DOMINION DIAMOND

Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
P.O. Box 938
Yellowknife, NT
X1A 2N7
Attn: Chuck Hubert, Senior Environmental Assessment Office

Re: EA1314-01 Jay Project, Dominion Diamond Corporation Developer's Assessment Report Adequacy Review

Dear Mr. Hubert:

Further to my letter of December 15, 2014 to the Chair of the Mackenzie Valley Environmental Impact Review Board (MVEIRB), please find attached the following information in response to the Adequacy Review document provided by the MVEIRB for the Jay Project on November 28, 2014:

- Item 4.2 – Confirm scores for the sensitivity analysis on multiple accounts analysis
- Item 8.1 (Part 2 only) – Copy of caribou reference
- Item 9.6 – Copy of maps 8F2.2-1 and 8F2.2-2 from Appendix 8F

The timelines for proposed responses to the Adequacy Review information requests were provided in Table 1 of my December 15 letter and the items herein provided corresponds to the information to be provided on December 19, 2014 to expedite the technical review of the DAR.

Once again, we would like to thank the MVEIRB and its staff for the thoughtful review of the Jay Project Developer's Assessment Report (DAR).

Regards,

Richard Bargery
Manager, Permitting Jay Project
Dominion Diamond Corporation

Attach.

DOMINION DIAMOND

Information Request Number: DAR-MVEIRB-4

Source: MVEIRB Jay Project Adequacy Review Item 4.2

Subject: Project Alternatives

DAR Section(s) Section 2.4.7.7.2

Preamble:

The Review Board staff did a check of the math for the sensitivity analysis. There appears to be a discrepancy in the final values calculated.

Request:

Please confirm the overall alternative scores for the sensitivity analysis.

Response:

The results of the Project Mining Method Alternatives Analysis sensitivity assessment were checked and an error was found in the overall alternative scores for the Case 3 sensitivity. A revised Table 2.4-13 for Section 2.4 of the DAR Project Alternatives is provided below.

The Case 3 scores for each alternative for each account (Technical Feasibility, Project Economic Viability, Environmental Consideration, and Social Economic Consideration) were all calculated correctly by multiplying the base case score by the correct account weightings for Case 3. The error was in the factored overall alternative scores. The weightings from Case 2 were incorrectly used to obtain the factored overall scores for Case 3. The revised Table 2.4-13 below has the corrected overall alternative scores, which were factored using the Case 3 weightings.

The corrected overall alternative scores have changed; however, the relative rankings of the alternatives does not change.

Table 2.4-13 Sensitivity Case 3 Results Summary - Revision 1

Account	Weighted Scores		
	Alternative 1 – Meadowbank-Style Dike, Option 1 Alignment (Hockeystick)	**Alternative 2 – Meadowbank-Style Dike, Option 2 Alignment (Horseshoe)**	**Alternative 3 – Diavik-Style Ring Dike**
Technical Feasibility	11.0	17.6	9.1
Project Economic Viability	24.4	24.4	12.9
Environmental Consideration	6.0	12.0	18.0
Social Economic Consideration	8.4	16.8	16.8
Overall Alternative Score	1.8	2.6	2.1

DOMINION DIAMOND

Information Request Number:	DAR-MVEIRB-8 - Question 2
Source:	MVEIRB Jay Project Adequacy Review Item 8.1
Subject:	Barren-Ground Caribou
DAR Section(s)	12.8

Preamble:

In the TOR, the temporal scope requires (p. 15) that “The developer will place special focus on the consideration of time during the development when . . . valued components are particularly sensitive to potential impacts . . .”

The DAR notes a recent 73% decline of the Bathurst herd since 2012 but does not identify the accelerated decline as a time of particular sensitivity. Yet the sensitivity will be increased as calf productivity is reduced and cow death rates are high during the accelerated decline (Boulanger et. al. 2014). The reduced productivity and high death rate reduce the herd’s resilience to cope to increased industrial activities. While Dominion does acknowledge that resilience is reduced during low abundance, this is not analyzed or the implications described for monitoring, mitigation and assessing effects. There is uncertainty about causes of the accelerated decline which then requires a cautious approach to factors including industrial development. Traditional knowledge states that during low numbers and for recovery, respect for caribou has to be increased including how people behave toward caribou (Legat 2001).

Request:

Please describe if and how the accelerated decline since 2012 is a time of particular sensitivity to potential impacts. Please provide an analysis and description of any particular sensitivity relative to assessing potential impacts and designing adaptive management.

