

# **A Review of the 2006 Diavik Diamond Mine Wildlife Monitoring Report**

Prepared for

**Environmental Monitoring Advisory Board**

May 2007

Prepared by



207 Edgebrook Close NW  
Calgary, Alberta  
T3A 4W5 Canada

Phone +1 (403) 241-8668  
Fax +1 (403) 241-8679  
Email: [mail@mses.ca](mailto:mail@mses.ca)

## Summary and Recommendations

We found no major errors or omissions that would underestimate the predicted effects to wildlife. Most effects continue to be at or below predicted levels. However, data quality may, in several instances, be improved and the precision of the analyses increased by changing the methods of measurement. Improving the precision of analysis is a very practical tool for the purposes of monitoring because, in some cases, the low resolution of data or lack of precision in analyses may undermine the ability to detect true trends of change. Diavik Diamond Mine Inc (DDMI) has responded to earlier recommendations and improved (or attempted to improve) several approaches including vegetation monitoring, caribou behavioural observations, and wolverine track counts. DDMI used information from the monitoring programs to adjust its practices, which included the improvement and increased awareness of waste management and the need for repairs along fences.

### Vegetation

It would be useful if DDMI could make a projection estimating when 100% of predicted habitat loss would be reached, and whether or not it is likely that the 100% prediction would be exceeded during the lifespan of the mine. This prediction may be particularly useful in order to understand future effects on specific habitat types, such as Riparian Tall Shrub and Esker (Table 2.1-1), that have already reached or slightly exceeded the predicted maximum loss.

Given the progression of the mine development, DDMI should comment on whether or not any areas are being reclaimed as the mine progresses.

The proposed increase in sample size of vegetation plots is a good advance and it may or may not provide for a stronger analysis. However, a less arbitrary determination of the required sample size can be done by power analyses. This is now possible because the variation between the plots is known.

### Caribou

#### New recommendations and comments

There is a noteworthy potential issue with reduced lichen cover, as found in the vegetation plots. Reduced lichen cover may also be a form of caribou habitat loss. The current study described in Section 5.2, p. 45 of the 2006 WMR is promising in terms of shedding light on this issue. We look forward to hearing about this in the upcoming years.

Although the trend is not statistically reliable, at present there is little indication that caribou would be more disturbed closer to the mine than farther away. Plans for more data collection and data analysis in 2008 are underway which we strongly encourage.

The numbers of caribou in the wildlife study area appear to be declining (Figure 3.3.2-2) which could be the result of declining population size. The meaning of these results is difficult to

interpret. More long-term data and rigorous analyses as proposed for 2008 are strongly encouraged, particularly concerning distance effects.

#### Modified recommendations

As to the possible regional movement and distribution, we suggested earlier that a larger area should be surveyed given changes by other operators such as BHP in the region and given new insights that suggest a possible effect of disturbance that might be measurable at about 25 km distance. DDMI proposes to do this.

The changes proposed by DDMI in the 2006 WMR on p. 41 are in line with the intent to better understand the possible long-range effects. DDMI's intent to keep the data collection protocols consistent is a good idea. We encourage DDMI to share their plans to revise the number and timing of surveys with EMAB as soon as possible.

#### Recommendations and Questions from previous reviews not addressed

We stated it in previous years that the data collection within the zone of influence (ZOI) is not detailed enough to demonstrate the differences between inside and outside of the ZOI. The sampling density needs to be increased. Behaviour data collected during aerial surveys indicates a lack of avoidance of the mine, i.e. more feeding and resting closer to the mine, which is principally supported by the increased presence of females with young near the mine. This should receive more attention in future analyses. The request to increase sampling density within the ZOI will help in obtaining better (more accurate) behavioural data.

As per a commitment during the workshop in May 2006, can DDMI show caribou habitat in a separate table (as opposed to HUs) and compare the results produced by the different procedures? [Section 3.2]

Could the continued low numbers of caribou observed in the study area, as compared to numbers at baseline, reflect the avoidance of the mine or is it likely simply the aggregation of water bodies surrounding the mine that causes the caribou to utilize upland areas farther from the mine? [Section 3.2]

If there is avoidance (by caribou) of the mine, does DDMI suggest remedial action in terms of scheduling of some activities in certain areas or attenuation of noise? [Section 3.2]

### **Grizzly**

#### New recommendations

Current data on bear sign as a measure of a disturbance effect seem to suggest that a ZOI does not exist. However, a rigorous data analysis is planned by DDMI for 2008, which we strongly encourage.

