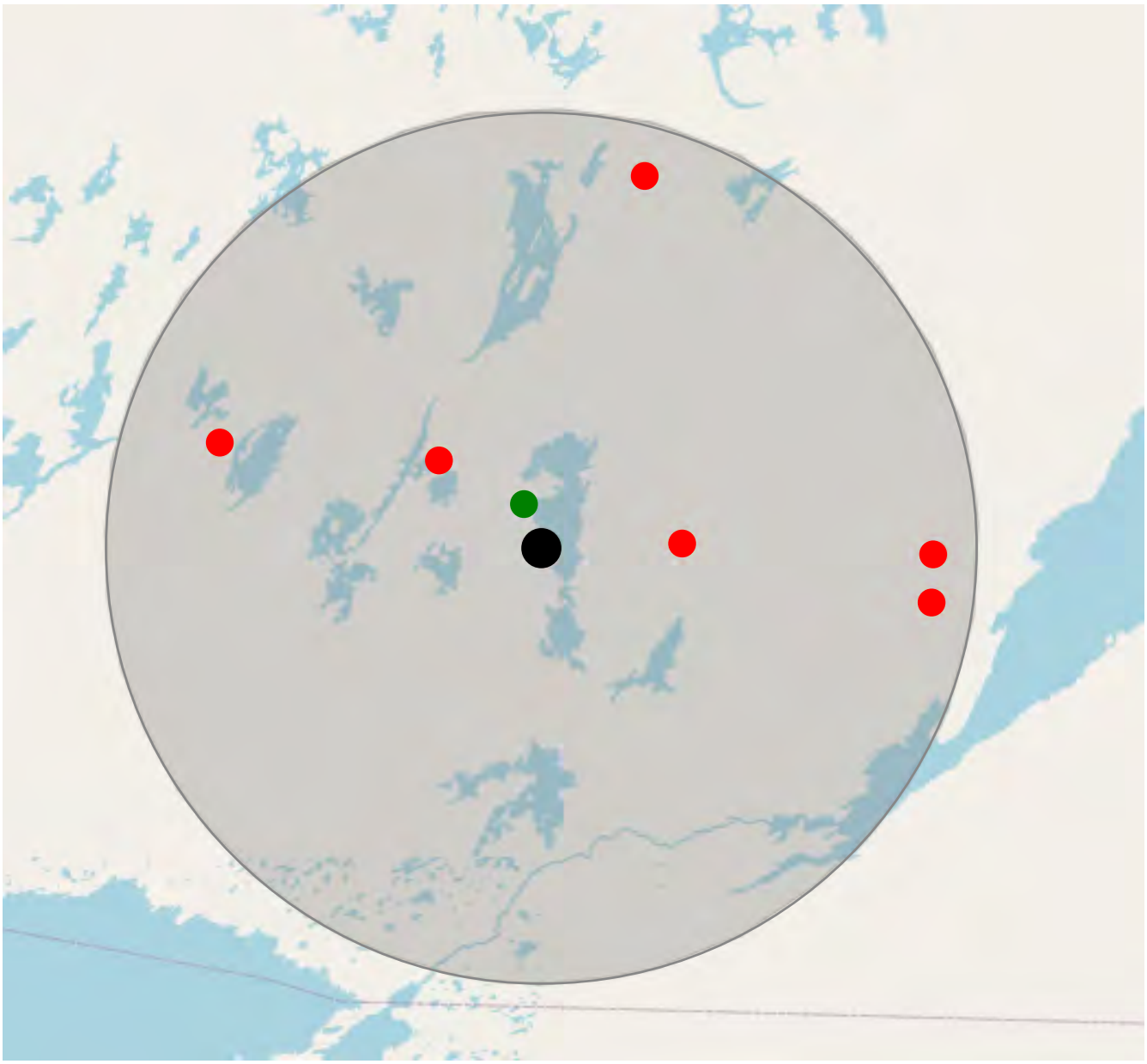
Individual caribou that had at least one radius of availability within a year overlapping the Mine or WIR were included in the final analysis.

