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Chair
Environmental Monitoring Advisory Board
5006 Franklin, Room 204
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James Hodson
Manager, Environmental Assessment and Habitat
Environment and Natural Resources - GNWT
PO Box 1320
Yellowknife, NT X1A 2L9

31 March 2021

Re: Diavik 2020 Wildlife Monitoring Report

Attached is an electronic copy of the 2020 Wildlife Monitoring Program Report for Diavik Diamond Mines (2012) Inc. (DDMI). This report summarizes work performed under DDMI's Wildlife Research (Monitoring) Permit during 2020. Included as appendices are DDMI's responses to comments from the Environmental Monitoring Advisory Board (EMAB) and the Government of Northwest Territories – Department of Environment and Natural Resources on the 2019 Wildlife Monitoring Report (see Appendices A and B), and a monitoring report on rough-legged hawk nesting success at the A21 open pit in 2020 (see Appendix P).

DDMI requests that you review these documents and provide comments and recommendations by May 31, 2021. DDMI will provide responses by July 31, 2021. If you have any questions regarding the above, please contact the undersigned or Kyla Gray (kyla.gray@riotinto.com) at your convenience.

Yours sincerely,

Kofi Boa-Antwi
Superintendent, Environment

Attachment: 2020 Wildlife Monitoring Report

REPORT

2020 Wildlife Management and Monitoring Report

Diavik Diamond Mine

Submitted to:

Diavik Diamond Mines (2012) Inc.

PO Box 2498
300-5201 50th Avenue
Yellowknife, NT 1XA 2P8

Attention: Kofi Boa-Antwi, Superintendent Environment

Submitted by:

Golder Associates Ltd.

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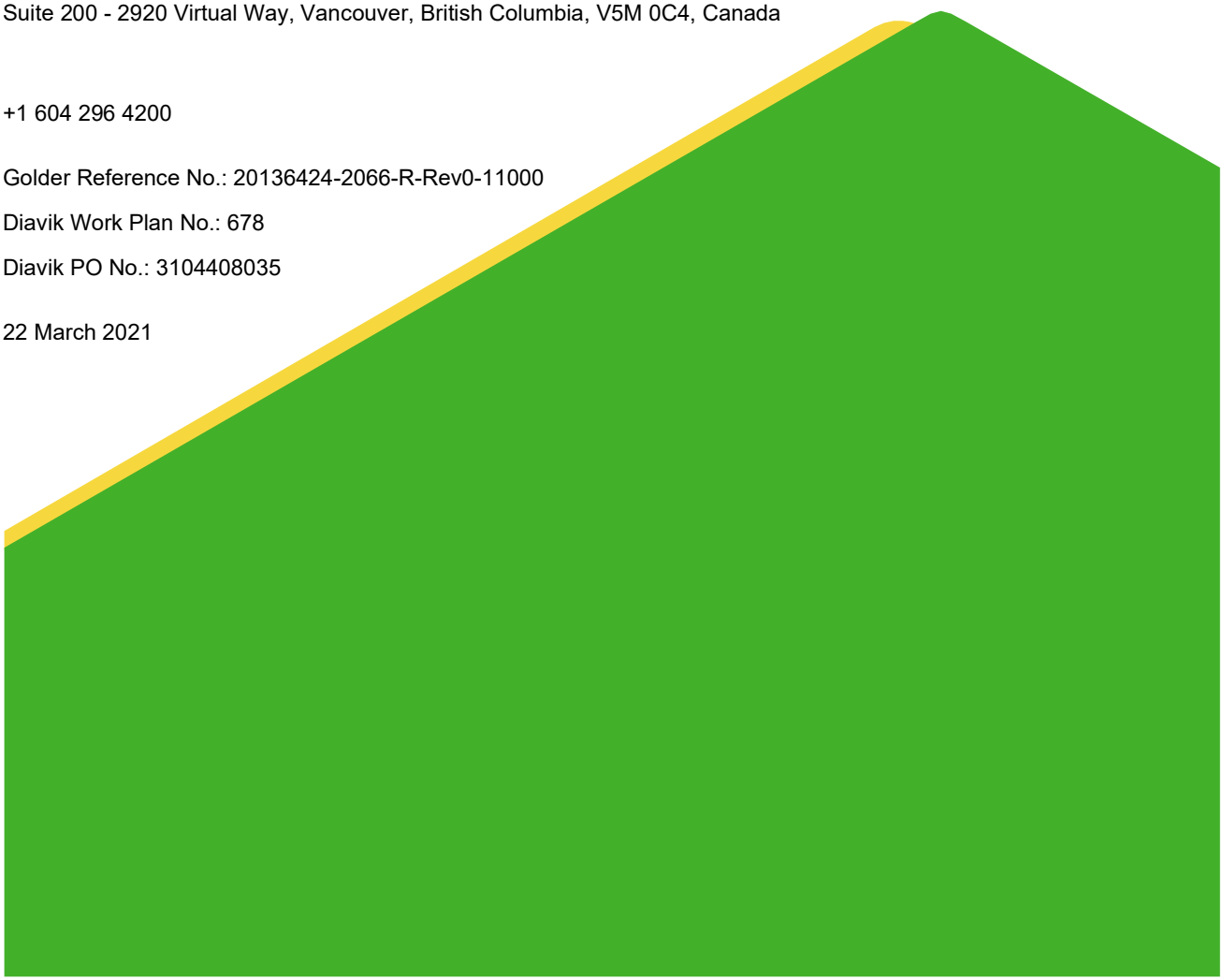
Golder Reference No.: 20136424-2066-R-Rev0-11000

Diavik Work Plan No.: 678

Diavik PO No.: 3104408035

22 March 2021



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Executive Summary

The Diavik Diamond Mine (Mine) is located on an island in Lac de Gras, Northwest Territories. As a requirement of the Environmental Agreement, Diavik Diamond Mines (2012) Inc. (DDMI or Diavik) has completed a Wildlife Monitoring Program (WMP) report each year since 2002. In 2019, the Government of the Northwest Territories (GNWT) issued guidelines for the development of a Wildlife Management and Monitoring Plan (WMMP) (GNWT-ENR 2019). Diavik prepared and submitted a WMMP to the GNWT in July 2020 (DDMI 2020a) in accordance with these guidelines, compliance with the Environmental Agreement, and the fundamental aspects of site monitoring and mitigation previously established and accepted in the WMP. This Wildlife Management and Monitoring Report (WMMR) aligns with the components and objectives of the WMMP, which consider wildlife issues of concern identified by communities and regulatory agencies. The WMMR provides the analysis and reporting of data collected using the methods described for wildlife valued ecosystem components and other wildlife in the WMMP (DDMI 2020a).

The objective of the WMMR is to collect and analyze information that will assist in determining if there are effects on wildlife in the study area and if these effects were accurately predicted in the Environmental Effects Report (EER). The WMMR also collects data to determine the effectiveness of site-specific mitigation practices and the need for any modifications through adaptive management. The following report documents the data collected and associated results for 2020. Where helpful, comparisons to the information gathered during the previous monitoring (2000 to 2019) and the pre-construction baseline (June 1995 to August 1997) have been included.

General observations for each program include the following.

Landscape Changes

- In 2020, the Mine footprint increased by 0.16 square kilometres (km^2). The total loss of terrestrial and aquatic habitats to date from mining activities (11.41 km^2) is below that predicted in the EER. The current footprint is expected to be at its maximum now for operations, with the exception of the South Country Rock Pile. The footprint may expand slightly during progressive reclamation activities on the North Country Rock Pile.

Barren-Ground Caribou

- The total caribou summer habitat loss to date is 2.81 habitat units, which remains below the prediction made in the EER.
- Caribou aerial surveys were not required or completed in 2020. Indications from the 2021 Slave Geological Province Wildlife Workshop were that aerial surveys of caribou can be discontinued as part of the annual WMMR.
- Thirty-three ground-based caribou behavioural scanning observations were completed in 2020. Observations occurred mostly during winter from 0 to 15 km from Mine infrastructure. Diavik will continue to monitor caribou behaviour in 2021.
- There were no Mine-related caribou injuries or mortalities reported in 2020.

- During 2020, the caribou traffic advisory remained at “No Advisory” for the entire year. There were four instances where greater than 100 caribou were observed at one time; however, these sightings were not on or immediately adjacent to the Mine site.
- There was no action taken to deter caribou away from potential hazards in 2020.

Grizzly Bear

- The total direct grizzly bear habitat loss to date is 8.20 km^2, which is below the amount predicted in the EER.
- The grizzly bear hair snagging program occurred in 2012 and 2013, was not undertaken from 2014 through 2016, and was last completed in 2017. Diavik completed this program in collaboration with Dominion Diamond Mines who operate the Ekati mine. Data analysis indicated that there have been no negative effects from the mines on the regional population of grizzly bears in the Slave Geological Province (grizzly bear populations are stable or increasing). Program partners at the Slave Geological Provincial Wildlife Workshop agreed that the grizzly bear hair snagging program will no longer be completed.
- In 2020, 95 reported instances of grizzly bears were recorded on East Island from 28 April to 26 October. Of these, 50 required deterrent actions and 45 did not require deterrent actions. There were two grizzly bear mortalities and one relocation event in 2020.

Wolverine

- One round of snow track surveys was completed in 2020. Due to the COVID-19 pandemic, the second round of snow track surveys was cancelled.
- A total of 21 wolverine tracks were detected at 12 of 40 transects (30% occurrence) during one sampling visit in 2020. The number of wolverine tracks identified at a transect ranged from 0 to 3 individuals. The average number of tracks per km per day once adjusted for weather variables was similar to previous years, suggesting wolverine occurrence remains constant.

  The wolverine hair snagging program was not completed in 2020. Program partners at the Slave Geological Provincial Wildlife Workshop agreed that the wolverine hair snagging program will no longer be completed.
- There was one wolverine relocation and no mortalities in 2020.

Raptors

- In 2020, regional raptor nest monitoring surveys were completed by ENR. DDMI assisted with the 2020 program by covering fuel, aircraft rental and consultant fees (total cost $16,745). These surveys are planned to take place every five years, with the next survey scheduled for 2025. The results of the 2020 nest monitoring survey are included in a regional database that is managed by ENR.
- A total of 55 Pit Wall/infrastructure inspections were completed from 9 May until 5 September 2020 to determine use by raptors. During the inspections, one rough-legged hawk nest was confirmed at the A21 pit. Common raven nested at the Site Services Line Up Area. There were also two potential, but unconfirmed, nesting sites for peregrine falcon at A418 and the Site Services Line Up Area, and one potential nesting site for rough-legged hawk at A154.
- One raptor mortality of unknown cause occurred at the Mine in 2020. No other incidents involving raptors were reported at the Mine in 2020.

Waste Management

- In 2020, waste inspections at the Waste Transfer Area (WTA), Landfill, Underground waste bins, and A21 were completed twice per week during the winter and once per week in the summer. During inspections staff identified and removed any improperly disposed waste and recorded all sign of wildlife and activity. Based on the results of inspections, workers are educated on waste management practices as part of adaptive management.
- Throughout 2020, 9,700 units of aluminium containers and 11,700 units of plastic containers were recycled, and the total monetary value ($2,140) was donated to charity. Copper wire was salvaged at the Mine in 2019 with an approximate value of $94,000 and donated in 2020 to the Yellowknife Women's Shelter.
- During 2020, a total of 139,278 litres of waste oil were collected and burned in waste oil heat-generating boilers.
- In 2020, the wind farm generated approximately 19,292.4 megawatt hours (MWh) of power, which represents an estimated diesel savings of 4.7 million litres.

Study Limitations

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Table of Contents

TABLES

FIGURES

APPENDICES

APPENDIX K
Wolverine Snow Track Survey Results 2020

APPENDIX L
Wolverine Incidental Observations Summary 2020

APPENDIX M
Pit Wall / Mine Infrastructure Raptor Survey Results 2020Camp Population

APPENDIX N
Camp Population

APPENDIX O
Waste Inspection Summary

APPENDIX P
Monitoring Report on Rough-Legged Hawk Nest in A21 Open Pit

1.0 INTRODUCTION

1.1 Background

Diavik Diamond Mines (2012) Inc. (DDMI or Diavik) completed wildlife baseline studies from 1995 to 1997. The information was used to describe ecological conditions in the Lac de Gras area in support of the Project Description and Environmental Assessment (DDMI 1998a,b). A Wildlife Monitoring Program (WMP) was developed as part of the Environmental Agreement for the Diavik Diamond Mine (Mine; DDMI 2002). Documents that were used in developing the WMP include the following:

- Comprehensive Study Report, Diavik Diamonds Project (The *Canadian Environmental Assessment Act* 1999)
- Environmental Assessment Overview, Diavik Diamonds Project (DDMI 1998c)
- Environmental Effects Report (EER), Wildlife, Diavik Diamonds Project (DDMI 1998b)
- Wildlife Baseline Report, Diavik Diamonds Project (Penner 1998)

Monitoring by DDMI during construction and operation of the Mine has been used to test impact predictions in the EER (DDMI 1998a,b), evaluate the effectiveness of mitigation, and provide feedback for adaptive management. In 2019, the Government of the Northwest Territories (GNWT) issued guidelines for the development of a Wildlife Management and Monitoring Plan (WMMP) (GNWT-ENR 2019). Diavik prepared and submitted a WMMP to the GNWT in July 2020 (DDMI 2020a) in accordance with these guidelines, compliance with the Environmental Agreement, and the fundamental aspects of monitoring and mitigation previously established and accepted in the WMP. This Wildlife Management and Monitoring Report (WMMR) aligns with the components and objectives of the WMMP, which consider wildlife issues of concern identified by communities and regulatory agencies. The WMMR provides the analysis and reporting of data collected using the objectives and methods described for wildlife valued ecosystem components (VECs) and other wildlife in the WMMP (DDMI 2020a).

Based on reviews and discussions among DDMI, communities, and regulators, the WMMR has evolved under the principles of adaptive management since the original design of the WMP in response to trends observed in the data and changes to objectives, study designs, and methods. Rationale for changes were based on the effectiveness of data to test effects predictions, community concerns, adaptive management principles, and the establishment of regional monitoring programs. Further, community site visits occur annually and provide community members an opportunity to observe Mine operations. Due to the COVID-19 pandemic in 2020, community visits were not completed.

Due to the large degree of natural variation inherent in ecosystems, it is often difficult to detect indirect effects with only one or two years of data. Therefore, a more comprehensive analysis and discussion of all data from the WMMR has been completed every three years and submitted as a separate report. Separate reporting began in 2004 following requests for more formal statistical analysis of monitoring data by the Environmental Monitoring Advisory Board (EMAB) (EMAB 2004) and ENR (ENR 2004).