---

Recommendations and Questions from previous reviews not addressed

Could DDMI provide information on how much heath tundra is, on average, available in a bear's home range, to evaluate the meaning of losing a given area of this habitat type?

**Wolverine**New recommendations

The snow tracking results and incidental observations show no detectable shift in wolverine distribution in the study area. There is also no indication by any of the wolverine data sets that there is a distance effect.

However, these data are not strong and they would benefit from an improved and better-stratified sampling program. We therefore commend DDMI on the intention to improve on the tracking program as per Appendix VII. The intended increase in the number of transects and the equal length of transects is the correct approach to the betterment of the program.

Recommendations from previous reviews not addressed

It is unclear how the new sample size of the proposed tracking program was determined. We therefore re-state that DDMI may benefit from analyzing the estimated required sample size and transect length. We also agree that the methods of the tracking survey should be comparable to other monitoring in the region.

**Waste Management**

There is clearly a decreasing trend in food and other attractants on the Waste Transfer Area. This is very encouraging and we hope that the trend will continue. However, there is no such trend evident for the land fill. In fact, in some cases, attractants at the landfill are as high or higher than in previous years. This requires corrective action on behalf of DDMI.

DDMI should be commended for their adaptive management in terms of using information from the waste monitoring programs to improve on mitigation measures such as fencing and the increased attention to already existing worker training programs

**Falcons**

The addition of spring surveys three years ago that allowed the assessment of productivity or failure of nests appears to work well and produce useful information. There does not seem to be a detectable change in nesting success as a result of the mine. We concur with DDMI's recommendation to continue with the falcon monitoring program as was done in 2006.

## **Waterfowl**

### New recommendations

Changes in waterfowl community composition occurred and this change was most apparent during the construction phase. However, without any reference sites this change is difficult to interpret as it may well be a natural phenomenon, and not caused by the mine

We anticipate that the analysis scheduled for 2008 will include waterfowl. Without the analysis, the data presented in the past two WMRs is difficult to interpret.

### Recommendations from previous reviews not addressed

We repeat our conclusion of past years that in order to draw conclusions about mine effects on bird diversity, if any, it is imperative to apply to control sites the same data collection techniques as are currently employed near the mine. However, if one accepts that the past analyses showed as a potential worst case scenario of effects that were relatively low, future waterfowl monitoring may not be required.

## Table of Contents

<b>SUMMARY AND RECOMMENDATIONS .....</b>	<b>II</b>
<b>I INTRODUCTION .....</b>	<b>1</b>
<b>2 GENERAL OBSERVATIONS .....</b>	<b>2</b>
2.1 OBJECTIVES OF THE WILDLIFE MONITORING PROGRAM .....	2
2.2 THE STATE OF CURRENT INFORMATION .....	2
<b>3 SPECIFIC REVIEWS.....</b>	<b>4</b>
3.1 VEGETATION AND WILDLIFE HABITAT .....	4
3.1.1 Information About Effects To Date .....	4
3.1.2 Current Data Collection .....	4
3.1.3 Potential for Adapting the Monitoring Program .....	5
3.2 BARREN-GROUND CARIBOU.....	5
3.2.1 Information About Effects To Date .....	5
3.2.2 Current Data Collection .....	5
3.2.3 Potential for Adapting the Monitoring Program .....	6
3.3 GRIZZLY BEARS .....	8
3.3.1 Information About Effects To Date .....	8
3.3.2 Current Data Collection .....	8
3.3.3 Potential for Adapting the Monitoring Program .....	8
3.4 WOLVERINE .....	8
3.4.1 Information About Effects To Date .....	8
3.4.2 Current Data Collection .....	9
3.4.3 Potential for Adapting the Monitoring Program .....	9
3.5 WASTE MANAGEMENT .....	9
3.5.1 Information About Effects To Date .....	9
3.5.2 Current Data Collection .....	10
3.5.3 Potential for Adapting the Monitoring Program .....	10
3.6 FALCONS .....	10
3.6.1 Information About Effects To Date .....	10
3.6.2 Current Data Collection .....	10
3.6.3 Potential for Adapting the Monitoring Program .....	10
3.7 WATERFOWL .....	10
3.7.1 Information About Effects To Date .....	10
3.7.2 Current Data Collection .....	11
3.7.3 Potential for Adapting the Monitoring Program .....	11
<b>4 CLOSURE .....</b>	<b>12</b>
<b>5 REFERENCES.....</b>	<b>13</b>