3.9.1.2 ENVIRONMENTAL DATA

A suite of environmental data were extracted to characterize a 1 km buffer around all used and available points. These were used to describe caribou habitat selection in the base habitat model. The environmental data used includes:

- The proportion of 15 different land cover classes, sourced from the 2020 Land Cover of Canada map (Latifovic 2020) with pixels provided at a 30 m spatial resolution;
- The proportion of eskers within the 1 km buffer; and
- The mean annual NDVI (sourced from the MODIS MOD13AQ1 product), extracted via the modisfast R package as described in Section 3.8.

FIGURE 3.9-1 HABITAT SELECTION MODEL, USED VS. AVAILABLE LOCATION EXAMPLE



3.9.1.3 BASE HABITAT MODELS

Base habitat models were built for each herd-season-feature (Goose or WIR) subset by comparing used and available point location data from all years. All habitat models were fit as conditional logistic regressions following Boulanger et al. (2012) and Boulanger et al. (2021). For each land cover variable (each of 15 land cover classes and esker length), a simple univariate model was fit that considered the main effect of the habitat variable as well as its possible interaction with NDVI within the 1 km buffer around each point. All significant terms from univariate models were identified and compiled into a final multivariate model intended to explain caribou habitat use prior to considering any potential ZOI from the Mine.

3.9.1.4 ZONE OF INFLUENCE MODELS

Potential ZOIs were evaluated following the approach of Boulanger et al. (2012). This included use of segmented regression, with a distance from infrastructure variable added on top of the multivariate base habitat model. Influence of distance from the Mine was assessed at values from 500 m to 60 km in 500 m increments.

The ZOI modelling process was completed separately for control and treatment subsets of caribou collar data. For assessments of Mine footprint effects, data were grouped into pre-construction (<=2022) and construction (2023 to 2024) sets, with separate likelihood profiles generated for each. Similarly, for assessment of WIR effects, data were grouped into road open (2019, 2022, 2023, 2024) and road closed (all other years 2017 onwards) subsets. Likelihood profiles for each subset were qualitatively compared for differences that might reflect a ZOI resulting from construction of the Mine or operation of the WIR.

3.9.2 RESULTS AND DISCUSSION

Detailed results including base habitat model tables are provided in Appendix H, with a summary provided here.

3.9.2.1 BASE HABITAT MODELS

Base habitat models were successfully developed for herd-season-infrastructure (Goose or WIR) combination, providing a baseline understanding of caribou use of the area within 100 km of the Mine and WIR. Habitat models largely varied in final covariates and complexity, ranging from a simple three-term model for Bathurst caribou in the spring near the Mine (reflecting increased selection of areas with higher NDVI, and lower selection of areas with more wetland type habitat), to complex for Beverly/Ahiak caribou in the spring near the WIR (a 13-term polynomial model, including interaction and non-linear terms).

The large discrepancies between the most supported habitat models for each herd-season-infrastructure combination suggest that there are likely to be other environmental factors shaping caribou habitat use not included in these models. ZOI modelling requires an extremely strong base habitat model to provide a reliable signal of any effect from the expected influential factor (the Mine or WIR in this case), which was not able to be achieved in this analysis with the environmental data available for modelling at this scale near the Mine.

3.9.2.2 ZONE OF INFLUENCE MODELS

Log-likelihood profiles were compared for before and during construction of the Mine (operating and non-operating for the WIR) for each herd-season-infrastructure combination, with the exception of the Beverly/Ahiak herd in summer at the Mine, where there was not enough collar data within proximity to the Mine available during the construction phase to allow model convergence. Likelihood profiles for each combination were highly irregular, with multiple peaks in likelihood precluding identification of natural patterns in use prior to construction of the Mine or operation of the WIR. Similarly, ZOI estimates were not able to be reliably estimated due to poor explanatory power of the base habitat models. Boulanger et al. (2012) states that: “an irregular shaped likelihood curve, or a curve without a peak indicated that other spatial factors were influencing caribou selection relative to the Mine (and which were not already accounted for in the base habitat model).”