Since 2010, WMMR studies for caribou, grizzly bear, and falcons have been suspended or removed through adaptive management and with consensus among communities, regulators, mine operators, and monitoring agencies after review of these programs at wildlife monitoring workshops (Marshall 2009; Handley 2010). The Slave Geological Provincial Wildlife Monitoring Workshop hosted by the GNWT on 2 and 3 of February 2021 determined that the grizzly bear and wolverine hair snagging and caribou behaviour monitoring programs should be discontinued. However, DDMI will continue to monitor caribou behaviour in 2021 and engage with communities and EMAB to discuss future monitoring of caribou behaviour. Discontinuation through adaptive management precludes the need to complete statistical analyses. In 2014, waterfowl monitoring was discontinued following review and agreement by Environment and Climate Change Canada (EC 2013). Of the studies completed in the most recent two comprehensive analysis reports in 2017 and 2014, the wolverine snow track monitoring is the only program at site that remains active and evaluates regional EER predictions. Based on the principles of adaptive management, DDMI no longer completes an independent comprehensive analysis report for wildlife. Instead, all comprehensive statistical analyses related to active monitoring programs are included every three years in the annual WMMR. The last comprehensive analysis report was completed in 2020 (Golder 2020a) and the next is scheduled for 2023. For the intermediate years, the annual reports present findings from that year, and summarize cumulative data collected up to that year. If critical issues become apparent in the shorter term, then a discussion of these issues is presented in annual reports. At the request of the EMAB in 2018 (EMAB 2018), a section on Traditional Knowledge related to wildlife has been added to the WMMR (Section 2.0).

1.2 Objectives

The overall objectives of the WMMR are to:

- Collect information that will assist DDMI to determine if there are effects on wildlife and if these effects were accurately predicted in the EER.
- Determine the effectiveness of mitigation practices intended to avoid and limit Mine-related effects on wildlife and whether or not these practices and policies require modification.
- Detect effects that were not predicted in the EER.

Objectives specific to wildlife VECs are presented in the following sections.

1.3 Study Area

The Mine is located on East Island in Lac de Gras (Figure 1). The wildlife study area is 1,200 square kilometres (km^2) and includes the East and West islands, aquatic habitats, many smaller islands in the northeast portion of Lac de Gras, and the mainland along the southern, eastern, and northern shores of Lac de Gras. An extension to the northwest was made to include the Lac du Sauvage narrows, an important caribou migration corridor (Penner 1998). The local study area during baseline studies (Penner 1998) covered approximately 805 km^2.

The Mine includes accommodation facilities, operations buildings, haul roads, an airstrip, country rock piles, the A154 and A418 pits and dikes, and A21 dike, and all other infrastructure (Figure 2). In 2012, the Mine was expanded to include the wind farm and access roads to the wind farm. The majority of haul roads required for mining activities are complete. The current footprint is expected to be at its maximum now for operations, with the exception of the South Country Rock Pile. The footprint may expand slightly during closure activities.

1.4 Report Organization

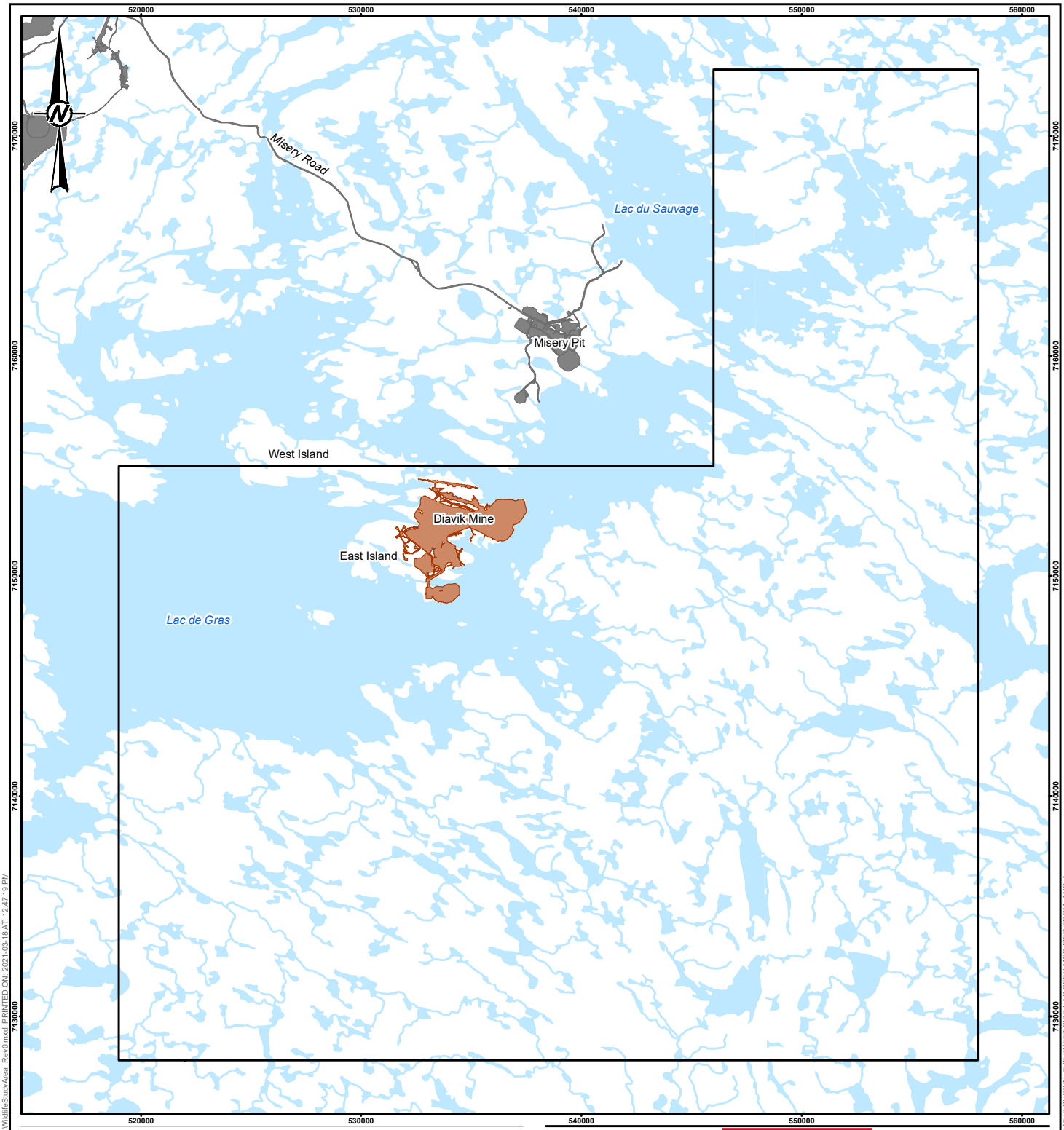
Within each section of this report, data are presented that will be tracked over the life of the Mine. Recommendations for changes to the WMMR based on adaptive management are presented at the end of each section for consideration and may be incorporated into the WMMR for subsequent years. The WMMR is an evolving program that reflects recommendations during previous years, as well as advances in Mine development. Changes will be captured in annual revisions of the WMMR.

The EMAB is an arm's length organization that reviews the WMMR report annually and provides comments and recommendations to DDMI (EMAB 2020, Appendix A). Golder provided responses to EMAB comments on the 2019 WMP report in August 2020 (Golder 2020b; Appendix A). None of the comments made by EMAB resulted in a change to the 2020 WMMR.

The GNWT also provided comments and recommendations to DDMI. Golder provided responses to the GNWT comments on the 2019 WMP report in February 2021 (Golder 2021; Appendix B). The GNWT recommended clarifying language around monitoring objectives versus impact predictions. These changes have been made in this report (Table 1).

Table 1: DDMI Responses to 2019 WMP Report Comments by the GNWT

GNWT Recommendation	DDMI Response	WMMP Section
"The revised impact prediction from Handley (2010) is: ■ To determine if caribou behaviour changes with distance from the mines" This is not an impact prediction, it is a monitoring objective. Clarify what the impact prediction is for changes to caribou behaviour either from the EER (DDMI 1998b) or Handley (2010).	DDMI agrees these are objectives based on Handley (2010). An explicit prediction for caribou behaviour (activity budgets was not presented in the EER (DDMI 1998b). These data have been collected to fill an information gap on the response by caribou to human-caused disturbances (Golder 2010). Future WMMP reports will identify this as a monitoring objective per Handley (2010).	Section 4.3
The "revised impact predictions presented in Handley (2010)" are monitoring objectives, not impact predictions. Revise text in future annual reports to clarify that these are monitoring objectives, not impact predictions.	DDMI agrees these are objectives based on Handley (2010) and not EER predictions and will revise future WMMP reports to identify them as the monitoring objective.	Sections 4.2, 4.3, 5.2, 6.2, 7.0



LEGEND

- DIAVIK WILDLIFE STUDY AREA BOUNDARY
- DIAVIK FOOTPRINT
- EKATI FOOTPRINT
- WATERCOURSE
- WATERBODY

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REFERENCE(S)

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PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

RioTinto

PROJECT

DIAVIK DIAMOND MINES INC.

TITLE

DIAVIK WILDLIFE STUDY AREA, 2020

CONSULTANT

GOLDER

YYYY-MM-DD	2021-03-18
DESIGNED	DC
PREPARED	ANK
REVIEWED	TS
APPROVED	JV

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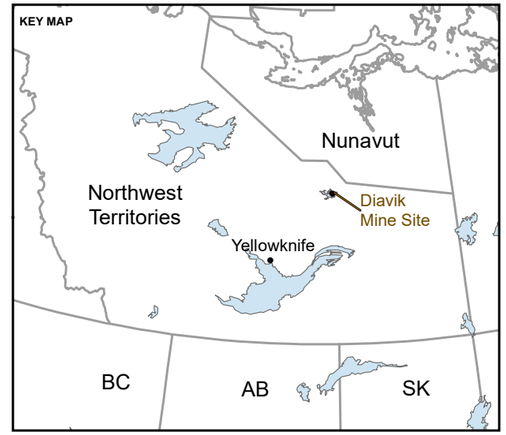
LEGEND

- INFRASTRUCTURE

KEY MAP



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CLIENT

Rio Tinto

PROJECT

DIAVIK DIAMOND MINES INC.

TITLE

DIAVIK MINE SITE INFRASTRUCTURE, 2020

CONSULTANT

GOLDER

YYYY-MM-DD	2021-03-18
DESIGNED	DC
PREPARED	ANK
REVIEWED	TS
APPROVED	JV

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2.0 COMMUNITY ENGAGEMENT AND TRADITIONAL KNOWLEDGE

Diavik engages with local Aboriginal communities and values community feedback and insights about how Diavik operates the Mine and monitors the environment or may be affecting the environment. As part of their commitment to the environment, Diavik incorporates available Traditional Knowledge in environmental plans and monitoring programs. For Diavik's WMMR, Traditional Knowledge has been incorporated through:

- study design
- wildlife ecology and the interpretation of monitoring results
- community participation with data collection

Incorporation of Traditional Knowledge into study design of monitoring programs has occurred for caribou habitat, grizzly bear, and wolverine. For caribou, Diavik and the Tłı̨chǫ Government carried out a Traditional Knowledge study in the summer of 2013 through a series of workshops and site visits where four participating elders from Tłı̨chǫ and Lutsel K'e shared stories and knowledge about caribou migration, preferred habitats (vegetation communities and landscape features), and traditional land use (Tłı̨chǫ Government 2013). The guidance provided by the elders resulted in selection of specific sampling sites for the vegetation and lichen monitoring program that were appropriate for caribou use. In addition to influencing the study design, Traditional Knowledge shared in this study has also been considered in the interpretation of monitoring results (see Appendix I of Golder 2017a). Elders in the 2013 Traditional Knowledge study noted that caribou will avoid using the areas close to the Mine during migration because dust on forage will alter its taste or smell. Traditional knowledge has also been incorporated into the caribou scan surveys through means of a questionnaire. When elders are present, observed caribou are commented on from an animal health and traditional use perspective.

In 2012, the Diavik and Ekati mines collaborated on a new regional scale grizzly bear monitoring program because past mine-specific monitoring programs yielded inconclusive results from highly variable data (Handley 2010). The regional grizzly bear program involved hair snagging methods and included Traditional Knowledge holders to determine the best locations for hair snagging devices (Section 5; ERM 2014). From 2003 to 2006, the study design and data collection for wolverine snow track monitoring was based on the experience of Inuit Qaujimajatuqangit to locate transects and record wolverine snow tracks (Section 6).

Diavik's Traditional Knowledge Panel provides recommendations to Diavik; however, all planned community participation was cancelled in 2020 due to COVID-19 safety restrictions. Communities have participated in a variety of programs over the history of monitoring by Diavik (e.g., Golder 2018) and this has been documented in past reports. The WMMR is anticipated to evolve as Diavik receives input through community engagement, regulatory workshops, site visits, and Traditional Knowledge studies.

3.0 LANDSCAPE CHANGES

The scope of the landscape component of the WMMR is to determine if vegetation and surface water loss are within the magnitude or amounts predicted in the EER (DDMI 1998b). East Island vegetation cover is predominantly characterized by heath tundra, and tussock / hummock landscape classes, but Mine construction and operation have also resulted in the loss of shallow and deep water. The main change from the Mine on the landscape is direct disturbance, which will be a long-term effect as the recovery of vegetation is slow in arctic environments (Burt 1997).

Diavik conducts ongoing monitoring to determine if dust from the Mine is affecting vegetation communities, and lichen and soil chemistry. Permanent vegetation plots are assessed for plant species cover (relative abundance) and richness at Mine and reference sites. Metals concentrations are analyzed in lichen and soil samples near and far from the Mine. A Comprehensive Vegetation and Lichen Analysis Report was generated every three years, which was last completed in January 2017 (Golder 2017b); however, the frequency of vegetation monitoring was recommended to increase from three to five years (i.e., next cycle in 2021) because dustfall since 2016 has not exceeded a trigger determined from reference sites.

The objective of this component of the WMMR is to:

- Determine if direct vegetation/habitat loss due to the Mine footprint exceeds the prediction of 12.67 km^2.

3.1 Methods

A satellite image was obtained and used to update the area of the current Mine footprint. The image was laid over the Ecological Landscape Classification (ELC) developed by the Department of Environment and Natural Resources, Government of the Northwest Territories (ENR) (Matthews et al. 2001). Each ELC type disturbed by the Mine was selected and calculations were made to determine the area (km^2) of each habitat type replaced by the Mine footprint. Values provided for ELC unit loss are estimates based on the predicted Mine extent (DDMI 1998a), the actual Mine footprint, and the ELC classification (Matthews et al. 2001). Portions of terrestrial habitat within the Mine footprint have remained as physically undisturbed residual areas (e.g., tundra areas) since construction and through the end of 2020. As such, these residual undisturbed areas were removed from the total Mine footprint calculations for the landscape changes analysis. Historical data summaries by year were also modified to reflect actual footprint calculations.