## I Introduction

The Environmental Monitoring Advisory Board (EMAB) for the Diavik Diamond Mine Project requested that Management and Solution in Environmental Science Inc (MSES Inc) review and assess the procedures and results of the 2006 Wildlife Monitoring Report (WMR). The WMR communicates the findings of surveys as established in the Wildlife Monitoring Program v.2 (WMP) developed by Diavik Diamond Mines Inc. (DDMI) in August 2002 in response to comments and issues raised by EMAB and the Department of Environment and Natural Resources (ENR, at that time referred to as Resources, Wildlife, and Economic Development (RWED)).

MSES' review of the past three WMRs covered a comprehensive analysis of the data collected thus far in addition of the yearly wildlife report. Numerous recommendations have been submitted for EMAB and DDMI to consider. As in our previous reviews, we focus on the responses to the recommendations and how they were considered by DDMI in the 2006 WMR. Accordingly we provide in the summary new recommendations and we re-state old ones that were apparently not yet addressed.

As in previous years, we comment on the contribution of current data collection to the findings of past monitoring and how the data collection will contribute to wildlife management in the future. We also provide specific recommendations to adapting the data collection in light of current information and in light of the objectives of the Wildlife Monitoring Program developed in 2002.

## 2 General Observations

### 2.1 Objectives of the Wildlife Monitoring Program

The objectives of the Wildlife Monitoring Program v. 2 of 2002 were developed five years ago. During past deliberations concerning DDMI's wildlife monitoring programs, the notion was raised that the objectives may need to be revisited. However, at present there is no apparent direction to do so, and MSES found no compelling argument to recommend such changes. For more clarity, below we re-state the objectives set forth in the Wildlife Monitoring Program v. 2 of 2002 to emphasize that these objectives are the foundation and focus of our review, and that the methods and results in the 2006 WMR, as in the past reviews of WMRs, are reviewed in light of these objectives.

The Objectives of the Wildlife Monitoring Program (WMP v. 2 of 2002) are to:

1. verify the accuracy of the predicted effects found in the Environmental Effects Report (Wildlife 1998) and the Comprehensive Study Report (June 1999);
2. ensure that wildlife and wildlife habitat management and mitigation measures are effective in preventing significant adverse impacts to wildlife.

Key features of the Wildlife Monitoring Program are to:

1. determine if predictions in the EA are accurate;
2. observe and systematically document project-wildlife interactions;
3. assess the effectiveness of mitigation strategies and procedures;
4. warn of wildlife occurrences (i.e. caribou migration and grizzly bears) to facilitate management decisions and actions;
5. promote regional mitigation approaches to avoid and minimize cumulative impacts;
6. evaluate on a regular basis, with input from stakeholders including Aboriginal and government agencies, the wildlife management procedures and the monitoring program, and;
7. provide regional information to contribute to understanding and managing potential cumulative effects.

### 2.2 The State of Current Information

As to the first objective, the 2006 WMR indicates that at the present time effects are at or below predicted levels. We found no major errors or omissions that would underestimate the effects. However, data quality may in several instances be improved and the precision of the analysis increased by changing the methods of measurement. Improving the precision of analysis is a very practical tool for the purposes of monitoring because, in some cases, the low resolution of data or lack of precision in analyses may undermine the ability to detect true trends of change. DDMI has responded to earlier recommendations and improved (or attempted to improve) several approaches including vegetation monitoring, caribou behavioural observations, and wolverine track counts. Specifics of the approaches are discussed in the respective sections below.

As to the second objective, given that effects do not exceed the predicted levels, DDMI's management and mitigation measures appear to be adequate. Moreover, DDMI used information from the monitoring to adjust its practices such as the improvement and increased awareness of waste management or the need for repairs along fences. Details on such adjustments are discussed in the respective sections below.