In addition, please provide the document referenced in Section 12. 8, p 12-140, of the DAR titled “Boulanger J, Croft B, Cluff D. 2014. Trends in size of the Bathurst caribou herd from the 2014 calving ground reconnaissance survey. Integrated Ecological Research. July 31, 2014.

Response:

A response to the first part of the request will be provided in January 2015.

The requested reference is provided in the following pages of this document.

Trends in size of the Bathurst caribou herd from the 2014 calving ground reconnaissance survey.

John Boulanger, Integrated Ecological Research, 924 Innes, Nelson, BC, VIL 5T2, boulange@ecological.bc.ca

Bruno Croft, North Slave Region, Environment and Natural Resources, Government of Northwest Territories, P.O. Box 2668, Yellowknife, NT, X1A 2P9, bruno_croft@gov.nt.ca

Dean Cluff, North Slave Region, Environment and Natural Resources, Government of Northwest Territories, P.O. Box 2668, Yellowknife, NT, X1A 2P9, dean_cluff@gov.nt.ca

Plain-language Summary: Calving ground reconnaissance surveys are one tool that biologists use to monitor barren-ground caribou herds. They are less intensive and much less expensive than population surveys. Reconnaissance surveys provide information on where a particular herd's calving grounds are located that year and an indicator of the number of cows on the calving ground. They are flown in June near the peak of calving using small planes that fly lines usually spaced 5 or 10 km apart. Observers record locations, numbers and type of caribou (cows with calves, bulls, yearlings and non-breeding cows) in a 400m strip on either side of the plane, which flies at a fixed height (usually 120m above ground). These surveys are not designed to provide a precise population estimate, but when flown consistently and repeated over time, they are an indicator of trend in the number of cows on the calving ground in-between population survey years. Results of reconnaissance surveys for the Bathurst and Bluenose-East herds in recent years have shown trends in caribou numbers that are consistent with the trends shown in the more intensive photographic population surveys.

This report describes the results of a reconnaissance survey of the Bathurst calving grounds in June 2014, with an evaluation of trends based on previous reconnaissance and photo surveys 2006-2013. Overall, reconnaissance surveys and the calving photo surveys showed a rapid decline in the Bathurst herd between 2006-2009 and an approximately stable trend 2009-2012. A reconnaissance survey in June 2013 suggested a marginal increase in caribou numbers on the calving ground, but this survey was carried out on June 16, which was past the peak of calving and so the numbers may have been inflated by the presence of early post-calving groups that included a higher proportion of non-breeding caribou. The June 2014 reconnaissance survey was flown June 8 and 9 near the peak of calving with very good survey conditions. The total estimated number of caribou at least one year old was 3,594 ± 2,133, compared to 14,390 ± 6,109 in June 2012. This suggests a decrease of 73% (CI=53-93%) over a 2-year period. While this trend is imprecise due to sampling variation, it does suggest a large decline in herd size. Of 18 collared Bathurst caribou cows, 17 were found in the June 2014 survey area, suggesting that a high proportion of the herd's cows were on the calving grounds. A photo survey planned for the summer of 2015 will provide more precise estimates of size and trend for the herd.

Introduction

This report summarizes the 2014 Bathurst reconnaissance survey results to compare with similar reconnaissance surveys conducted in previous years. The main purpose of the survey was to determine trend in numbers of breeding females on the calving grounds. When conducted with consistent methods, these surveys provide an indicator of the numbers of caribou at least one year old on the calving grounds. Breeding females normally make up a high proportion of the caribou on the calving grounds.

The main objectives of the trend analyses were as follows:

1. Provide an objective approach to estimate trend of 1^{+}-year-old caribou and associated confidence intervals from consecutive surveys of annual calving grounds that accounts for differences in coverage, calving ground core area, and other sampling issues with surveys.

2. Ensure that trend estimation methodology is statistically similar to calving ground survey methods that estimate population size (with more intensive sampling coverage) to allow estimates of trend from the two methods to be comparable.

Methods

Field methods

The basic field methodology of reconnaissance surveys is to survey core calving areas with systematically spaced transects (with 5 or 10 kilometer spacing) at or near the peak of calving. Caribou were counted within a 400 meter strip on each side of the survey plane (800 m total, Gunn and Russell 2008). Strip width was defined by the wheel of the airplane on the inside, and wood doweling defined on the wing strut. Planes were flown at an average survey speed of 160 kilometers per hour at an average altitude of 120 meters above the ground to ensure that the strip width of the plane remained constant.