3.2 Results

As of December 2020, a total area of 11.41 km^2 has been altered since Mine construction in 2000. This represents a relative loss of 90.0% of the predicted landscape disturbance (DDMI 1998a). Land cover types at or slightly exceeding the predicted loss include riparian shrub, birch seep and shrub, boulder complex, disturbed, and esker (Table 2). In 2020, the ELC types that changed included heath tundra (0.06 $km^{2)}$, heath boulder (0.02 km^2), health bedrock (0.02 km^2), tussock/hummock (0.03 km^2), birch seep and shrub (0.01 km^2), shallow water (0.01 km^2), and deep water (0.01 km^2). The increase in deep water is associated with disturbance of a wetland during 2020 development of the South Country Rock Pile (Figure 3). The South Country Rock Pile and North Country Rock Pile will increase due to operation and reclamation activities, respectively. However, the remainder of the footprint is not expected to increase during operation and remain at or below the prediction. The annual geographic extent of landscape disturbed from the Mine footprint is illustrated in Figure 3.

Table 2: Total and Predicted Ecological Landscape Classification Unit Loss (km^2) Associated with Mine Development Phases, 2000 to 2020

ELC Type	Construction and Open Pit Mining (2000 to 2005)	Open Pit Mining (2006 to 2009)	Underground Mining (2010 to 2016)	A21 Pit Development (2017 to 2020)[c]	Predicted[d]
Heath Tundra	2.60	2.94	3.28	3.58	3.68
Heath Bedrock (30% to 80%)	0.45	0.56	0.61	0.63	0.78
Health Boulder (30% to 80%)	1.06	1.47	1.64	1.73	1.89
Tussock/Hummock	1.19	1.41	1.50	1.58	1.64
Sedge Wetland	0.16	0.21	0.22	0.24	0.26
Riparian Shrub	0.03	0.03	0.03	0.04	0.03
Birch Seep and Shrub	0.08	0.09	0.10	0.11	0.11
Boulder Complex	0.03	0.04	0.05	0.05	0.05
Bedrock Complex	0.05	0.06	0.06	0.06	0.07
Esker Complex	0.17	0.17	0.17	0.17	0.16
Disturbed[b]	0.05	0.06	0.06	0.06	0.06
Shallow Water	0.29	0.34	0.40	0.44	0.48
Deep Water	1.93	2.12	2.63	2.71	3.46
Total[a]	**8.10**	**9.50**	**10.75**	**11.41**	**12.67**

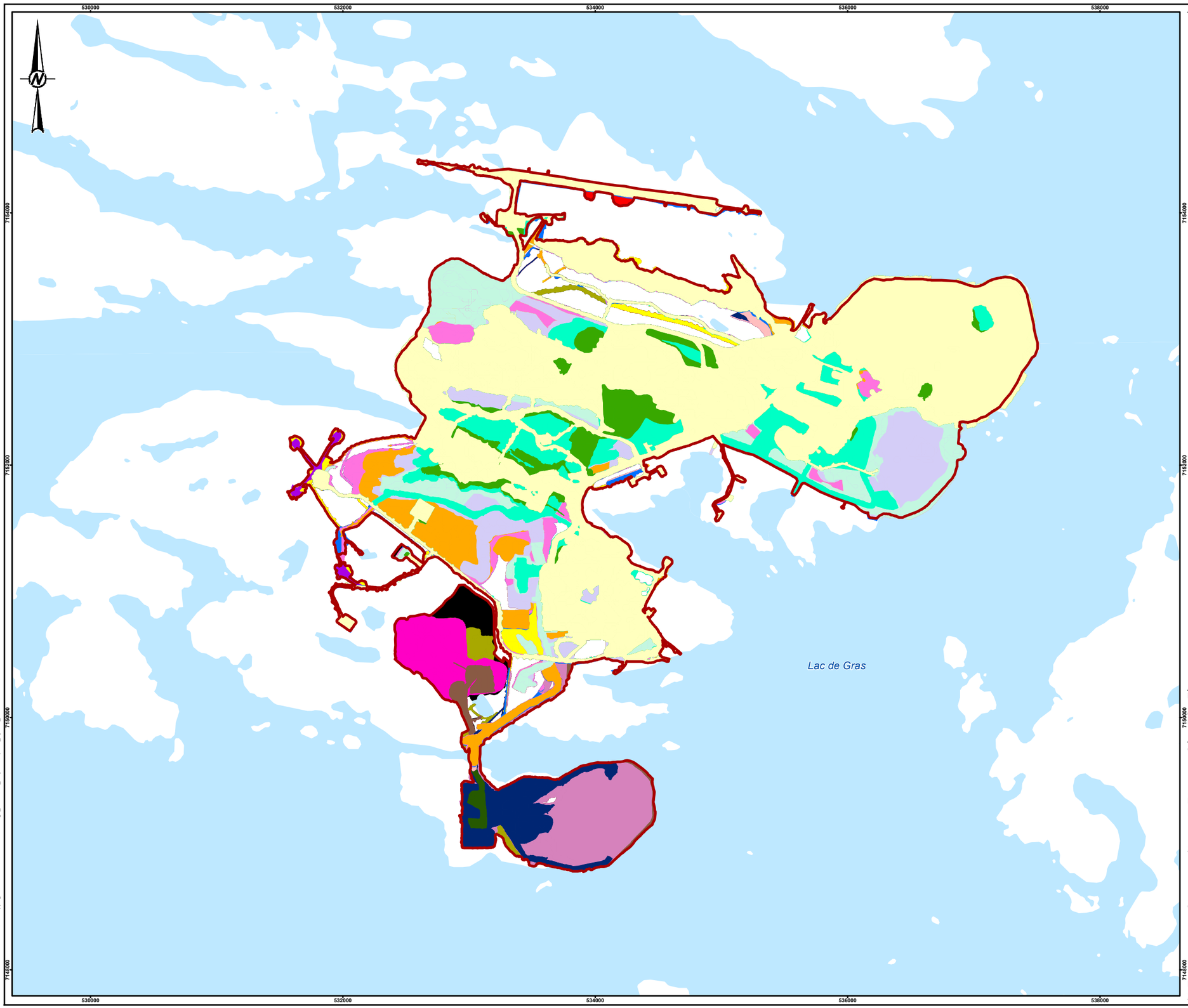
(a) Any discrepancies in totals across the rows results from the rounding of numbers in annual columns for presentation purposes.

(b) Disturbed includes areas that were already disturbed by exploration activities when the ELC was created.

(c) Also represents cumulative loss to 2020.

(d) From DDMI 1998a.

km^2 = square kilometres; % = percent.

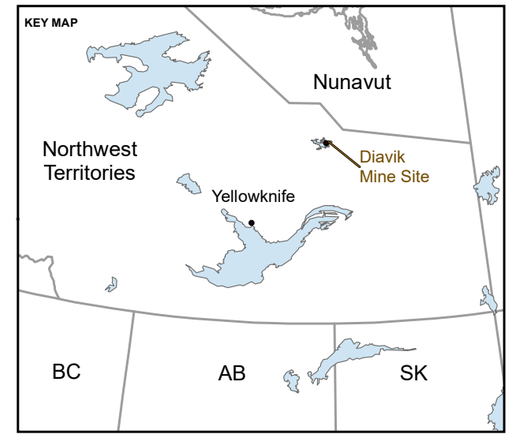


LEGEND

- MINE PERIMETER 2020
- WATERBODY

DISTURBANCE (2002-2020)

- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020



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CLIENT

RioTinto

PROJECT

DIAVIK DIAMOND MINES INC.

TITLE

MINE FOOTPRINT EXPANSION BY YEAR, 2002 TO 2020

CONSULTANT

GOLDER

YYYY-MM-DD	2021-03-18
DESIGNED	DC
PREPARED	ANK
REVIEWED	TS
APPROVED	JV

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4.0 BARREN-GROUND CARIBOU

The Mine is within the spring (northern migration), summer, and fall/rut seasonal ranges of the Bathurst caribou herd (Gunn et al. 2002). Caribou of this herd may travel through the Lac de Gras area during the northern migration to the calving grounds, and forage and move through the area during the summer and fall periods, sometimes following shorelines and onto the West and East Islands. Caribou from the Ahiak and Beverly caribou herds may also have ranges that overlap with the Mine to a lesser extent based on collared animal locations. At the time of this report, wintering caribou were present in the study area and caribou collar locations suggest these animals were most likely from the Beverly/Ahiak and Bathurst herds. While caribou from different herds may interact with the Mine, mitigation used by the Mine is designed to protect all caribou from any herd.

In 1996, the mean population size (± 95% confidence interval) of the Bathurst caribou herd was estimated at 349,000 ± 95,000 (Case et al. 1996; Gunn et al. 1997). The most recent population estimate determined by ENR in June 2018 was 8,200 animals (ENR 2018a). Although the Beverly and Ahiak herds are not monitored as intensively as the Bathurst herd, the last census for the Ahiak herd was in June of 2011 and estimated 71,000 individuals (ENR 2018b). Similar to the Bathurst caribou herd these herds are believed to also be in decline as are a number of other circum-Arctic herds (Festa-Bianchet et al. 2011; Gunn et al. 2011). Barren-ground caribou (*Rangifer tarandus groenlandicus*) were listed as threatened by the NWT Species at Risk (SAR) Committee on 11 July 2018 (NWT SAR 2018). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed barren-ground caribou in November 2016 as threatened (COSEWIC 2021). To support the recovery of all barren-ground caribou herds, the 2011 to 2015 NWT Barren-ground Caribou Management Strategy was developed (GNWT 2011). The overall goal of the strategy is to maintain numbers of caribou within their natural range of variation. The GNWT has outlined five objectives to obtain this goal:

- engage co-management partners in monitoring and management of caribou
- ensure appropriate, up-to-date information is available for management decisions
- manage impacts of key factors affecting caribou that are within control
- inform the public about the status of caribou and their role in management
- maximize benefits from caribou for NWT residents

The strategy outlined the need to monitor the effects of predators on caribou as predation was considered a factor that could be managed. Wolves are the most important year-round natural predator of barren-ground caribou and knowledge of wolf numbers could help understand fluctuations in caribou populations and provide information required to support management decisions. A new barren-ground caribou management strategy for 2018 to 2022 is under development (ENR 2018c). In 2019, ENR developed a Bathurst Caribou Range Plan (GNWT 2019), which proposes development limitations and hierarchical management actions for different areas in the Bathurst annual range. The Mine is located in Area 2 of the draft Bathurst Caribou Range Plan, which has a proposed moderate development level and status of cautionary. Diavik is in compliance with recommended mitigation described in the Bathurst Caribou Range Plan.

4.1 Habitat Loss

Physical alteration of the landscape reduces available caribou forage (DDMI 1998b). Habitat loss on East Island is expressed in habitat units (HUs) for caribou summer habitat. A habitat unit is the product of surface area and suitability of the habitat in that area to supply food for caribou and cover from predators (DDMI 1998b). Habitats were rated on a scale of 0 to 1 HUs for their capability to support caribou, with values greater than 0.30 regarded as highly suitable habitat and values less than 0.25 rated as low suitability for caribou. The area of each habitat type on East Island was multiplied by its habitat suitability value to determine the number of foraging habitat units available to caribou.

One objective of the caribou component of the WMMR is to determine if direct summer habitat loss (in habitat units [HUs]) is greater than predicted. The impact prediction in the EER (DDMI 1998b) is:

- At full development, direct summer habitat loss from the project is predicted to equal 2.965 HUs.

Dust deposition can also alter the landscape either by positively influencing vegetation vigour through deposition of nutrients and increased snowmelt rates, or by reducing plant growth by coating leaves and adversely changing soil chemistry. Both mechanisms can lead to a change in plant communities, and forage quality and quantity for caribou. Diavik also monitors for the effect of dust deposition on vegetation (including lichen) and soil chemistry (Section 3.0).

4.1.1 Methods

Using the ELC unit loss (Table 2), the area (km^2) of ELC lost was multiplied by its habitat suitability value (DDMI 1998b) to determine habitat units lost.

4.1.2 Results

Direct summer habitat loss to date from the Mine is approximately 2.81 HUs (Table 3). As noted above (Table 2), ELC unit loss is below the level predicted in the EER. Similarly, total direct losses of summer HUs for caribou are currently below that predicted in the EER.

Table 3: Caribou Summer Habitat Unit Loss to 2020

ELC Type	Habitat Suitability Value	Cumulative ELC Loss to 2020 (km^2)	Cumulative Habitat Unit Loss to 2020
Heath Tundra	0.37	3.58	1.323
Heath Boulder	0.40	1.73	0.694
Riparian Shrub	0.46	0.04	0.020
Bedrock Complex	0.27	0.06	0.017
Tussock/Hummock	0.30	1.58	0.473
Sedge Wetland	0.28	0.24	0.068
Esker Complex	0.30	0.17	0.052
Birch Seep and Shrub	0.11	0.11	0.012
Boulder Complex	0.21	0.05	0.011
Heath Bedrock	0.23	0.63	0.145
Total	**-**	**8.20**	**2.815**

Any discrepancies in totals result from the rounding of numbers for presentation purposes.

4.2 Changes to Movement

Miller and Gunn (1979) described disturbance in relation to wildlife as “the phenomenon, which resulted from the introduction of unfamiliar stimuli into an animal’s environment brought about by the presence of human activities”. Mining activities have the potential to decrease the use of habitat adjacent to human developments by caribou due to behavioural disturbance (DDMI 1998b; Golder 2011; Boulanger et al. 2012).

The current objective for this component of the WMMR is to determine if the area around the Mine where caribou distribution is altered (the zone of influence [ZOI]) due to mining activities is greater or less than predicted. The following section summarizes the methods used and results obtained from surveys. The revised monitoring objective presented by Handley (2010) is:

- To determine whether the zone of influence changes in relation to Mine activity.

From 2002 through 2009, DDMI completed weekly aerial surveys, weather permitting, within a study area that surrounds the Mine. In 2009, the survey area was aligned with that of the Ekati Diamond Mine to improve sampling efficiencies while covering a larger area. In 2012, aerial surveys were completed in collaboration with the Ekati Diamond Mine. Diavik and the Ekati Diamond Mine requested to omit the ZOI requirements for the caribou monitoring program in 2013; the request was approved by ENR on 2 May 2013. Caribou aerial surveys were not completed from 2013 through 2020.

The most recent analysis completed for ZOI monitoring (Golder 2020a) concluded caribou distribution follows the spatial distribution of preferred habitat as would be expected in the absence of a ZOI. The analysis did not detect a ZOI, after accounting for numerous other factors such as changes in study area size, changes in overlap with the Bathurst caribou herd distribution, insect harassment, and other annual but unmeasured factors. Discussions at the 2021 Slave Geological Province Wildlife Workshop indicated that annual caribou aerial surveys may be replaced with other techniques to monitor ZOI as part of the WMMR. Diavik intends to use collared caribou data for future ZOI monitoring as described in the WMMP (DDMI 2020a).