The Key features of the WMP clearly distinguish between local (Key Features 1 to 4) and regional (Key Features 5 and 6) information needs. Accordingly, our review and recommendations are based on the premise that information must be gathered at different scales:

1. The local scale, i.e. within the predicted zone of influence (ZOI), requires information on distribution, movement and behaviour of wildlife on a scale of hundreds of meters and up to a few kilometers. This information is relevant for the individual operator that needs to know how to mitigate the project activities to reduce disturbance to wildlife at the project site.
2. The regional scale requires information on wildlife movements and distribution on a scale from tens or hundreds of kilometers. This information facilitates the management of regional cumulative effects and is relevant for decision making by resource management agencies such as ENR. As for caribou, the recent findings by Boulanger et al. (2004) and by Johnson et al. (2005) namely that effects on caribou can be detected at about 25 km distance from the mine suggest the need for a regional analysis of caribou movements and distribution covering tens of kilometers. Although the 25 km distance is, in our view, only a hypothesis that needs a great deal of verification itself, the need is apparent for understanding the effects accumulated through a variety of developments in the region.

Consequently, the two scales require different types of information which are intended to facilitate different types of decisions. Currently, the monitoring at the local scale for caribou and probably bears is not precise enough to detect subtle differences within and outside of the ZOI. The data and analysis are therefore limited in their ability to satisfy Objectives (1.) and (2.). Although the existing data do not indicate that major differences would exist, a true test of the predictions as per Objective (1.) is of limited power in several instances, and hence, the ability to assure the effectiveness of habitat management and mitigation measures as per Objective (2.) may be hampered.

For the regional scale, the current information does not cover a large enough area to conclusively investigate the potential 25 km distance effect to caribou. Therefore, adjustments to the regional component of the caribou program should be made and harmonized with other operators in the region. Details on this will be discussed in the caribou sections below.

## 3 Specific Reviews

### 3.1 Vegetation and Wildlife Habitat

#### 3.1.1 Information About Effects To Date

The monitoring results to date confirm the predictions regarding effects on vegetation and wildlife habitat. The current total loss of habitat is estimated at 69.9%. This estimate appears to be credible as the methods used to determine it are appropriate and straight forward, using current technology.

It would be useful if DDMI could make a projection, given the current rate of habitat loss, estimating when 100% would be reached, and whether or not it is likely that 100% would be exceeded in the lifespan of the mine. This prediction may be particularly useful in order to understand future effects on specific habitat types, such as Riparian Tall Shrub and Esker (Table 2.1-1), that have already reached or slightly exceeded the predicted maximum loss.

The question arises as to whether or not any areas are being reclaimed as the mine progresses. If so, EMAB may be interested in monitoring the success of reclamation as it may counteract future additional vegetation clearing and contribute to wildlife recolonization or use.

#### 3.1.2 Current Data Collection

DDMI should be commended on the new sampling design and data analysis on permanent vegetation plots. The analysis provides for new insights into the differences between vegetation near and far from the mine. The 2006 data indicate that lichen cover is higher farther away from the mine. Because this is an important food source for caribou, it will be useful to better understand:

1. the cause of the lower lichen cover near the mine (if any), and
2. the effect of the lower lichen cover on caribou.

The former may or may not be a result of mine emissions or dust. The study “Dust Distribution and Monitoring Using Lichens as Bio-indicators” by the university of Alberta will provide useful insights in this issue. This would be a very important consideration in addressing the effects on caribou and particular thought would have to be given to whether or not the reduced cover is indeed caused by the mine or whether this is a natural occurrence (which it could be given the proximity of the plots to the large water bodies).

Please note that in light of these results there seems to be an incorrect generalization on p. 22 that “there are no statistically significant differences”. Also, please number the Tables in Appendix VIII that are referred to on p. 21.

### 3.1.3 Potential for Adapting the Monitoring Program

We concur with the recommendation on increasing the sample size. The increase to five plots seems reasonable, albeit arbitrary. This sample size may or may not provide for a stronger analysis, but a less arbitrary determination of the required sample size can be done by power analyses. This is now possible because the variation between the plots is known.

## 3.2 Barren-ground caribou

### 3.2.1 Information About Effects To Date

#### Habitat

Habitat loss through direct clearing does not seem to exceed predicted effects. However, note the potential issues of reduced lichen cover discussed in Section 3.1.2 above. Reduced lichen cover may also be a form of habitat loss. The current study described in Section 5.2, p. 45 of the 2006 WMR is promising in terms of shedding light on this issue. We note that there does not appear to be any form of validation of the habitat models developed by DDMI in 1998. Given the importance of models on predicting habitat loss, validation should probably be done to evaluate the reliability of models. Alternatively, we would appreciate a reference to this work if it has been done. For the record, a useful discussion on validation can be found in Johnson (2001).