While this method was not successful in providing an estimated ZOI with the available data, the WMMP Plan (B2Gold 2024a) includes re-assessment of the potential ZOI every 3 years. With this in mind, new data sources for environmental covariates to improve base habitat models will be investigated. Additionally, new methods beyond those used by Boulanger et al. (2012) will be investigated for potentially improved explanatory power relating to ZOI’s around the Mine for caribou.

3.10 INCIDENTAL OBSERVATIONS

All personnel are responsible for recording wildlife sightings in the camp’s wildlife log (Appendix I). These logs provide an indication of the wildlife species that occur in proximity to and interact with Back River infrastructure, as described in Section 7.3.1.4 of the WMMP Plan (B2Gold 2024a).

Personnel were onsite at the Goose camp and MLA year-round in 2024 (Table 3.10-1). The average daily occupancy at the Goose site throughout the 2024 season was 570 people, with a peak of 799 people in October. At the MLA site, the average was 127 people, with a peak of 166 people in March.

TABLE 3.10-1 AVERAGE NUMBER OF ONSITE PERSONNEL IN 2024

Month	Number of Personnel Onsite	
	MLA	Goose
January	95	426
February	114	499
March	166	329
April	176	525
May	108	510
June	108	590
July	126	633
August	131	723

Month	Number of Personnel Onsite	
	MLA	Goose
September	125	612
October	112	799
November	114	626
December	144	566

3.10.1 METHODS

All personnel at the Back River Mine receive training that includes the requirement to report observations of wildlife occurring around or interacting with the Mine to the Environment Department. Incidental observation reports include location (GPS coordinates), date, time, species, number observed, behaviour, and any other descriptive information regarding the sighting. Incidental observations were also recorded during wildlife regional monitoring programs that were completed in 2024.

Incidental observations were recorded in accordance with and using the data sheet provided in the Incidental Wildlife Observations SOP (B2Gold 2024k).

3.10.2 RESULTS AND DISCUSSION

Caribou observations recorded in the Back River Mine's wildlife logs and during wildlife regional monitoring programs in 2024 are summarized in Table 3.10-2 and Table 3.10-3, respectively, by season and general location. Overall, there were a total of 189 incidental observations of caribou, totaling an estimated 6,832 animals (Appendix I). Caribou were most frequently recorded during post-calving (June 16 to July 20) and summer (July 21 to August 31), with 105 sightings (accounting for 56% of observation events) and 5,061 individuals (74% of individuals observed). It is important to note that this does not suggest 6,832 separate individuals were recorded, as several animals were likely re-sightings.

Caribou observations by onsite personnel in 2024 are provided in Table 3.10-2. In total, onsite personnel observed caribou on 116 separate occasions, with a total estimate of 3,317 individual caribou.

Caribou observations made during wildlife regional monitoring programs in 2024 throughout the RSA are provided in Figure 3.10-1. Overall, there were 73 separate incidental observations of caribou made by biologists during wildlife regional monitoring programs, totaling an estimated 3,515 animals. Caribou were most frequently observed during post-calving (June 16 to July 20) and summer (July 21 to August 31) during regional monitoring, with 29 observation events and 3,208 individuals.

TABLE 3.10-2 SUMMARY OF INCIDENTAL OBSERVATIONS OF CARIBOU RECORDED BY B2GOLD STAFF DURING EACH SEASON IN 2024

Season	Dates	Goose Site		MLA Site		WIR[1]	
		Observation Events	Estimated Number of Individuals	Observation Events	Estimated Number of Individuals	Observation Events	Estimated Number of Individuals
Winter	January 1–April 14[2]	0	0	0	0	20	1,084
Spring Migration	April 15–June 4	3	22	2	15	5	281
Calving	June 5–June 15	1	6	0	0	0	0
Post-Calving	June 16–July 20	28	886	16	62	0	0
Summer	July 21–August 31	11	812	20	92	1	1
Fall Migration	September 1–October 31	1	20	5	33	0	0
Winter	November 1–December 31[3]	0	0	0	0	0	0
Total[4]		**44**	**1,746**	**43**	**202**	**26**	**1,366**

Notes:
[1] Includes both the MLA and Goose forward camps.
[2] The caribou winter season is defined as November 1 to April 14; however, the Back River WMMP reporting year is January 1 to December 31. As a result, only incidental sightings from January 1 to April 14, 2024, are included in this report.
[3] Winter sightings in November and December 2024 are included in this report, but do not cover the entire 2024 to 2025 winter season, as the WMMP reporting year ends on December 31, 2024.
[4] The total number of observation events and estimated number of individuals does not include three observation events (three animals) where a date was not recorded.