4.3 Changes to Behaviour

Ground-based behavioural observations, or scan sampling, are completed to provide data on changes in caribou behaviour as a function of distance from the Mine. Monitoring has been completed cooperatively with the Ekati mine as caribou are often close to the Ekati mine infrastructure. Because the primary habitat within 5 km of the Mine footprint is water, DDMI is focused on collecting behavioural scans of groups of caribou observations further from the mine during snow-free seasons. The monitoring objective from Handley (2010) is:

- To determine if caribou behaviour changes with distance from the mines.

4.3.1 Methods

Caribou groups were scanned every eight minutes for a minimum of four observations and a maximum of eight observations. For each scan, the number of animals exhibiting each type of behaviour was recorded (Murphy and Curatolo 1987). Individual caribou activities were recorded as feeding, bedded, standing, alert, walking, trotting or running. Individuals were classified as feeding when they were actually foraging or searching for food (i.e., walking with head down). The GPS location was recorded, and observations were completed during the autumn (and more recently, during winter) when more caribou were passing through the area. Group composition was classified, and the number of animals in the group was recorded. If a group was too large where recording behaviour for each individual was not feasible, the total group size was noted, and a subset of the group was observed for behaviour. The response variable is caribou behaviour, while the covariates include distance from either mine, group composition, and weather variables.

Caribou observations during snow-free periods were performed in one habitat type (tundra with <30% bedrock or boulders). During recent years, caribou have been present during winter, when far-field monitoring of caribou behaviour increases human health risks or requires a change in methods of data collection (e.g., snowmobile versus helicopter). Such changes influence continuity with historical data and may increase disturbance to caribou. During winter months, only caribou groups near the Mine are monitored to avoid these issues. In winter months, habitat types are not observable and scans are completed on caribou groups irrespective of habitat type. For the scan observations, weather conditions such as wind speed and direction, temperature, and type of precipitation were documented.

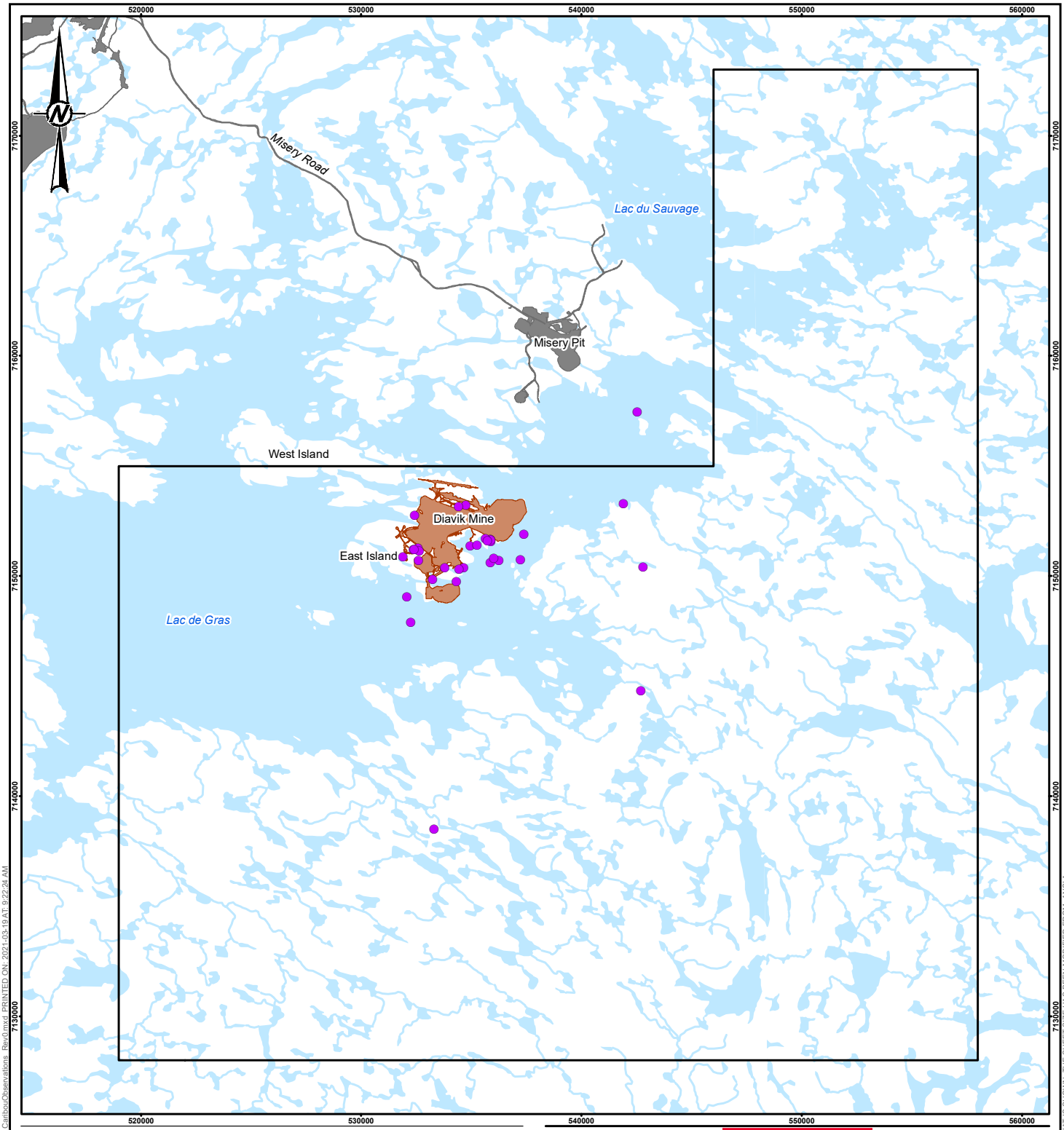
Response of caribou to stressors (natural or anthropogenic) was also assessed. In the event that a stressor was introduced during scan sampling, the observers noted the time and recorded the response of caribou to stressors as either no response, looked in the direction of the stressor, trotted or ran away. The reaction of the majority of the group was used in selecting the category. Estimated distance (m) from the stressor was also recorded. Stressors included type of wildlife, type of aircraft, type of vehicle, and blasts from pits. The observers then waited until the animals resumed their previous behaviour (usually 1 to 2 minutes) and would begin scanning observations again.

Focal scans provide information on activity budgets (i.e., the amount of time an animal is engaged in different behaviours), the temporal sequence of behaviours relative to stressors or other stimuli, and the length of time it takes the animal to return to a non-stressed state following a stressor event. For focal surveys, an individual is selected from a group for observation. Behaviour and time of behaviour changes are recorded. Focal surveys are undertaken on both cows and bulls, for a minimum of 20 minutes. Focal scans have never been a part of the historical caribou behaviour monitoring completed at Diavik mine and are not included in the WMMP (DDMI 2020a). In 2016, DDMI agreed to perform focal scans to support cumulative effects caribou behaviour monitoring completed by ENR by collecting this type of data but only after Diavik collected sufficient group scans for the mine’s monitoring requirements. Low and inadequate annual group scan samples have been communicated with EMAB and documented in annual reports (Golder 2018, 2019, 2020a). The emphasis by DDMI continues to be collection of group scan data until a fulsome set of observations that align with other regional observations is achieved.

4.3.2 Results

From 6 February to 13 November behaviour scans were completed on 33 caribou groups from 0 km to 15 km from the Mine (Appendix C). These caribou were potentially from the Beverly/Ahiak and Bathurst herds based on collared caribou locations. The total number of caribou observed was 509. Group size ranged from 1 to 150 with the average group size of 15 animals (1SD=26 animals). The estimated mean proportion (± 2SE) of caribou behaviour observed is as follows; bedded 30% (16%), feeding 39% (17%), standing 5% (8%), alert 2% (5%), walking 20% (14%), trotting 2% (5%), and running 2% (4%). No focal scans were completed in 2020.

The number of caribou groups observed in 2020 remained below the 55 groups in different strata required to detect a 15% change in behaviour derived from past summer and autumn results. If seasonal variation in behaviour is present, it would increase sample size requirements for these data to be combined with observations collected during summer/autumn (because most caribou were not present in past winters). Seasonal variation in female and male behaviour is expected due to differences in energetic and nutritional demands and environmental conditions (e.g., milk production for calves, autumn rut, insect harassment, and snow depth and hardness).



LEGEND

- LOCATION OF SCANNING OBSERVATIONS
- DIAVIK WILDLIFE STUDY AREA BOUNDARY
- DIAVIK FOOTPRINT
- EKATI FOOTPRINT
- WATERCOURSE
- WATERBODY

0 5 10

1:250,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

RioTinto

PROJECT

DIAVIK DIAMOND MINES INC.

TITLE

LOCATIONS OF CARIBOU BEHAVIOUR SCANNING OBSERVATIONS, 2020

CONSULTANT

GOLDER

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DESIGNED	TS
PREPARED	ANK
REVIEWED	TS
APPROVED	JV

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4.4 Incidents and Mortalities

Mineral development in the Bathurst caribou herd range created concerns about increased mortality, which includes vehicle collisions, aircraft collisions, and accidents associated with caribou in hazardous areas around mining activities (DDMI 1998b). Mitigation practices and policies have been implemented to avoid and reduce the potential for mortalities such as, wildlife have the right-of-way on all roads, communicating the presence of caribou via radio, and the caribou traffic advisory. The objective for this component is to determine the number of caribou deaths or injuries associated with the Mine. The following section summarizes the methods and results from incident reporting and road observations. The impact prediction in the EER (DDMI 1998b) is:

- Mine-related mortality is expected to be low.

4.4.1 Methods

Mine-related incidents and mortalities are reported to the Environment Department for documentation in a detailed incident investigation for immediate follow-up (Appendices D and E). All caribou mortalities are reported immediately to ENR, and ENR is consulted for follow-up mitigation and disposal procedures. The information is tabulated and provided for annual comparisons.

4.4.2 Results

In 2020, there were no Mine-related caribou injuries or mortalities recorded, which has been the case for the past 15 years (Table 4). The only Mine-related caribou mortality reported to date occurred in 2004. One natural mortality event occurred in 2020. One injured caribou was reported initially on 31 March 2020, with subsequent observations occurring over the next week. Diavik provided ENR with this information and ENR decided the best approach was to euthanize the individual. This was completed on 11 April by ENR officers. The carcass was transported back to GNWT facilities for meat salvage.

Table 4: Caribou Mortalities on East Island, Baseline to 2020

	Baseline[a]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural Caribou Mortalities on East Island	8	7	1	1	0	2	0	0	1	0	0	0	1	1	1	1	0	0	1	0	0	1
Mine-related Mortalities	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(a) Includes data from 1995 to 1997.

4.5 Caribou Advisory

The objective of the Caribou Advisory Monitoring program is to make certain that workers are aware of the approximate numbers of caribou on and near East Island, which is related to the potential for interactions between caribou and mining activities. This raises general awareness so that employees are alert to the likelihood that mitigation could be triggered. The number of animals on East Island and in specific areas dictates the type of mitigation practices that will be undertaken (e.g., haul road closure, speed reduction).

4.5.1 Methods

Various methods were used to determine whether or not animals were present in the vicinity of East Island, which included incidental observations reported from pilots and workers, and using the satellite collar locations provided by ENR. If animals were reported in the general area, ground surveys were initiated. Ground-based surveys are completed by Environment personnel travelling in vehicles along the haul roads twice per day during a caribou advisory and documenting approximate caribou numbers. Caribou road surveys, and PKC and rock pile monitoring surveys were discontinued on a scheduled basis in 2014 (Golder 2020a).

4.5.2 Results

In 2020, caribou numbers on the East Island reported by staff ranged from 1 to approximately 300 animals. Caribou were most likely from the Beverly/Ahiak and Bathurst herds based on collared caribou data. Photos of caribou taken at the Mine are included in Appendix F. There were also three instances where groups of 100 caribou or more were observed away from site, once on 25 February west of the Processed Kimberlite Containment facility, once on 16 March south of the A21 Muster point, and once on 13 April during wolverine track surveys. In total there were 57 different incidental observations reported from 6 February to 13 November (Appendix G). Groups of one to two caribou were spotted on or in proximity to haul roads eight times in 2020, which resulted in additional traffic control measures being implemented. However, no formal advisories were issued due to the low numbers of caribou on site and short duration of presence near Mine infrastructure.

There were no reported Mine-related incidents involving caribou in 2020. Caribou were observed near the airport on two occasions but did not trigger deterrent actions.

4.6 Deterring Caribou from Hazardous Areas

When caribou are present on East Island their movements are monitored so that Mine personnel are aware of their presence and location. Of particular importance from a safety perspective (both human and animal), is caribou presence near hazardous areas (such as the airstrip and blast areas). When caribou are sighted adjacent to potentially hazardous areas, DDMI implements its Standard Operation Procedure for deterring caribou from these areas.

4.6.1 Methods

The method used to move caribou away from hazardous areas consists of the slow advancement of Environment Department staff behind the caribou, encouraging the movement of the animals in a safe direction.

4.6.2 Results

In 2020, deterring caribou at the Mine was not required.

4.7 Adaptive Management and Recommendations

Re-analysis of Diavik and Ekati aerial survey data from 1998 to 2009 and 2012 did not detect a change in how caribou are distributed relative to preferred habitat. In contrast to past inferences from these data, the results demonstrate that caribou are distributed in accordance with habitat selection theory as would be expected in the absence of sensory disturbance from Diavik and Ekati mines. The February 2021 Slave Geological Provincial Wildlife Workshop concluded aerial surveys for caribou ZOI monitoring are likely no longer needed. Instead, DDMI will focus on using collared caribou data for ZOI monitoring as an alternative line of evidence.

The 2021 Slave Geological Provincial Wildlife Workshop also concluded that caribou behaviour monitoring is no longer necessary. However, DDMI will continue to monitor caribou behaviour in 2021 and engage with communities and EMAB to discuss future monitoring of caribou behaviour.

5.0 GRIZZLY BEAR

The barren-ground grizzly bear (*Ursus arctos*) ranges throughout most of the NWT. The western population of grizzly bear is currently listed as a species of special concern by COSEWIC (COSEWIC 2021) and listed as sensitive under the NWT General Status Rank (NWT SAR 2021).

Grizzly bears have low population densities, low reproductive rates and are sensitive to human activity (DDMI 1998b; McLoughlin et al. 1999). While some grizzly bears may avoid mineral developments, others may be attracted to human activity through odours associated with development (Gau and Case 1999; Johnson et al. 2005).

Effects to grizzly bears from mining may occur through direct habitat loss, habitat suitability reduction, and direct mortality. The focus of the monitoring program is to estimate direct habitat loss, monitor grizzly bear presence and distribution, and report Mine-related mortalities.