#### Zone of Influence

Although behavioural data are still limited, the trends seem to indicate more feeding and resting behaviour within the 3 km zone than farther out. Even if this trend is not statistically reliable, at present there is little indication that caribou would be more disturbed closer to the mine than farther away. Plans for more data collection and data analysis in 2008 are underway which we strongly encourage.

#### Movement

The data on movement, based on both aerial surveys and satellite collars, support the prediction that caribou would travel east of the mine during the southern migration. However, they also travel east of the mine during the northern migration which is contrary to the prediction. The numbers of caribou in the wildlife study area appear to be declining (Figure 3.3.2-2) which could be an effect of declining population size. The meaning of these results is difficult to interpret. More long-term data and rigorous analyses as proposed for 2008 are strongly encouraged, particularly concerning distance effects.

#### Mortality

As predicted, mine related mortality was not an issue of concern in recent years.

### 3.2.2 Current Data Collection

We stated it in previous years that the data collection within the ZOI is not detailed enough to demonstrate the differences between inside and outside of the zone of influence. The sampling

density needs to be increased because at 4 km distance between transects, the mechanisms of events within a 3 km zone are very difficult to gauge. The approach of collecting information through aerial surveys as described thus far by DDMI is acceptable, except for the density of survey transects.

As to the possible regional movement and distribution, we suggested earlier that a larger area should be surveyed given changes by other operators in the region and given new insights that suggest a possible effect of disturbance that might be measurable at about 25 km distance. DDMI proposes to do this. See section 3.2.3 below for recommendations on adapting the program.

Although we noted our skepticism throughout the earlier reviews that the ground based behavioural observations (scans) may not be as useful as putting an equal amount of effort into more aerial surveys, DDMI wishes to continue with this program. Given this desire, DDMI promised on p. 18 of the 2005 WMR that it would implement a more structured program in 2006. DDMI notes again in this 2006 WMR that more effort is required in the ground-based program of 2007. However, we do not see the results of this program.

### 3.2.3 Potential for Adapting the Monitoring Program

The recommendations below have been submitted last year. We repeat these recommendations partially in light of the changes to caribou surveys proposed by BHP. The two scales of disturbance effects (see section 2.2) and two scales of management actions require different types of information which are intended to facilitate different types of decisions.

#### Regional Scale:

- a. **Billiton Diamonds Inc (BHP) proposed changes to their surveys.** BHP's intent to expand to a larger area is commendable and in harmony with the intent to improve the information on regional effects.
  - i. BHP proposes to amend its caribou aerial survey program to follow the recommendations submitted by Poole and Boulanger in 2004. These recommendations are logically rationalized and based on analyses of data from previous years of surveys. BHP's proposal includes five of the twelve recommendations from Poole and Boulanger. These five appear to be the overarching changes recommended. The other seven recommendations are somewhat more detailed and are perhaps not listed in BHP's letter of 22 May 2006, because they are implicitly incorporated into the new survey approach. Whether or not this is true should be clarified with BHP.
  - ii. The proposed timing of the surveys by BHP is sensible.
  - iii. Sampling density and proposed timing of the survey aside, the transect design proposed by BHP is compatible with other surveys in the region such as that conducted by DDMI.
  
- b. **DDMI should adopt BHP's changes.** BHP's new survey design is more effective at gathering information of caribou distribution in the region. The expanded survey area addresses the need for testing the hypothesis that

disturbance effects may be measurable as far as about 25 km from the mine. It also appears to be more cost effective because surveys are conducted during times when caribou are in the area, as opposed to during predetermined times when caribou may or may not be there. The changes proposed by DDMI in the 2006 WMR on p. 41 are in line with this intent. DDMI's intent to keep the data collection protocols consistent is a good idea. We encourage DDMI to share their plans to revise the number and timing of surveys with EMAB as soon as possible.