TABLE 3.10-3 SUMMARY OF INCIDENTAL OBSERVATIONS OF CARIBOU RECORDED BY BIOLOGISTS COMPLETING REGIONAL MONITORING PROGRAMS DURING EACH SEASON IN 2024

Season	Dates	Goose Site		MLA Site		WIR[1]	
		Observation Events	Estimated Number of Individuals	Observation Events	Estimated Number of Individuals	Observation Events	Estimated Number of Individuals
Winter	January 1–April 14[2]	0	0	0	0	0	0
Spring Migration	April 15–June 4	3	26	6	28	0	0
Calving	June 5–June 15	0	0	0	0	0	0
Post-Calving	June 16–July 20[3]	6	2,153	21	54	0	0
Summer	July 21–August 31	2	1,001	0	0	0	0
Fall Migration	September 1–October 31	27	221	8	32	0	0
Winter	November 1–December 31[4]	0	0	0	0	0	0
Total		**38**	**3,401**	**35**	**114**	**0**	**0**

Notes:
[1] Includes both the MLA and Goose forward camps.
[2] The caribou winter season is defined as November 1 to April 14; however, the Back River WMMP reporting year is January 1 to December 31. As a result, only incidental sightings from January 1 to April 14, 2024, are included in this report.
[3] The majority of sightings of caribou during the post-calving season at both MLA and Goose occurred on July 20, 2024, accounting for 2,151 individuals, or 97% of caribou observations.
[4] Winter sightings in November and December 2024 are included in this report, but do not cover the entire 2024 to 2025 winter season, as the WMMP reporting year ends on December 31, 2024.

The estimated number of individuals does not indicate the exact number of individual animals present, as general estimates were given for large groups and animals may have been observed on more than one occasion. Observation events from both the MLA Forward Camp (KM 100) and Goose Forward Camp (KM 30), both located along the WIR, were included under the totals for the WIR. Additionally, the 2024 incidental sightings reported in this section do not include 51 sightings recorded by wildlife monitors along the WIR, as these are described in Section 3.3.2.1.

Incidental observations of caribou were most common at Goose, with 85 sightings (accounting for 45% of observation events) and 5,150 individuals (75% of individuals observed). Observations of caribou at Goose were made during all seasons, except winter. Group size ranged from 1 to 1,800, but most observations were with group sizes of 20 or less (87% of observations).

Caribou were observed near the MLA 78 times (316 animals), with observations mainly made during post-calving and summer season (73% of observations). Group sizes ranged from 1 to 14, with 74% (n=58) of these observations being made of 5 or fewer caribou. Although observations of caribou at the MLA accounted for 41% of observation events, the number of individuals observed only represented 5% of total caribou observed.