5.1 Habitat Loss

Grizzly bears use a wide variety of vegetation and habitats types. Studies of grizzly bears in the NWT have led to understanding their seasonal habitat preferences (McLoughlin et al. 2002). Loss of habitat may result in negative effects on grizzly bears. The objective of this component of the WMMR is to determine if direct habitat loss for grizzly bear from the Mine footprint is within the prediction in the EER (DDMI 1998b):

- At full development, direct terrestrial habitat loss for grizzly bear from the project is predicted to be 8.67 km^2.

5.1.1 Methods

Methods used to determine grizzly bear habitat loss are similar to that described in Section 4.1; grizzly bear habitat is assumed to include all terrestrial habitats (i.e., all landscape types in Table 2 except for deep water, shallow water, and disturbed areas).

5.1.2 Results

Cumulative direct grizzly bear habitat loss resulting from the Mine up to 2020 was 8.20 km^2, which is below that predicted in the EER.

5.2 Presence and Distribution

Mining activities can affect the presence of grizzly bears due to disturbance and habitat loss (DDMI 1998b). Vegetation loss and changes to caribou distribution from mining activities may also influence the presence, abundance, and distribution of grizzly bears (Gau and Case 1999; Johnson et al. 2005).

Monitoring is completed to determine if mining activities influence the presence of grizzly bears in the study area. The predicted effect is:

- Mine development is not predicted to influence the presence of grizzly bears in the area.

The revised monitoring objective in Handley (2010) is to:

- Determine if Mine-related activities influence the relative abundance and distribution of grizzly bears in the study area over time.

In 2010, a pilot study using a hair snagging technique was initiated to assess its effectiveness in determining grizzly bear abundance in the DDMI wildlife study area. In April 2012, a request was made on behalf of DDMI, BHP Billiton Canada, and De Beers Canada Inc. to undertake a joint grizzly bear hair snagging program that encompassed Ekati, Diavik, Snap Lake, and Gahcho Kué (Rescan 2013a). Following discussions and clarification of methods (Rescan 2013b), the program was initiated in June 2012 using a standard set of sampling protocols. At the March 2013 Wildlife Monitoring Workshop hosted by the GNWT, the monitoring objective for grizzly bear was revised to:

- Provide estimates of grizzly bear abundance and distribution in the study area over time (GNWT 2013a).

5.2.1 Grizzly Bear Hair Snagging Program

5.2.1.1 Methods

Diavik, Snap Lake, Gahcho Kué, and Ekati mines jointly completed the regional grizzly bear hair snagging program. The study area consisted of a northern section, sampled by the Diavik and Ekati mines (ERM Rescan [ERM] 2014), and a southern section, sampled by Snap Lake and Gahcho Kué (Jessen et al. 2014). The northern section was sampled in 2012, 2013, and 2017 and included 113 stations, arranged in a grid pattern spaced at approximately 12 km by 12 km (ERM 2014, 2018). A wooden tripod with a fixed base and the legs wrapped in barbed wire was used to collect grizzly bear hair for DNA analysis. The wooden tripod was placed in high quality grizzly bear habitat (e.g., esker, riparian area, upland meadow, wetland meadow) to increase the likelihood of capturing grizzly bear hair. Community participants applied Traditional Knowledge to inform on high quality habitat for site selection (Rescan 2014). Non-reward lures (e.g., cured cows' blood, fish oil, seal oil and sweeter scented oils) were used to attract the bears to the tripods. The lures were poured on the top of the posts and down the legs, and in the centre of the ground to encourage a bear to squeeze between the legs. The posts were not relocated between each sampling period, but a novel scent combination was used each session to prevent habituation.

At the end of each session, all grizzly bear hair was removed from the tripod and placed in a paper envelope. Each grouping of hair was stored separately, and supporting information such as the tripod identification, date, and location on tripod were recorded. The hair samples were sent to Wildlife Genetics International for DNA fingerprinting.

5.2.1.2 Results

Results of the 2012, 2013 and 2017 hair snagging program are provided in ERM (2014) and ERM (2018). Table 5 summarizes results from the hair snagging program. Hair snagging has not been completed since 2017.

Table 5: Number of Grizzly Bears Identified During DNA Analysis

Year	# Samples	Individuals	
		Males	Females
2012	1,902	42	70
2013	4,709	60	76
2017	3,657	55	81

Source: ERM 2018.

Note: refers to grizzly bears that had no previous detections in the regional database.

Analysis of these data indicated a stable or increasing number of grizzly bears in the northern section relative to studies completed in the late 1990's (McLoughlin and Messier 2001). Data analysis indicated that there have been no negative effects on the regional population of grizzly bears in the Slave Geological Province due to the Ekati and Diavik mines (ERM 2018). Program partners at the 2021 Slave Geological Provincial Wildlife Workshop agreed that the grizzly bear hair snagging program will no longer be completed.

5.3 Incidents and Mortalities

Although there is some interaction between the Mine and grizzly bears, every effort is made to immediately report any animals that come into contact with the Mine. Bear awareness instruction is provided to employees and has contributed to the timely reporting of bears approaching site, which limits interactions. Despite mitigation, Mine activities may lead to grizzly bear mortalities, injuries, or relocations from year to year. The specific impact prediction in the EER (DDMI 1998b) is:

- Mortalities associated with mining activities are predicted to be 0.12 to 0.24 bears per year.

5.3.1 Methods

Incidental observations of grizzly bears are recorded and are usually made by Mine staff and reported to the Environment Department. Typically, each independent grizzly bear observation is recorded because it is usually not known if it is the same bear. As the number of incidental observations may be partially related to the number of people on site, the occurrences of incidental observations of grizzly bears were compared to the camp population.

Mine-related incidents and mortalities are reported to the Environment Department for documentation in a detailed incident investigation for immediate follow-up. All grizzly bear mortalities are reported immediately to ENR, and ENR is consulted for follow-up mitigation and disposal procedures. If wildlife had to be deterred to reduce the risk of a wildlife-human incident, then all effort is made by the Environment staff to start with the least intrusive method available, and all deterrent actions are recorded.

5.3.2 Results

There were 95 reported instances of grizzly bears on East Island, and a total of 169 grizzly bears were observed (Table 6; Appendix H). Grizzly bears were observed on 79 days from 28 April to 26 October. While these observations are not collected systematically, and contain repeated observations, incidental observations provide an indication of the potential for wildlife incidents or problem wildlife.

In 2020, there was an average of 585 people at the Mine. The number of incidental observations of grizzly bears does not appear to be related to the number of people on site (Spearman correlation rho=-0.20, P=0.41); however, staff reporting incidental observations does foster an awareness of wildlife issues at the Mine (Table 6). Of the 169 grizzly bears seen (95 observation instances), 50 involved deterrent actions and 45 did not involve deterrent actions (Table 7). Deterrents used to encourage bears to move away from infrastructure included trucks, air horn, bear bangers, rubber bullets, cracker shells, gun cycles, and clapping (Appendix I).

Table 6: Average Camp Population and Number of Incidental Grizzly Bear Observations, 2002 to 2020

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average Camp Population	1100	470	397	646	716	747	979	562	579	630	629	537	484	524	625	641	578	586	585
Grizzly Bear Reported instances on East Island	5	19	24	43	21	41	5	22	44	56	97	65	69	77	137	89	90	80	95

One grizzly bear was relocated on 31 July 2020. There were two grizzly bear mortalities on 14 September 2020. A sow and yearling cub were destroyed in the same event as they posed a risk to Mine personnel due to habituation and entry into the camp cafeteria (Table 7). The bears were not known to be resident, or problem bears prior to the incidents. Approval from ENR was obtained prior to euthanizing the animals. Construction began at the Mine in the year 2000. The calculated Mine-related mortality rate over the 21-year monitoring period is 0.14 bears per year, which is within the range predicted in the EER.

Table 7: Grizzly Bear Deterrent Actions, Incidents and Mortalities, 2000 to 2020

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Days with Bear Visitations on East Island	15	14	5	15	24	34	20	34	5	22	44	41	77	47	59[a]	56[b]	94[c]	73[d]	70[e]	70[f]	79[g]
Days Deterrent Actions were Utilized	10	8	2	6	20	23	8	20	3	18	40	31	65	40	39	27	50	51	36	45	50
Relocations	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1
Mortalities	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

(a) Over 59 separate days, 69 grizzly bear observations were recorded.

(b) Over 56 separate days, 77 grizzly bear observations were recorded.

(c) Over 94 separate days, 137 grizzly bear observations were recorded.

(d) Over 73 separate days, 89 grizzly bear observations were recorded.

(e) Over 70 separate days, 90 grizzly bear observations were recorded.

(f) Over 70 separate days, 125 grizzly bear observations were recorded.

(g) Over 79 separate days, 169 grizzly bear observations were recorded.

5.4 Adaptive Management and Recommendations

Diavik participated in regional grizzly bear monitoring in collaboration with BHP Billiton and De Beers Canada Inc. in 2012 and 2017. The results through 2017 indicate that the regional grizzly bear population is stable or increasing and is not adversely affected by the Diavik and Ekati mines. Program partners at the 2021 Slave Geological Provincial Wildlife Workshop concluded that the grizzly bear hair snagging program will no longer be completed. As a result of a 2020 incident, an audit of facility door handles on site was completed and all handles on site switched to a bear-proof model. Diavik continues to use deterrent actions to keep grizzly bears and personnel safe.

6.0 WOLVERINE

6.1 Introduction

Wolverine (*Gulo gulo*) are annual residents in the Lac de Gras region (DDMI 1998b). Wolverine are federally listed as Special Concern under Schedule 1 of the *Species at Risk Act* (SARA; Government of Canada [GOC] 2020) and are considered Not at Risk in the NWT (NWT SAR 2021, Species at Risk Committee 2014).

Wolverine home ranges have been estimated at 126 km^2 for adult females and 404 km^2 for adult males (Mulders 2000). The feeding behaviour of wolverine may result in their attraction to camps and habituation if they receive a food reward, which has been demonstrated during baseline, construction, and operations in the Lac de Gras area. Wolverines in the tundra have been shown to depend primarily on scavenging barren-ground caribou for their diet (Mattisson et al. 2016) particularly in the winter (Magoun 1987) and may travel long distances in search of carrion (NWT SAR 2021).

6.2 Presence and Distribution

The initial objective of this component of the WMMR was to determine if mining activities are influencing the presence of wolverines in the study area. The revised monitoring objective determined in Handley (2010) is to:

- Provide estimates of wolverine abundance and distribution in the study area over time.

To meet this objective, DDMI participated in a joint wolverine DNA hair sampling research program in cooperation with Dominion Diamond Mines and the GNWT. Program partners present at the Slave Geological Province Wildlife Workshops hosted by the GNWT in February 2021 determined to discontinue hair sample monitoring for wolverine. The initial monitoring objective on wolverine presence noted previously will be resumed.

Wolverine presence around the Mine is monitored using the following systematic and anecdotal methods:

- snow track surveys
- incidental observations at site

6.3 Snow Track Surveys

6.3.1 Methods

Snow track surveys began in 2003 and have been completed with the assistance of a community member, when available. From 2003 to 2006, the study design and data collection used the experience of Inuit Qaujimajatuqangit to locate transects and record wolverine snow tracks. This included surveys of 23 transects of variable length and distance from the Mine within a 1,270 km^2 area. In 2008, DDMI revised the wolverine track survey to increase statistical power to detect changes in wolverine occurrence in the study area. Design changes included the placement of 40 survey transects of equal length (4 km long, total length = 160 km) located in areas of preferred wolverine habitat including heath tundra and heath boulder habitat. The final locations of snow track survey transects were the result of a stratified random sampling process of potential locations in the study area, but some transects were relocated from Lac de Gras to areas of preferred wolverine habitat (based on Inuit Qaujimajatuqangit), including heath tundra and heath tundra boulder habitats.

Each transect is driven by a snowmobile in March and/or April and all wolverine tracks and other sign (e.g., digs and dens) are recorded. Since 2015, each transect was surveyed twice so that detection probability could be estimated and incorporated into analyses of relative presence and distribution in the study area. In 2020, the second round of wolverine snow track surveys was cancelled as a consequence of the COVID-19 pandemic (Appendix J).

The detection of snow tracks can be influenced by wind or snowfall. The effect of snowfall was estimated by determining the number of days from the survey date since the most recent snowfall. A wind threshold index was estimated by determining the number of days prior to the survey date that the mean hourly wind speed eclipsed 7.7 metres per second (m/s) because a wind speed of 7.7 m/s is sufficient to move dry snow along the ground (Li and Pomeroy 1997). For each transect, a track density index (TDI) was calculated as the number of wolverine tracks per transect length per number of days since recent snowfall or threshold wind speed.

6.3.2 Results

The 2020 snow track surveys were completed between 1 April and 18 April, and all 40 survey transects were surveyed. Wolverine tracks were identified at 12 of 40 (30% occurrence) transects (Appendix K). The number of wolverine tracks identified at a transect ranged from 0 to 3 individuals. One wolverine was sighted off transect on 18 April (12W 555760m E 7168871m N). Weather-adjusted measures of track density index (TDI) yielded a mean TDI (± 2SE) of 0.138 ± 0.103 tracks/km/day since the last weather threshold (Table 8). The last comprehensive report analysed long-term wolverine snow tracking data and found that occupancy rates had remained stable over the life of the Mine (Golder 2020a), and this year's result is consistent with those findings. Mean TDI in 2020 was equivalent to that observed in round one surveys in 2019. Detection rates could not be estimated in 2020 because a second survey was not completed due to COVID-19 restrictions.

One other species was identified during snow tracking surveys. Wolf was identified at two transects, and three individuals were observed at each transect.