Two observers were used on both sides of the survey airplane to minimize the chance of missing caribou. Previous research Boulanger et al. 2014a)demonstrated that this approach increases sightability compared to single observers. During the survey the two observers communicated to ensure that groups of caribou were not double counted.

Caribou groups were classified by whether or not they contained breeding caribou. Breeding caribou were defined by female caribou with hard antlers or presence of calves. A female with a hard antler potentially indicated that the caribou had just given birth or was yet to give birth. Non-breeding caribou were also classified as yearlings (as indicated by a short face and small body), bulls (as indicated by thick, bulbous antlers and large body), and non-antlered females. In most cases, each group was recorded individually, but in some cases groups were combined given that the plane only had a single data recorder. Data were recorded on a tablet computer by a single data recorder in the plane. As each data point was entered, a real-time GPS waypoint was generated, allowing geo-referencing of the survey data.

Analytical methods

The underlying assumption of this analysis is that changes in the estimated number of adult 1^{+}-year-old caribou observed per 8 km^2 segment on reconnaissance level surveys (transects flown at 5 or 10 kilometer intervals) reflect changes in the overall numbers of caribou present on the calving ground each year. If this assumption is met, an unbiased trend estimate can be obtained by comparison of estimates from yearly surveys.

1. *The proportion of adult (1+ year-old) population returning to the calving ground is similar each year.* It is likely that a high proportion of breeding females return to the core calving ground each year. There will also be non-breeders on the calving ground but this will not bias estimates of adult 1+ trends as long as the proportion of non-breeders on the calving ground is the same as the proportion of non-breeders in the population.

2. *The annual concentrated calving area is consistently delineated each year so that the "target population" of caribou remains constant.* The survey area that was considered was based upon the presence of breeding caribou (Nishi 2010) and relative densities of caribou (as discussed earlier). It is assumed that this area is consistently delineated and that the proportion of non-breeders within this area is relatively constant. Movement rates of collared caribou were used to assess whether surveys occurred near the peak of calving as indicated by movement rates that were less than 5 km/day for female caribou (Gunn et al. 1997, Nishi et al. 2007, Gunn et al. 2008, Gunn and Russell 2008, Nishi et al. 2010).

3. *The sightability of caribou from the aircraft is similar each year so that any change in counts reflects change in population size rather than changes in sightability*. It is likely that ground conditions and aircraft type will influence sightability (Boulanger et al. 2014a). Similar aircraft (Cessna 206 or 337), and 2 observers were used for surveys from 2003-2008. The aircraft type was changed to a Cessna Caravan with 4 observers in 2009 thru 2011. A turbo-beaver was used from 2012 to 2014.

The relative size of the core of the Bathurst calving ground and the degree of aggregation of caribou within the core calving ground has changed over time. After the 2011 survey, methodology was changed so that transect spacing was reduced from 10 km to 5 km to accommodate the reduction of size of the core calving area.

Previous methodologies to estimate trend from the core calving area assessed changes in mean segment density as an indicator of trend. However, this approach did not adequately account for changes in overall size and aggregation of caribou within the core calving area. The simplest method to account for change in aggregation and core calving area size is estimation of the number of caribou within the core calving area as well as the associated variance with this estimate. This approach, which is used as the initial step in stratification in photo-surveys, effectively accounted for both change in core calving area size and aggregation. Formulas used for calving ground surveys (Jolly 1969) were used to estimate caribou in the core area. The formula to estimate population size was simply the number of caribou counted divided by the proportion of the core area surveyed. This proportion, often termed

survey coverage was 8% for surveys with 10 kilometer spacing (surveys prior to 2012) and 16% for surveys with 5 kilometer spacing (surveys from 2012 to present).

Estimates from recent surveys and past surveys (up to 2009) were compared graphically. T-tests were used to determine if changes in successive yearly estimates were statistically significant. Degrees of freedom for each stratum surveyed were calculated as the number of north-south transects flown minus one. Degrees of freedom for the t-tests, and for surveys that included multiple strata, were estimated using estimates of variance and degrees of freedom from the surveys being compared or combined (Heard 1985).