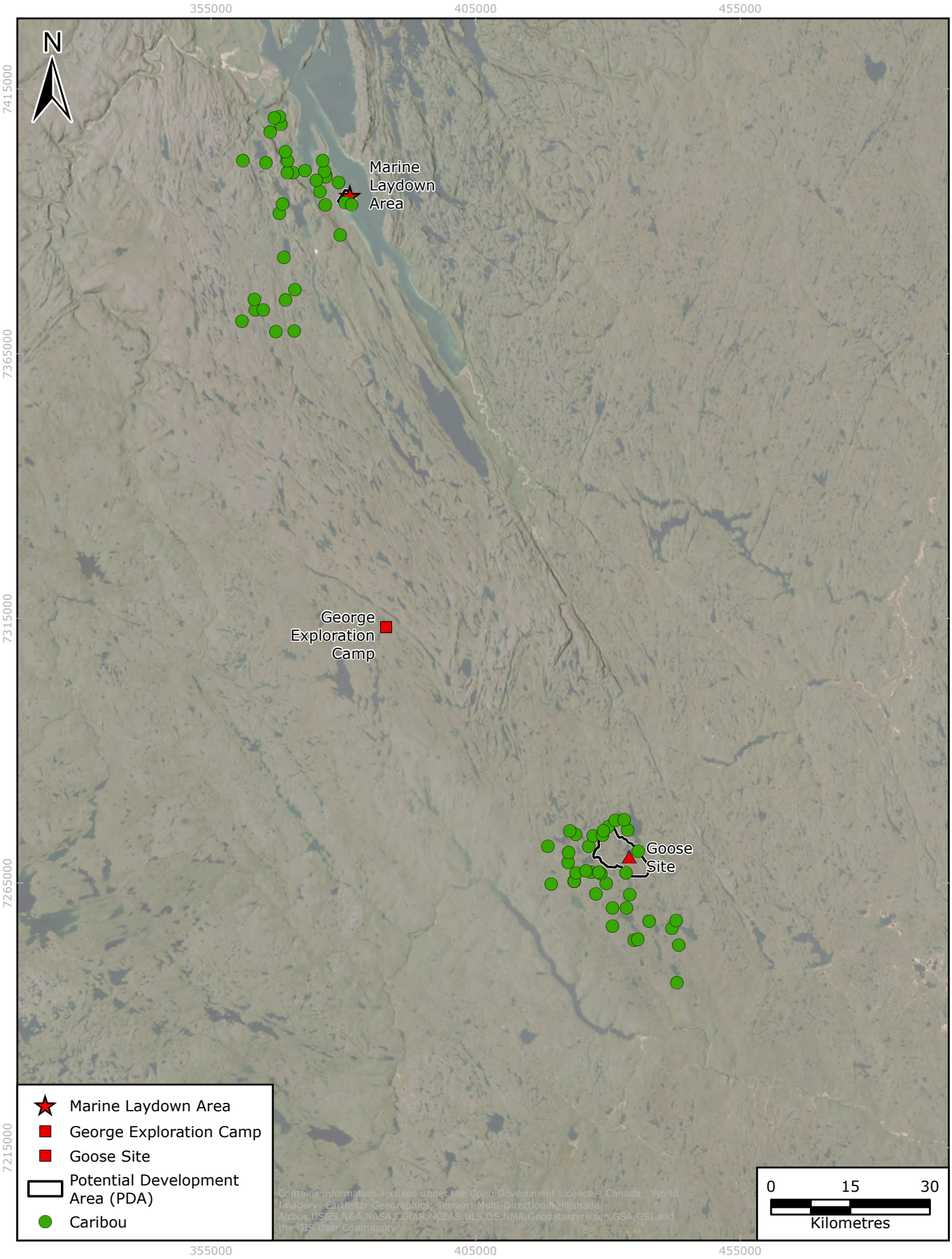
Caribou were observed along the WIR 26 times by B2Gold Nunavut staff (1,366 animals), with 25 observation events made between March 27 to April 25 while the WIR was operational, and one observation event made at the Goose Forward Camp on August 24. Group sizes ranged from 1 to 300, with 73% (n=19) of these observations being made of groups of 50 or less caribou.

During the winter season in 2024, there were 20 sightings of caribou recorded between March 27 and April 14. All of these sightings occurred along the WIR (Figure 3.10-1). The largest group of caribou observed during the winter was recorded on April 14, when a group of 300 animals was observed near P27 of the WIR (Figure 3.10-1). Additional sightings during winter along the WIR made by dedicated biologists monitoring the WIR for caribou are not included in this section and are summarized in Section 3.3.2.1.

During spring migration, there were 19 sightings of caribou between April 17 and May 29, six of which were observed from Goose, eight from MLA, and the remaining five from WIR. The largest group of caribou observed during spring migration was of approximately 150 animals, observed at the saddle along the WIR on April 21, 2024. Additional sightings during the spring migration were recorded along the WIR by the dedicated caribou biologists and are reported in Section 3.3.2.1.