Table 8: Wolverine Track Index and Mean Days Since Snow Fall, 2003 to 2020

Year	Survey Period	Number of Tracks	Distance Surveyed (km)	Mean Days Since Snowfall[a]	Mean Days Since Threshold Wind Speed[a]	Track Index (Tracks/km)	Mean Track Density Index (± 2SE)[b]
2003	10 – 12 Apr	13	148	2.2	2.1	0.09	0.046 ± 0.044
2004	16 – 24 Apr	22	148	4.0	4.6	0.15	0.061 ± 0.040
2004	2 – 8 Dec	10	148	3.9	2.5	0.07	0.048 ± 0.042
2005	30 – 31 Mar	7	148	7.5	3.9	0.05	0.026 ± 0.022
2005	7 – 12 Dec	18	148	2.4	3.5	0.12	0.106 ± 0.044
2006	30 Mar – 1 Apr	5	148	1.0	2.5	0.03	0.029 ± 0.010
2007[c]	-	-	-	-	-	-	-
2008[d]	30 Apr – 2 May	15	160	17.1	4.1	0.09	0.022 ± 0.011
2009	2 – 4 Apr	11	156	31.0	9.0	0.07	0.007 ± 0.005
2010[e]	-	-	-	-	-	-	-
2011	30 Mar – 3 Apr	23	156	0.9	6.7	0.15	0.167 ± 0.072
2012	28 Mar – 3 Apr	22	160	2.8	4.4	0.14	0.096 ± 0.065
2013	2 – 6 Apr	26	156	3.1	2.9	0.17	0.076 ± 0.043
2014	23 – 26 Mar	25	160	6.7	1.0	0.13	0.156 ± 0.082
2015	24 – 29 Mar	21	160	5.3	11.0	0.13	0.062 ± 0.049
	14 – 17 Apr	17	160	2.1	1.6	0.11	0.172 ± 0.130
2016	22 – 27 Mar	50	160	6.5	5.5	1.25	0.190 ± 0.129
	8 – 13 Apr	50	160	6.7	3.1	1.25	0.215 ± 0.099
2017	22 Mar – 4 Apr	10	160	4.1	2.5	0.06	0.019 ± 0.014
	9 – 19 Apr	42	160	2.4	2.7	0.26	0.258 ± 0.013
2018	23 Mar – 11 Apr	10	132	4.5	1.8	0.08	0.076 ± 0.060
	13 – 22 Apr	4	132	3.2	1.7	0.03	0.030 ± 0.029
2019	23 Mar – 2 Apr	14	160	1.6	1.2	0.09	0.138 ± 0.109
	13 – 21 Apr	32	160	2.1	2.3	0.20	0.206 ± 0.115
2020[f]	01 Apr – 18 Apr	21	160	2.0	3.6	0.13	0.138 ± 0.103

(a) Presented as a summary of the data used to calculate track densities. Wind threshold speed = 7.7 metres per second.

(b) For each transect, a track density index (TDI) was calculated as the number of wolverine tracks per transect length per number of days since recent snowfall or threshold wind speed. TDI is reported as mean Track Density Index ± 2 times the standard error (Appendix K).

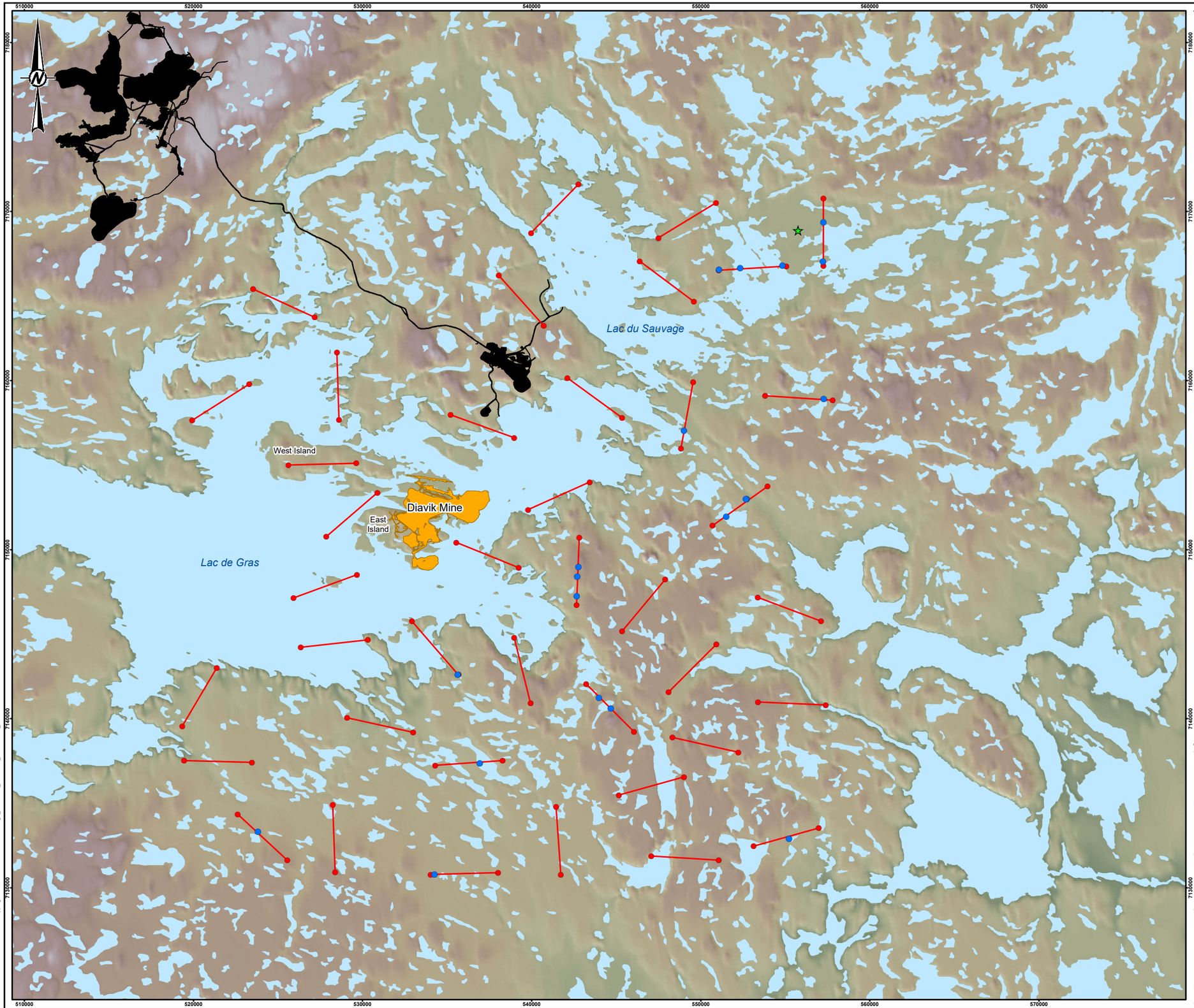
(c) Survey was not completed in 2007 because a Wildlife Research permit was not acquired in time.

(d) The new survey technique was introduced in 2008. Only data hereafter was included in the multi-season occupancy analysis.

(e) Survey was not completed in 2010 due to community assistant not being available to participate in survey.

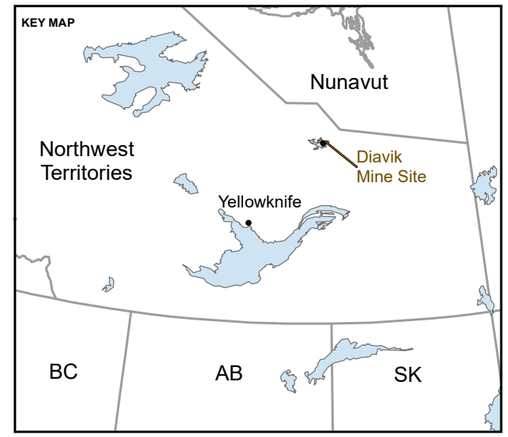
(f) Second round of surveys was not completed due to site access restrictions resulting from the COVID-19 pandemic.

km = kilometres; tracks/km = tracks per kilometre; SE = standard error.



LEGEND

- WOLVERINE TRACK
- WOLVERINE SIGHTING
- TRANSECT
- DIAVIK FOOTPRINT
- EKATI FOOTPRINT
- WATERBODY



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1. DEM AND HILLSHADE OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. HYDROLOGY OBTAINED FROM CLIENT.

PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

RioTinto

PROJECT

DIAVIK DIAMOND MINES INC.

TITLE

SNOW TRACK TRANSECTS AND WOLVERINE OCCURRENCES IN 2020

CONSULTANT

GOLDER

YYYY-MM-DD	2021-03-18
DESIGNED	TS
PREPARED	ANK
REVIEWED	TS
APPROVED	JV

PROJECT NO.	PHASE	REV.	FIGURE
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6.3.3 Hair Snagging

6.3.3.1 Methods

The wolverine hair snagging is a regional research program completed in partnership with ENR and Dominion Diamond Mines. This program is also completed with the assistance of community members. The survey is carried out in March and April by snowmobile. A total of 134 posts constructed of 4 inch × 4 inch lumber in 5 foot lengths are erected across the DDMI study area in a 3 km by 3 km grid. Each post is spiral-wrapped in barbed wire, intended to snag hair from wolverine, and baited with a small portion of local meat and two types of commercially prepared lures (GNWT 2013b). Posts are surveyed in the order they are deployed and are removed after the second visit. Hair samples are submitted to Wildlife Genetics International for DNA fingerprinting to determine the sex and number of individuals in the study area.

6.3.3.2 Results

The wolverine hair snagging program was last completed in 2014. Efford and Boulanger (2018) completed an analysis of wolverine individuals detected by the hair snagging programs from 2004 to 2015 among study areas associated with the Diavik, Ekati, Snap Lake, and Gahcho Kué mines, and Daring Lake. A key finding of study was that wolverine across these study areas function as a single population, so there is limited utility for this type of monitoring to detect separate mine-related effects (Efford and Boulanger 2018). The authors showed that program frequency depends on the number of individuals identified and could be repeated every four to six years to detect an annual decline of 5%. The hair sample program for wolverines will be discontinued as determined by program partners at the Slave Geological Province Wildlife Monitoring Workshops hosted by the GNWT in February 2021.

6.4 Incidents and Mortalities

Mortalities can occur if wolverines become habituated to mining activities resulting from efforts to locate food or shelter (DDMI 1998b). Diligent waste management, strictly enforced speed limits, and immediate reporting of wildlife sightings on East Island have limited the mortality of wolverine during the operational period of the Mine. To date, efforts have been focused on limiting Mine-related mortalities and associated changes to wolverine population parameters.

The prediction made in the EER was:

- Mine-related mortalities, if they occur, are not expected to alter wolverine population parameters in the Lac de Gras area.

6.4.1.1 Methods

Incidental observations of wolverine by Mine staff are reported to the Environment Department. Mine-related incidents and mortalities are also reported to the Environment Department for documentation in a detailed incident investigation and through incident reports submitted by Mine staff (Appendices D and E). All wolverine mortalities are reported immediately to ENR, and ENR is consulted for follow-up mitigation and disposal procedures. If wildlife had to be deterred to reduce the risk of a wildlife-human incident, then all effort is made by the Environment staff to start with the least intrusive method available and all deterrent actions are recorded.

6.4.1.2 Results

In 2020, there were 17 reported instances when wolverines were observed on East Island (Appendix L). These sightings were reported during 16 days from 13 February to 28 December. These observations are collected incidentally and may contain repeated observations of the same animal. Incidental observations provide an indication of the potential for wildlife incidents or problem wildlife. Wolverine incidental observations decreased in 2020 slightly from 2019. There is no correlation between the number of incidental observations of wolverine and the number of people on site (Spearman correlation rho = 0.09, P = 0.71); however, staff reporting incidental observations does foster an awareness of wildlife issues at the Mine (Table 9).

Table 9: Average Camp Population and Number of Incidental Wolverine Observations, 2002 to 2020

Year [(a)]	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average Camp Population	1100	470	397	646	716	747	979	562	579	630	629	537	484	524	625	641	578	586	585
Wolverine Observation instances on East Island	4	38	14	43	31	19	46	21	28	4	11	3	6	118	105	44	28	21	17

(a) Monthly average camp population is not available for 2000 and 2001.

There were 17 observations of wolverines on East Island in 2020 and no incidents. A total of 35 deterrent actions were used during 4 of the 17 observations. The most frequently used deterrent was a vehicle horn. One relocation of a wolverine occurred on 9 October 2020. This individual had been recorded on site frequently over the past two weeks prior to relocation. Since 2000, seven wolverines have been relocated and five mortalities have occurred at the Mine (Table 10). No wolverine mortalities occurred in 2020. Although there was one relocation in 2020, relocations and mortalities continue to be uncommon at the Mine.

Table 10: Wolverine Observations, Deterrents, Relocations and Mortalities, 2000 to 2020

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Days with Wolverine Visitations on East Island	25	36	4	38	14	43	31	19	46	21	28	4	11	3	6	83[b]	73[c]	36[d]	23[e]	21[f]	16[g]
Days Deterrent Actions were Utilized	9	10	0	1	1	5	2	1	17	1	0	0	1	0	0	4	6	4	0	7	4
Relocations	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2	1
Mortalities	0	1	0	0	0	0	0	0	1	0	0	0	2[a]	0	0	0	1	0	0	0	0

(a) Two wolverine mortalities occurred in 2012 at an off-site fish compensation program undertaken by DDMI.

(b) Over 83 separate days, 118 independent wolverine observations were recorded. It is believed that the majority of these observations were for the same wolverine which was relocated on 23 March 2015.

(c) Over 73 separate days, 105 independent wolverine observations were recorded.

(d) Over 36 separate days, 44 independent wolverine observations were recorded.

(e) Over 23 separate days, 28 independent wolverine observations were recorded.

(f) Over 19 separate days, 21 independent wolverine observations were recorded.

(g) Over 16 separate days, 17 independent wolverine observations were recorded.

6.5 Adaptive Management and Recommendations

Future monitoring of wolverine snow tracks will continue to include two rounds of surveys to determine whether detection rates of snow tracks vary over longer periods of time. Results from the analysis of long-term snow track monitoring indicate consistent presence of wolverine since 2008. The Environment Department will continue to encourage staff to report wolverine and other wildlife sightings as these promote awareness at site and help to prevent and limit incidents. The Environment Department will continue to work with site departments as a reminder about the importance of waste segregation and securing waste bins to prevent wildlife access. Program partners at the 2021 Slave Geological Provincial Wildlife Workshop determined that the wolverine hair snagging program will be discontinued.

7.0 RAPTORS

Raptors (birds of prey) present in the study area include peregrine falcons, gyrfalcons, rough-legged hawks, snowy owls, and short-eared owls. The Federal *Species at Risk Act* (SARA) considers the peregrine falcon (*Falco peregrinus anatum/tundrius)* as *Special Concern*; however, they currently have no status under NWT species at risk legislation but have a general species rank of sensitive (NWT SAR 2021). In 2017, COSEWIC re-assessed the status of the *anatum/tundrius* peregrine falcon as Not at Risk (NWT SAR 2021). Peregrine falcon is scheduled for assessment by NWT SAR in March 2021 (NWT SAR 2021).

Habitat loss, sensory disturbance, and changes to prey populations may influence raptors nesting in the Lac de Gras area. Mining activities may cause raptors to avoid the area and surrounding habitats. Mine-related changes in habitat quality can influence the presence and distribution of raptors. Impact predictions related to raptors (DDMI 1998a) were:

- Disturbance from the Mine and the associated zone of influence is not predicted to result in measurable impacts to the distribution of raptors in the study area.
- The Mine is not predicted to cause a measurable change in raptor presence in the study area.