### Local (ZOI) Scale:

- c. **However**, BHP's proposed changes also reflect a compromise of practicality and economic limitations. That is, in order to cover a larger area, the transect density is lowered. The new distance between transects is now 8 km. We see the lower density of transects as a major weakness of the new survey design proposed by BHP because the lower density is contrary to the objective of testing the predicted ZOIs.
- d. **Caribou within ZOI:** There are two complementary approaches currently pursued: behavioural observations from the ground and air surveys that record behaviour and habitat associations.
  - i. **Air surveys:** sampling density within the ZOI needs to be increased. We recommend that within 7 km of the mine, transects are flown to cover the total area. This requires more transects; however, the surveys should be flown only when caribou are in the area which will reduce the total flying time. Given current knowledge on barren-ground caribou responses to development, the 7 km distance should cover the most apparent responses such as movement, foraging or resting. Differences between males and females with young should also be detectable. We expect that avoidance would be gradual over this distance; that is, if caribou avoid the mine, there should be the lowest number of caribou close to the mine, while at 7 km distance the number of caribou and their behaviour should be close to normal.
  - ii. **Behaviour:** We do not object to scan sampling from the ground as over the first few years of the monitoring program this approach provided some insight into the strength of the behavioural changes. The changes are small indeed. Unless a much more rigorous program for behavioural studies is developed, we do not believe that behavioural observations from the ground will strengthen the understanding of the mine effects. We therefore believe that this program could be discontinued in favour of a more intensive air survey program as described above. However, if DDMI wishes to continue the behavioural program it should be improved as follows:
    - I. The behavioural observations will need a strong boost in sample size. The collection of behavioural data in control areas is a

good development. Based on our experience with these sort of data, it is likely that the sample size would need to be at least 40 or more in each of the affected and the control areas to detect the behavioural changes.

2. We recommend that future analyses make a concerted effort in resolving an apparent contradiction: there are more females and young (should be more scared of humans) near the mine but overall, caribou tend to slightly avoid the mine.

As to the advisory monitoring and mitigation effectiveness monitoring in Sections 4.0 and 5.0, we concur with the recommendation that the programs should continue.

### **3.3 Grizzly Bears**

#### **3.3.1 Information About Effects To Date**

Habitat loss in the context of an individual bear's home range appears to be minimal. Bears maintain active home ranges with the DDMI study area. In fact, an incident of a bear that appeared to be undisturbed by air traffic may suggest a tendency for habituation rather than bears avoiding the disturbance associated with project activity.

Current data on bear sign as a measure of a disturbance effect seem to suggest that a ZOI does not exist. However, a rigorous data analysis is planned by DDMI for 2008, which we strongly encourage.

#### **3.3.2 Current Data Collection**

We have no comments on the current data collection for grizzly bears.

#### **3.3.3 Potential for Adapting the Monitoring Program**

We concur with the recommendations that bear awareness training needs to continue and we add that the data collection for the bear monitoring program should continue.

### **3.4 Wolverine**

#### **3.4.1 Information About Effects To Date**

The snow tracking results and incidental observations show no detectable shift in wolverine distribution in the study area. However, these data are not strong and they will benefit from an improved and better-stratified sampling program (see below).

The DNA data are strong and the effort in collecting them is commendable. These data also do not show changes between the two years in the numbers of wolverine (however, a comparison

to pre-disturbance cannot be made because the pre-mine numbers of wolverine are not known). Moreover, there is no indication by any of the wolverine data sets that there is a distance effect.

### 3.4.2 Current Data Collection

Changes to the current data collection program are timely. We caution DDMI to more carefully interpret the track data as presented in Table 7.1-1. On p. 62 DDMI concluded that the numbers are down this year compared to previous years. However, when the number of days since snow are included in the track index, the index is 0.03 tracks /km/day which is as high as in 2003 and higher than in 2004. In other words, there is no real indication of a reduced use of the study area.

The analysis of data presented in Appendix VII is well done, credible, and, most of all, useful. We only wish that such analyses would be available for other data sets.

### 3.4.3 Potential for Adapting the Monitoring Program

We commend the intention to improve on the tracking program as per Appendix VII. The analysis shows, amongst other things, that the track data are a useful tool in monitoring the effects of the mine. Although they are clearly of lower quality than the DNA data, they still show habitat use and, if stratified properly, they can be powerful enough and effective in detecting potential effects of the mine, if there are any.

The DNA data are very useful to have because it can now be understood how many individuals may be in the area. This allows us to interpret the potential effects, if any, on populations in the region. However, now that this is known, the track data will be strong enough to monitor where shifts in wolverine abundance occur in the future. Incidence reporting will be the additional tool that will contribute to the understanding of mortality.