During the calving season, there was one sighting of six caribou near Goose Camp on June 6. During the post-calving season, there were 71 caribou sightings of 3,155 caribou, with 54% (n=38) of the sightings being of individual caribou. The remaining 33 sightings were of group sizes between 1 and 1,800 animals, with the largest group (1,800 animals) observed on July 20, 2024. All groups between 50 to 1,800 caribou were observed at the end of the post-calving season between July 19 and July 20. Observations were made relatively equally at Goose (48% of observations) and the MLA (52% of observations).

FIGURE 3.10-1 INCIDENTAL OBSERVATIONS OF CARIBOU, 2024



ERM

CLIENT: B2Gold
GIS NUMBER: BAC-23-655-03

DATE: 27 February 2025

PROJECTION: NAD 1983 UTM Zone 13N
SCALE: 1:1,000,000 when printed at 8.5x11

During the summer, there were a total of 34 caribou sightings. At the MLA, there were 20 sightings during the summer of 92 caribou between August 8 and August 28, the largest group composed of 10 animals, observed on August 9. At Goose, there were 13 sightings of 1,813 caribou at Goose between July 21 and August 26, with the largest group being estimated at 1,000 caribou on July 21, 2024. Along the WIR, there was one observation of a single caribou at Goose Forward Camp.

During fall migration, there were 41 sightings of caribou. At Goose, there were 28 caribou sightings with 241 individuals between September 5 and October 6, with the largest group (50 animals) observed on September 7. At the MLA, there were 13 observations of 65 individuals from September 5 to October 6.

There were an additional three sightings of a single caribou made by onsite personnel; however, no dates were recorded for these sightings. Two of these sightings were near lower camp at Goose, and one of the sightings was at Major at Goose.

A higher number of incidental observations were made in 2024 compared to previous years (2018 to 2023; Table 3.10-2); however, fewer animals were recorded in 2024 compared to 2023 (Table 3.10-4). The elevated number of observation events and individuals in 2023 can be attributed to more consistent presence of staff onsite throughout the year. In addition, effort in recording incidental sightings increased in 2024 based on feedback from previous years, resulting in improved compliance from all staff with reporting expectations.

Between 2018 and 2024, winter and summer are the only seasons when caribou are consistently observed by mine personnel (at the MLA or Goose site; Figure 3.10-2). During the calving season (June 5 to June 15) in 2024, one group of six caribou were observed travelling past Goose on June 6. No caribou were observed during the calving season in 2018, 2020, and 2021. All caribou observed during the calving season in 2019 (four observation events), 2022 (one observation event of nine individuals), and 2023 (one observation event of one individual) were between 1 and 4 km from Goose camp. Although the sightings of caribou in 2019 were of large groups (greater than 100 or greater than 1,000), they were actively travelling past the area (presumably migrating to the calving area). The incidental observations made from 2018 to 2024 support that the Back River Mine does not overlap with the calving grounds.