Analysis of Diavik and Ekati peregrine falcon and gyrfalcon nest data from 1998 to 2010 determined that sensory disturbance was not influencing nest occupancy and success (Coulton et al. 2013). Instead, the study concluded that the patterns of use and success were associated with the spatial distribution of nest site quality and the age of nest sites, respectively, which is consistent with findings from another long-term study (Wightman and Fuller 2005). The results confirmed the decisions at the 2010 Diamond Mine Wildlife Monitoring Workshop that annual collection of raptor nest occupancy and success in the study area should be discontinued, and data collection should be focused on mitigating effects to raptors nesting in open pits and on Mine infrastructure.

The monitoring objectives presented in Handley (2010) are to:

- Determine if pit walls or other infrastructure are utilized as nesting sites for raptors.
- Determine nest success in areas of development and document effectiveness of deterrent efforts used.
- Document and determine the cause of direct Mine-related mortalities of raptors.

Another objective related to monitoring the regional status of raptor populations includes:

- Support ENR in regional monitoring of raptor nest occupancy and productivity to determine long-term population trends.

Note that the Handley (2010) objective for regional monitoring of raptor nest occupancy for the Canadian Peregrine Falcon Survey (CPFS) has been changed because the CPFS has been discontinued. Instead, monitoring is contributed to a regional database administered by ENR.

7.1 Nest Site Occupancy

7.1.1 Methods

The Canadian Peregrine Falcon survey is no longer completed; however, DDMI will still support surveys of nest use and success in the study area for regional monitoring by ENR and other researchers. Nest monitoring for inclusion in regional and national databases is scheduled for every five years and was completed in 2020. The monitoring was completed by ENR biologists and included surveys of known nest sites in early and late summer to determine nest use and the presence of hatchlings. The monitoring approach included a helicopter survey using fly-by techniques to minimize disturbance to nesting birds. The next regional survey is scheduled for 2025.

Falcons and other raptors have been known to nest on Mine infrastructure and within the vertical rock faces of open pits at both the Mine and the Ekati mine. Pit wall/infrastructure inspections at the Mine are completed at least once per week during the nesting season. Pit walls and other infrastructure are inspected for nests and falcon nesting behaviour. If nests are found, DDMI attempts to determine the species occupying the nest along with the presence of eggs and/or chicks. Nests are only considered active if eggs or young are observed. Deterrent actions are only considered in consultation with ENR if the nest is in an area hazardous to the birds but not if eggs or young are observed.

Pit wall/infrastructure inspections are completed at nine locations on the Mine: A21 Pit area (Lookout #1, #2, #3, A21 South Ramp, and A21 North Ramp), A154 Pit area (Lookout #1 and #2), A418 Pit area (Lookout #1 and #2), South Tank Farm, Process Plant, Powerhouse (Lookout #1 and #2), Site Services Building, Boiler House, and Backfill Plant. The survey is completed by stopping at a clear vantage point and thoroughly scanning the area for any potential nesting locations.

7.1.2 Results

The 2020 regional nest monitoring survey was completed over four days on 18 to 19 June and 27 to 28 July. The results of the 2020 nest monitoring survey are included in a regional database that is managed by ENR.

A total of 55 Pit Wall/infrastructure inspections were completed from 9 May until 5 September to determine use by raptors (Appendix M). A potential rough-legged hawk nesting site was first observed at the south ramp pit wall at the A21 Pit on 20 May 2020. An adult was frequently observed in the nest throughout June and early July, and three chicks were observed in the nest on 9 August (Appendix P). Potential raptor nesting was also observed at A418, A154, and the Site Services Line-up. A peregrine falcon was observed harassing a common raven at A418 on 6 June and again on 12 June, potentially defending a nest site. A rough-legged hawk along with whitewash was also observed at A154 at a previous nest site on 14 June, with additional whitewash observed at this location on 17 August. Finally, a pair of peregrine falcons were observed perched on a wall behind the Site Services Line Up Area on 28 June. No eggs or young were observed at these locations in 2020 so were not confirmed as active nests. Once the nest was confirmed to no longer be active, no further inspections were undertaken.

Although not considered “raptors”, common ravens are functional raptors and were confirmed nesting at on a rock wall near the Site Services Line-up Area (Table 11).

Table 11: Active Nests Observed on Mine Infrastructure and Open Pits in 2020

Area	Species	Date	Observations
A21 South Ramp	Rough-legged hawk	20 May to 9 August	Potential nesting was first observed on 20 May and later confirmed on 3 June when the female was observed incubating. On 9 August, three nestlings were observed in the nest.
Site Services Line Up Area	Common raven	25 May to 31 May	An active common raven nest was recorded on 25 May and 31 May. Fledglings were heard begging on 31 May. Nest success was not recorded.

A total of 22 instances of deterrent actions were used to prevent raptor nesting at the A21 Pit area from 12 May to 14 July. Bear bangers were the main deterrent used, along with water spraying, rope dragging (noise maker), and snow fencing. Initial deterrent use focused on a pair of rough-legged hawks. These efforts proved unsuccessful as the pair established a nest on the south ramp wall at this location. Once this nest was active, deterrence efforts on this pair ceased. Deterrent actions were also used at the A21 Pit on peregrine falcons. Peregrine falcon were not recorded nesting at the A21 Pit so deterrent actions were deemed successful.

7.2 Incidents and Mortalities

7.2.1 Methods

Mine-related incidents that occur are reported to Environment Department staff through incident reports submitted by Mine staff. Environment Department staff follow up on any incident and complete the necessary documentation, ENR is consulted for mitigation and disposal procedures. This information is tabulated and provided for annual comparisons.

7.2.2 Results

One rough-legged hawk mortality occurred in 2020. On 17 September, a barely responsive rough-legged hawk was discovered at night on Lakeshore Boulevard and died shortly after the discovery. Diavik contacted ENR and the carcass was sent out for necropsy. The cause of the mortality is unknown.

7.3 Adaptive Management and Recommendations

Diavik will continue Pit Wall/infrastructure monitoring for nesting raptors and support regional nest monitoring. In 2020, DDMI assisted with the program by covering fuel, aircraft rental and consultant fees (total cost $16,745). The next regional nest monitoring is scheduled to occur in 2025 and assumed to be completed by ENR.

8.0 WASTE MANAGEMENT

Diavik is committed to taking the necessary steps to collect, store, transport, and dispose of all waste generated by the Mine. These procedures are being completed in a safe, efficient, and environmentally compliant manner. The Waste Management Plan is an integral part of DDMI's Environmental Management System and focuses on practical and positive management of waste.

The objectives of the Waste Management Plan include:

- creating a system for proper disposal of waste
- minimizing potentially adverse impacts on the physical and biological environment
- complying with Federal and NWT legislation

Mitigation practices include food waste incineration, categorical segregation of non-food waste for storage and subsequent removal from site, and on-site disposal and monitoring. In addition to these mitigation practices, DDMI has implemented recycling and renewable energy initiatives.

In addition to waste management, waste rock and the number of employees at site have been identified as indices of Mine activity (Golder 2017a) and have been reported annually beginning in 2017. Waste rock deposition includes hauling of waste rock and is a source of fugitive dust, noise, and general activity at the Mine site. Mine activity includes all sources of sensory disturbance (e.g., dust, smells, lights, noise, and presence of people) potentially influencing the distribution of wildlife in areas adjacent to the Mine.

8.1 Waste Inspections

The DDMI Waste Management Plan outlines practices for waste disposal and mitigation actions. A Waste Management Plan was submitted in January 2015 to the Wek'èezhìı Land and Water Board (WLWB) as part of the water license renewal under water license number W2015L2-0001 (WLWB 2015). An updated version of Waste Management Plan was submitted to the WLWB on 5 June 2020 and was implemented in 2020 (DDMI 2020b). The Asset Management Department at the Mine maintains the various waste collection transfer and disposal points, inventories of bulk wastes, waste management datasheets, and status of protective equipment and spill kits. This assists in evaluating the capacity of waste management facilities, planning for logistics associated with backhauling, and requirements for any modifications to the system.

Waste Management staff identify problem areas and work with contractors and Mine employees to resolve any issues. Numbering and inspecting waste collection bins prior to pick up is an effective method of facilitating communication between Waste Management and Environment Department staff and addressing issues within various departments. Efforts are made to identify improperly disposed waste in the large waste collection bins prior to collection; however, on occasion improperly disposed waste may end up in either the Landfill or the burn pit.

Incineration, segregation, and storage of waste takes place at the waste transfer area (WTA), which was established to provide proper handling and storage of waste on site. The facility is located on the south side of East Island. The WTA is a lined facility surrounded by a gated, three-metre high chain link fence to control wind transportation of any litter and prevent most wildlife intrusion. Contained within the WTA are two incinerators for food waste, a burn pit for non-toxic/non-food contaminated burnable material, a contaminated soils containment area, a treated sewage containment area, as well as sea cans, sheds, and storage areas for drums, crates, bins, and totes. Two water scrubbed incinerators were installed and operational in October 2012 and are located within the incinerator building. One of the incinerators was replaced in the fall of 2020 with a non-scrubbed incinerator that is large enough to handle all waste. The remaining incinerator is currently used as a back up to the new incinerator. The majority of waste is inventoried and stored at the WTA while awaiting backhaul on the Tibbit-to-Contwoyto Winter Road.

On-site disposal of non-burnable wastes such as steel (ground support for underground mining), vent tubing, plastics, and glass currently occurs at the inert Landfill located within the Waste Rock Storage Area – North Country Rock Pile. Waste is pushed into a large depression in the landfill. The location of the Landfill within the rock pile and traffic in the area will continue to discourage wildlife access to the Landfill, thereby limiting the availability of infrequently misdirected food and food packaging for animals.

8.1.1 Methods

In 2020, waste inspections at the WTA, Landfill, Underground waste bins, and A21 were completed twice per week during the winter and once per week in the summer. These inspections are to confirm that all waste segregation, storage, and disposal procedures set out in the Waste Management Plan are being followed. Inspections undertaken by Environment Department staff consist of walking the area of the WTA, Landfill, A21 Area, and Underground waste bins, where safe to do so, and documenting the type and number of misdirected waste items, as well as wildlife species and sign that were present during the survey. Corrective actions at the WTA and Landfill area include notifying a WTA coordinator and transferring items to the appropriate disposal area. Corrective actions at the A21 Area and Underground waste bins include notifying the area supervisor to arrange for the transfer of items to the appropriate disposal area and additional worker education where required. All misdirected waste items found during inspections in the WTA and Landfill are sorted into the proper disposal area by Waste Management staff. For example, non-burnable material is removed from the incinerator waste stream and transferred to the designated area in the Landfill. Hazardous wastes are stored in the WTA until they can be shipped to licensed facilities off-site.

8.1.2 Results

Development of the Underground mine and the A21 open pit in 2020 yielded 8,254,260 tonnes of mined waste rock and 1,196,265 tonnes of overburden till and lake bottom sediment. Development also yielded 134,073 tonnes of waste rock for the Underground mine and 2,478,575 tonnes of ore were processed. The average daily population at the Mine in 2020 was 585 people, and weekly the population ranged from 546 to 606 people (Table 6; Appendix N). During 2020, the WTA and Landfill were surveyed on 82 and 79 occasions, respectively. The A21 Area was surveyed 79 times and the Underground was surveyed 85 times. All surveys occurred between 2 January to 30 December (Table 12; Appendix O). A total of 499 misdirected waste items were found during WTA inspections, 851 items during Landfill inspections, 300 items at the A21 Area, and 765 items at the waste segregation area of the Underground (Table 12). At the WTA, landfill, A21, and Underground, 51.2%, 63.3%, 48.1%, and 47.1% of the inspections had at least one item of misdirected waste, respectively.

In the WTA, the most common misdirected waste item was gloves (177 items), followed by cigarette butts (100 items), and recyclable drink containers (87 items). In the Landfill, the most common misdirected item was also gloves (282 items), followed by oily rags (192 items), and cigarette butts (102 items). In the A21 Area, the most common misdirected waste item was oily rags (157 items), followed by gloves (70 items) and aerosol containers (26 items). In the Underground, the most common misdirected waste item was cigarette butts (493 items), followed by gloves (104 items), and oily rags (59 items).

Considering the total amount of waste disposed (438,949 kg incinerated and 2,604 tonnes landfilled), the amount of misdirected waste is negligible. Improperly disposed items at the WTA and Landfill were reported to Waste Management staff for immediate rectification.

Table 12: Misdirected Waste at the Waste Transfer Area, Landfill, A21 Area, and Underground, 2020

Misdirected Waste Type	Waste Transfer Area (n = 82 surveys)		Landfill (n = 79 surveys)		A21 Area (n = 79 surveys)		Underground (n = 85 Surveys)	
	Total Number Found in All Inspections	Percent of Inspections	Total Number Found in All Inspections	Percent of Inspections	Total Number Found in All Inspections	Percent of Inspections	Total Number Found in All Inspections	Percent of Inspections
Aerosol Cans	15	9.8	31	15.2	26	10.1	37	10.6
Batteries	1	1.2	4	3.8	0	0.0	2	2.4
Cigarette Butts	100	1.2	102	2.5	0	0.0	493	22.4
Cigarette Packaging	17	9.8	11	7.6	5	6.3	6	5.9
Drink Containers Recyclable	87	22.0	60	53.2	15	12.7	8	9.4
Food	29	8.5	4	2.5	0	0.0	1	1.2
Food Packaging	42	19.5	33	13.9	8	5.1	5	3.5
Gloves	177	37.8	282	53.2	70	24.1	104	29.4
Oil Contaminated Waste	0	0.0	19	8.9	5	3.8	17	5.9
Oil Products and Containers	0	0.0	15	6.3	1	1.3	3	3.5
Oily Rags	28	11.0	192	34.2	157	29.1	59	20.0
Other	3	3.7	98	7.6	13	2.5	30	2.4
Total	**499**	**51.2[1]**	**851**	**63.3[1]**	**300**	**48.1[1]**	**765**	**47.1[1]**

[1] This value indicates the total percentage of inspections with at least one misdirected waste item for that particular sample location.

Wildlife were observed on 2.4% of inspections of the WTA and 1.3% of inspections of the Landfill. Wildlife were not observed during inspections of the Underground or the A21 Area (Table 13). Wildlife sign was observed on 42.7%, 31.6%, 15.2%, 8.2% of inspections at the WTA, Landfill, A21 Area, and Underground, respectively. The only wildlife species observed during inspections were red fox. The most common wildlife signs observed were red fox and unspecified wildlife tracks.