The intended increase in the number of transects and the equal length of transects is the correct approach to the betterment of the program, but for completeness sake, we note that the transects should still focus on “wolverine habitat” as per the guidance by IQ. This intention is mentioned on p. 23 of Appendix VII, but Figure 4-1 does not show that (in fact, transects on the lake do not seem to represent good wolverine habitat).

## 3.5 Waste Management

### 3.5.1 Information About Effects To Date

There is clearly a decreasing trend in food and other attractants at the Waste Transfer Area. This is very encouraging and we hope that the trend will continue. However, there is no such trend evident with the landfill. In fact, in some cases, attractants are as high or higher than in previous years. Having food packaging almost 40% of the time at the landfill is not a good performance record for DDMI.

### **3.5.2 Current Data Collection**

DDMI should be commended for their adaptive management in terms of using information from the waste monitoring programs to improve on mitigation measures such as fencing and the increased attention to already existing worker training programs. Please continue such efforts.

### **3.5.3 Potential for Adapting the Monitoring Program**

We concur with the recommendations proposed by DDMI in Section 8.1.

## **3.6 Falcons**

### **3.6.1 Information About Effects To Date**

The current information support the prediction that the mine effects will not result in measurable change in raptor presence and distribution. This is indicated by a lack of change in nest occupancy, a productivity of nests that seems to be within the normal range for the area, and the fact that a nest on the high wall of the mine pit appears to be productive. Moreover, there are no mortalities reported.

### **3.6.2 Current Data Collection**

We have no comments on the current data collection for falcon monitoring.

### **3.6.3 Potential for Adapting the Monitoring Program**

It was agreed in previous workshops that a more intensive program which would record habitat variables including prey abundance was not warranted. Indeed, the addition of spring surveys three years ago that allowed the assessment of productivity or failure of nests appears to work well and produce useful information. We concur with DDMI's recommendation to continue with the falcon monitoring program.

## **3.7 Waterfowl**

### **3.7.1 Information About Effects To Date**

Analysis of previous results and studies on adjacent mines (Smith et al. 2006) suggest that changes in waterfowl community composition occurred and that this change was most apparent during the construction phase. While the loss of habitat is, as of the 2006 WMR, still below the

predicted level, the composition of the waterfowl community does not support the prediction of “no measurable change in waterfowl presence”. However, without any reference sites this change is difficult to interpret as it may well be a natural phenomenon, and not caused by the mine. As stated in previous reviews, this lack of any before-after-control-impact approach (BACI) hampers the ability to establish cause-and effect relationships between mine and waterfowl, if any.

### **3.7.2 Current Data Collection**

The data presented in the 2006 WMR will contribute to a future analysis on waterfowl diversity and abundance. We anticipate that the analysis scheduled for 2008 will include waterfowl. Without the analysis, the data presented is difficult to interpret. The changes in mine altered water bodies will need to receive attention in future years and be subject to the upcoming analyses.

### **3.7.3 Potential for Adapting the Monitoring Program**

We encourage the continuation of the waterfowl monitoring program. We concur with the intent to increase the bird identification program.

## 4 Closure

The review of the 2006 WMR reported herein presents the conclusions arrived at by MSES. We understand that statistical analyses similar to those conducted in association with the 2004 WMR are planned for 2008. Several data sets in the 2006 WMR will require this analysis to facilitate the interpretation of the information the data contain. We concur with this schedule as a new rigorous analysis will benefit from the addition of some more monitoring years. These views are submitted to EMAB for its consideration of potential recommendations and actions.

## 5 References

Boulanger J., K. Poole, B. Fournier, J. Wierzchowski, Gaines T., and A. Gunn. 2004. Assessment of Bathurst caribou movements and distribution in the Slave Geological Province. RWED, GNWT, Yellowknife, Manuscript Report No. 158

Johnson, C. J., Boyce, M. S., Case, R. L., Cluff, H. D., Gau, R. J., Gunn, A. & Mulders, R. 2005. Cumulative effects of human development on arctic wildlife. *Wildlife Monographs*, **160**, 1-36.

Johnson, D.H. 2001. Validating and evaluating models. In: *Modeling in natural resource management* (ed. by T.M. Shenk and A.B. Franklin), pp. 105-122. Washington, Island Press,

Smith, A. C., Virgl, J. A., Panayi, D. & Armstrong, A. R. 2005. Effects of a Dimond Mine on Tundra-Breeding Birds. *Arctic*, **58**, 295-304.