FIGURE 3.10-2 NUMBER OF INCIDENTAL OBSERVATIONS OF CARIBOU BY SEASON, 2018 TO 2024

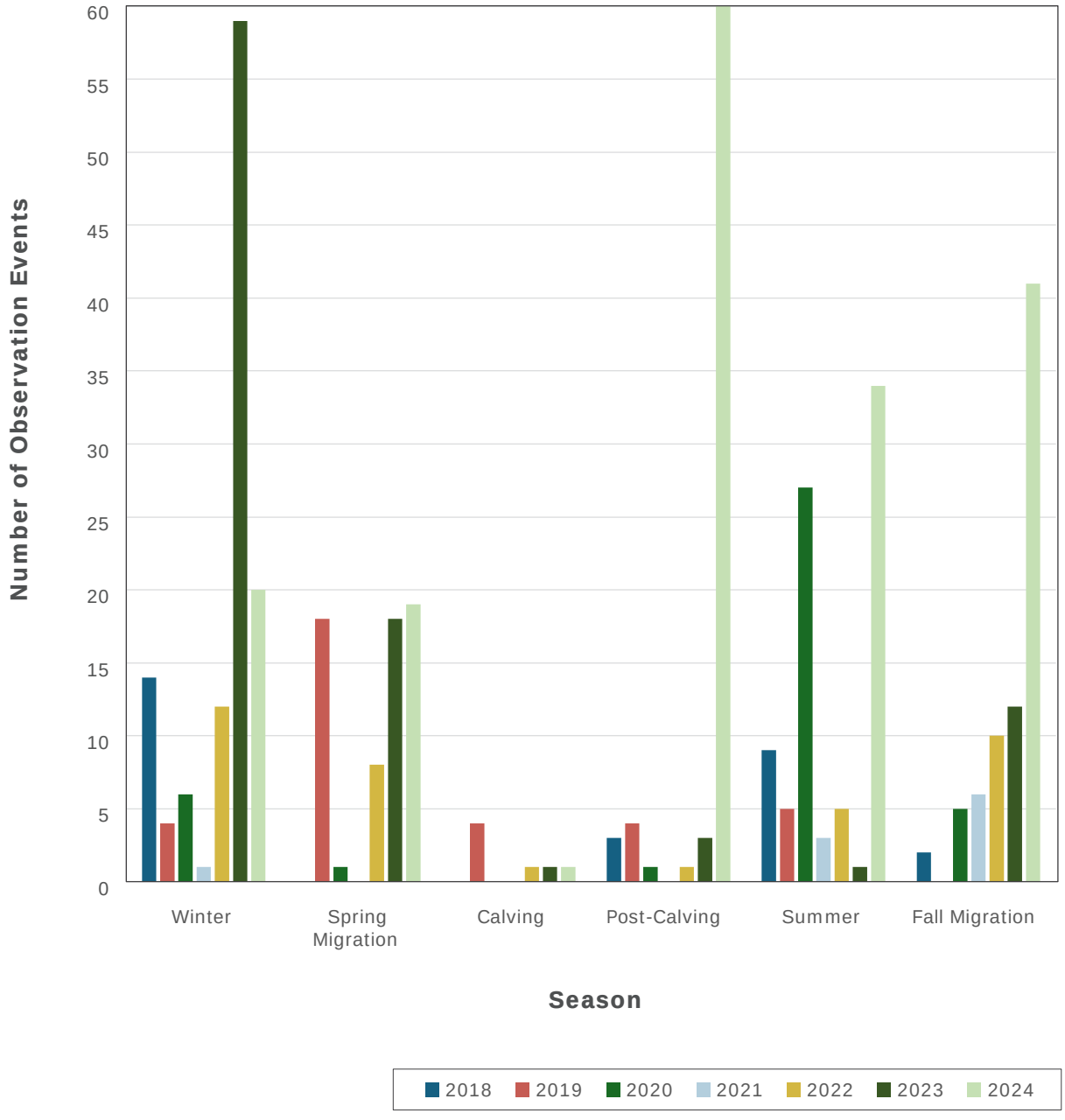


TABLE 3.10-4 SUMMARY OF INCIDENTAL OBSERVATIONS OF CARIBOU DURING EACH SEASON BY B2GOLD STAFF, 2018 TO 2024

Season	Number of Sightings							Estimated Number of Individuals						
	2018	2019	2020	2021	2022	2023	2024[1]	2018	2019	2020	2021	2022	2023	2024[1]
Winter	14	4	6	1	12	59	20	1,603	252	21	1	1510	25,953	1,084
Spring Migration	0	18	1	0	8	18	19	0	13,310	2	0	950	9,511	372
Calving	0	4	0	0	1	1	1	0	1,400	0	0	9	1	6
Post-Calving	3	4	1	0	1	3	71	7	7	1	0	1	3	3,122
Summer	9	5	27	3	5	1	34	128	7	3,071	157	261	1	1,906
Fall Migration	2	0	5	6	10	12	41	21	0	16	918	939	41	306
Total	**28**	**35**	**40**	**10**	**37**	**94**	**186**	**1,759**	**14,976**	**3,111**	**1,076**	**3,670**	**27,510**	**6,829**

Note:
[1] The total number of observation events and estimated number of individuals does not include three observation events (three animals) where a date was not recorded.