Table 13: Wildlife and Wildlife Sign in the Waste Transfer Area, Landfill, A21 Area, and Underground, 2020

Species	Waste Transfer Area (n = 82 surveys)			Landfill (n = 79 surveys)			A21 Area (n = 79 surveys)			Underground (n = 85 Surveys)		
	Number of Inspections with Wildlife Observations	Total Number of Observations	Number of Inspections with Wildlife Sign Observed	Number of Inspections with Wildlife Observations	Total Number of Observations	Number of Inspections with Wildlife Sign Observed	Number of Inspections with Wildlife Observations	Total Number of Observations	Number of Inspections with Wildlife Sign Observed	Number of Inspections with Wildlife Observations	Total Number of Observations	Number of Inspections with Wildlife Sign Observed
Red fox	2	2	28	1	1	17	0	0	8	0	0	3
Grey wolf	0	0	1	0	0	0	0	0	0	0	0	0
Wolverine	0	0	1	0	0	0	0	0	0	0	0	0
Grizzly bear	0	0	0	0	0	1	0	0	0	0	0	0
Arctic hare	0	0	0	0	0	1	0	0	0	0	0	0
Bear spp.	0	0	0	0	0	0	0	0	0	0	0	1
Goose spp.	0	0	0	0	0	0	0	0	0	0	0	1
Unspecified	0	0	5	0	0	6	0	0	4	0	0	2
Total	**2**	**2**	**35**	**1**	**1**	**25**	**0**	**0**	**12**	**0**	**0**	**7**

spp. = species.

Since 2014 (when frequency of inspections during summer was reduced to once per week), wildlife observed during waste inspections has remained relatively low and consistent. The highest amount of wildlife was recorded at the WTA in 2014, while 2019 and 2020 had no wildlife recorded at the Landfill (2019 only), A21 Area, and the Underground (2020 only). Overall, 8.1% of inspections since 2014 have included wildlife observations (Figure 6).

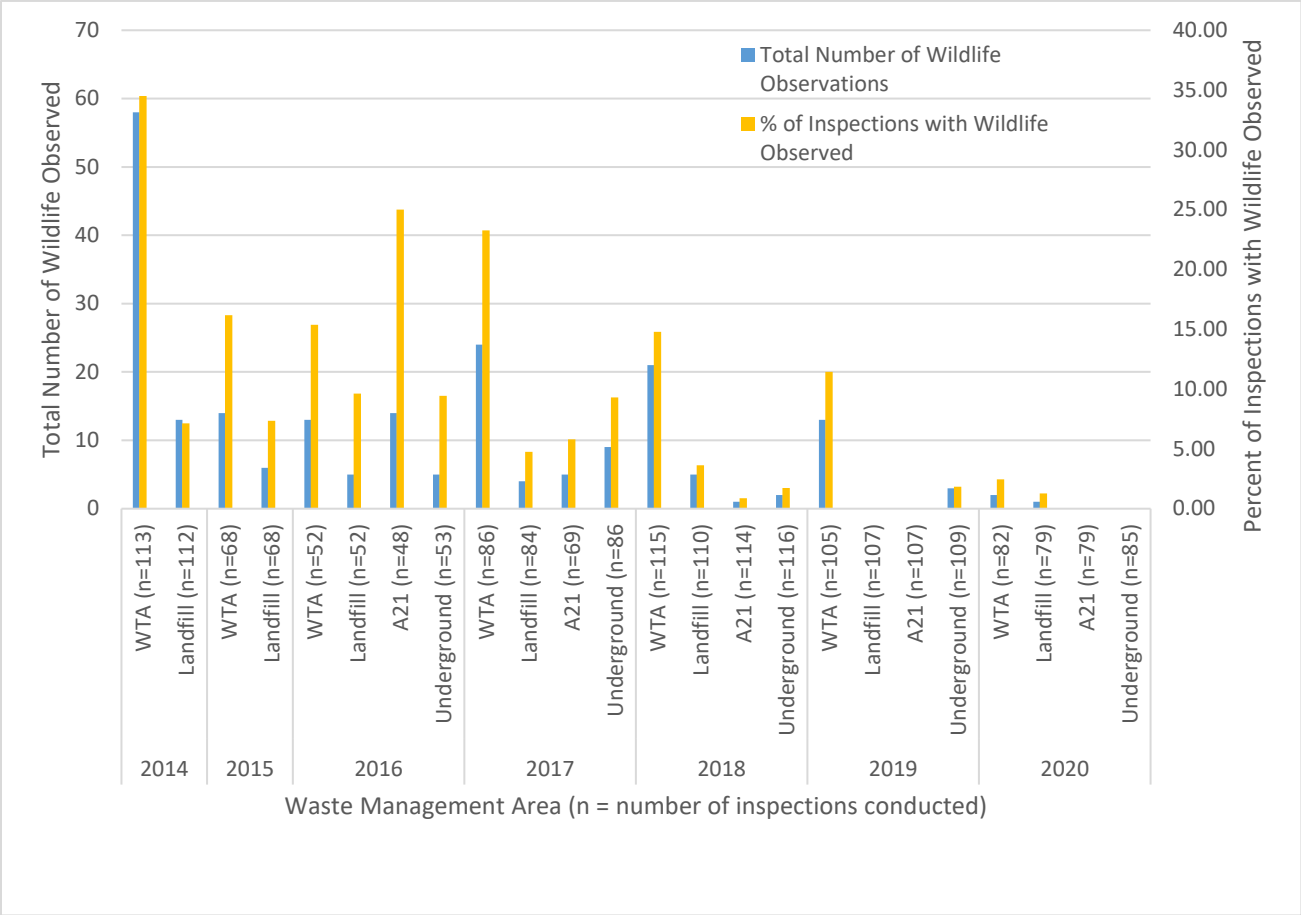

Figure 6: Total Number of Wildlife Observations per Waste Management Area, 2014 to 2020

The WTA has had an average of 20.7 wildlife observations recorded per year during inspections, with 2014 having the highest amount of wildlife recorded with 58 observations recorded.

Wildlife observed since 2014 during waste inspections are summarized in Table 14. The most frequently observed species at the WTA has been red fox. The Landfill has had an average of 4.9 observations recorded per year during inspections, with 2014 having the highest amount of wildlife recorded with 13 observations. The most frequently observed species at the Landfill has been common raven. An average of four observations have been recorded per year since 2016 when inspections began at the A21 Area, with 2016 having the highest amount of wildlife recorded with 14 observations. The most frequently observed species at the A21 Area has been fox species. An average of 3.8 observations have been recorded per year since 2016 when inspections began at the Underground, with 2017 having the highest amount of wildlife recorded with nine observations. The most frequently observed species at the Underground has been fox species.

Table 14: Wildlife Reported During Waste Inspections, 2014 to 2020

Year	Location	Number of Surveys in Year	Red fox	Fox spp.	Grey wolf	Wolverine	Arctic hare	Common raven	Rough-legged hawk	Gull spp.	Unidentified	Total
2014	WTA	113	38	0	0	0	0	14	0	2	4	**58**
	Landfill	112	4	0	1	1	0	4	3	0	0	**13**
2015	WTA	68	0	6	0	0	0	5	0	0	3	**14**
	Landfill	68	0	3	0	0	0	3	0	0	0	**6**
2016	WTA	52	0	5	0	0	0	1	0	0	7	**13**
	Landfill	52	0	2	0	0	0	2	0	0	1	**5**
	A21	48	0	11	0	3	0	0	0	0	0	**14**
	Underground	53	0	3	0	2	0	0	0	0	0	**5**
2017	WTA	86	0	16	0	2	0	5	0	1	0	**24**
	Landfill	84	0	2	0	0	0	2	0	0	0	**4**
	A21	69	0	1	0	1	0	2	0	0	1	**5**
	Underground	86	0	7	0	0	0	2	0	0	0	**9**
2018	WTA	115	19	0	0	1	0	1	0	0	0	**21**
	Landfill	110	2	0	0	0	0	3	0	0	0	**5**
	A21	114	0	0	0	1	0	0	0	0	0	**1**
	Underground	116	0	0	0	0	0	2	0	0	0	**2**
2019	WTA	105	11	0	0	0	0	1	0	1	0	**13**
	Landfill	107	0	0	0	0	0	0	0	0	0	**0**
	A21	107	0	0	0	0	0	0	0	0	0	**0**
	Underground	109	2	0	0	0	1	0	0	0	0	**3**
2020	WTA	82	2	0	0	0	0	0	0	0	0	**2**
	Landfill	79	1	0	0	0	0	0	0	0	0	**1**
	A21	79	0	0	0	0	0	0	0	0	0	**0**
	Underground	85	0	0	0	0	0	0	0	0	0	**0**
Total			**79**	**56**	**1**	**11**	**1**	**47**	**3**	**4**	**16**	**218**

Note: waste inspections began in 2016 at the A21 and Underground waste bin areas.

8.2 Recycling Initiatives

During 2008, DDMI implemented an employee-driven recycling program for plastic bottles and aluminium cans generated on site. Throughout 2020, 9,700 units of aluminium containers and 11,700 units of plastic containers were recycled and the total monetary value ($2,140.00) given to charity. All proceeds were donated to the Stanton Foundation (Mud Run). To date, the total proceeds since the inception of the employee-driven recycling program has generated $30,777.50.

Scrap copper was also collected in 2019 and sold for $94,000 in 2020. These proceeds were donated to the Yellowknife Women's Society.

During 2020, approximately 139,278 litres of waste oil were collected to be used in the waste oil boiler that was commissioned in the second quarter of 2014. Since the boiler was commissioned, 1,537,210 litres of waste oil were burned to create heat rather than being shipped off-site.

In addition, a number of waste materials generated on-site are shipped off-site using winter road backhauls. Diavik is committed to maximizing recycling opportunities for wastes generated from Mine operations that cannot be disposed of on site. Items shipped for recycling include:

- used oil, oil filters, and grease
- used glycol
- aerosol cans
- batteries (lead-acid and dry cell)
- expired/waste fuel (e.g., Jet B)
- oil-based paint
- absorbents

Diavik will continue to increase recycling opportunities and reduce waste streams generated at the Mine.

8.3 Renewable Energy

The wind farm became operational on 28 September 2012 and it was predicted that it would reduce Mine diesel consumption by 10%, as well as greenhouse-gas emissions by 12,000 tonnes of carbon dioxide (CO_2) annually. During the ninth year of operation, the wind farm generated 19,292,380 kilowatt hours (kWh) of power, which represents 10.7% of the total power generated in 2020 and an approximate diesel savings of 4.7 million litres (Figure 7).

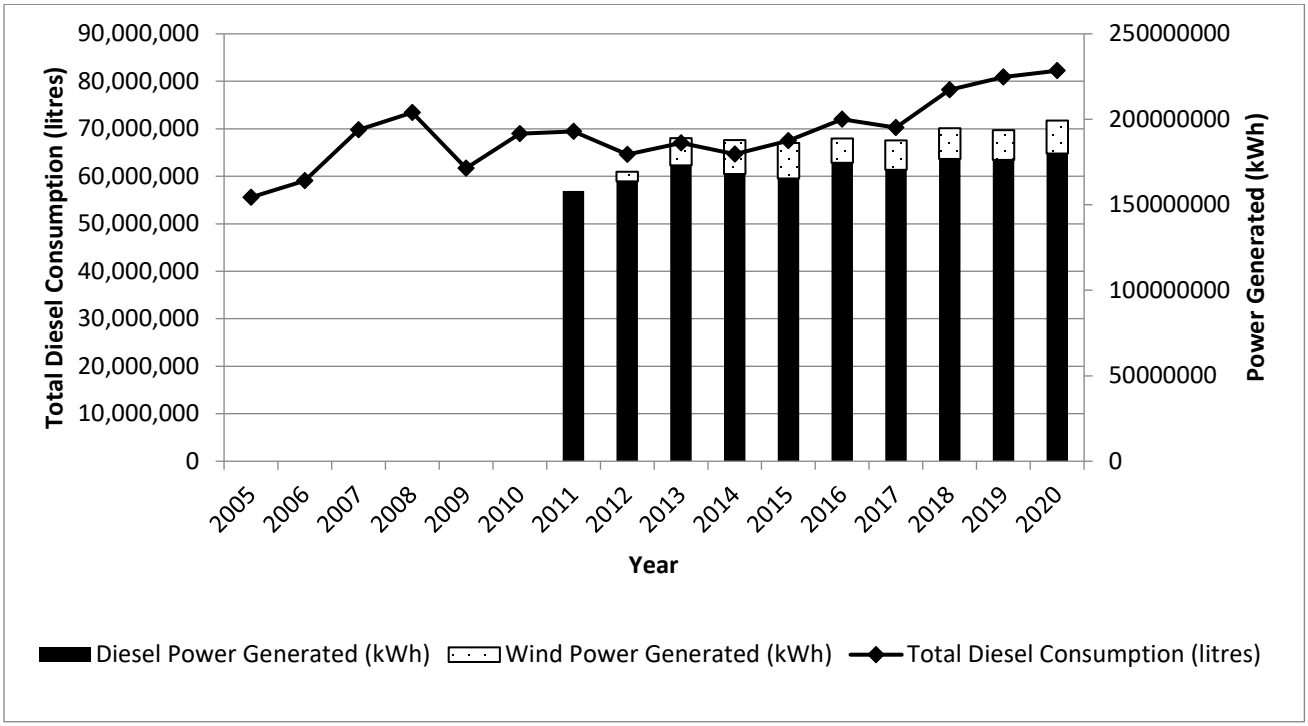

Figure 7: Annual Diavik Power Generation and Diesel Consumption

Table 15: Total Litres of CO_2 Offset by the Wind Farm (2013-2020)

Year	2013	2014	2015	2016	2017	2018	2019	2020
Wind Farm Energy Generated (KWh's)	15,823,543	19,747,333	20,842,138	14,297,803	17,192,885	18,001,285	17,326,685	19,292,380
CO_2 Offset (tonnes)	12,000	14,068	14,403	9,030	10,478	12,063	10,798	12,898
Total CO_2 Offset by Windfarm (tonnes)								**95,738**

The peak amount of total power used can be as high as 60% wind power on a given day. The wind farm offset an estimated 12,898 tonnes of carbon dioxide emissions in 2020 (Table 15). From 2005 through 2020, the annual diesel fuel consumption at the Mine has ranged from 55,573,00 litres to 82,236,753 litres. In 2020, the total fuel consumption was 82,236,753 litres, which is the highest consumption during this period. The total carbon dioxide emissions (equivalents) offset since 2013 by the wind farm is 95,738 tonnes.

8.4 Adaptive Management and Recommendations

Procedures and mitigation strategies currently in place have been relatively successful at limiting wildlife interactions in the WTA and Landfill. While foxes, ravens and occasionally wolverine appear to be present at the WTA and Landfill, A21 Area and Underground waste bins, these animals are natural scavengers and will continue to be visit these areas throughout the Mine's life. Diavik will continue to monitor the WTA and Landfill at the frequency of twice per week in the winter and once per week in the summer, and the A21 Area and Underground once per week during the year. Diavik remains committed to carrying out employee education programs related to waste handling.

9.0 CLOSURE

The reader is referred to the Study Limitations, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

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