Interpretation of year-specific changes in reconnaissance estimates should be undertaken cautiously because the estimates contain both sampling and process variance (Thompson et al. 1998). Sampling variance is usually high and may be biased given the lower number of survey lines in reconnaissance surveys. Process variance or biological variation in trend due to factors such as variation in productivity and survival rates will also create yearly variation that may obscure longer-term average trends. Weighted least squares analysis was used to estimate trend from the time series of data (Brown and Rothery 1993). Each estimate of caribou on the core calving ground area was weighted by the inverse of its variance to account for unequal variances of surveys, and to give more weight to the more precise surveys. Annual rate of population change (λ) was estimated using the ratio of successive predicted population sizes from the regression model. The per capita growth rate (r) was related to the population rate of change (λ) using the equation $\lambda=e^{r}=N_{t+1}/N_{t}$. If $\lambda=1$ then a population is stable; values greater or less than 1 indicate increasing and declining populations, respectively. Confidence limits on lambda were generated using Monte Carlo simulation methods (Manly 1997, Boulanger et al. 2014b).

Results

The relative dimensions of the core calving area for the Bathurst caribou herd and the number of caribou observed has varied in recent years. Consequently, summaries of the 2012 and 2013 June surveys follow to provide further context for the 2014 survey results.

2014 survey results

The 2014 survey was flown on June 8th and 9th 2014 with a Turbo-beaver stationed in Kugluktuk, Nunavut. Survey conditions were ideal with clear skies and less than 25% snow cover (Figure 1). Mean movement rates of caribou were approximately 5 km per day on the 6th and 7th of June suggesting the herd was near the peak of calving when the survey was conducted. Unlike previous years, mean movement rate did not decline below 5 kilometers per day for a successive number of days suggesting that the peak of calving was not well defined or pregnancy rate was lower for the collared caribou.

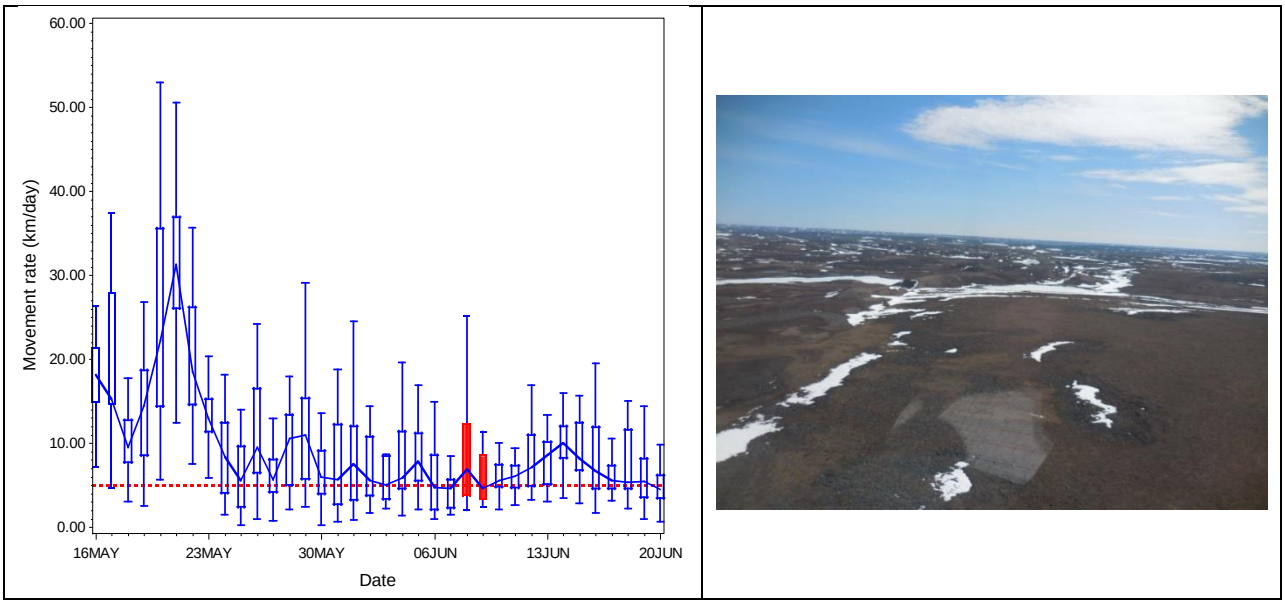

Figure 1: Boxplots showing distances moved per day (km) of caribou during the survey (red boxes) from 18 collared caribou. A picture of ground conditions during the survey is displayed on the right.

The core area that was surveyed was centered on 18 collared female caribou in the area. Transect lines were flown to the north and south of the core area until no breeding caribou were observed (Figure 2). The core area was then delineated to encompass where the majority of breeding caribou were observed. All breeding caribou observed were included in the core area with exception of a single antlered caribou that was observed away from the main congregations of breeding caribou.

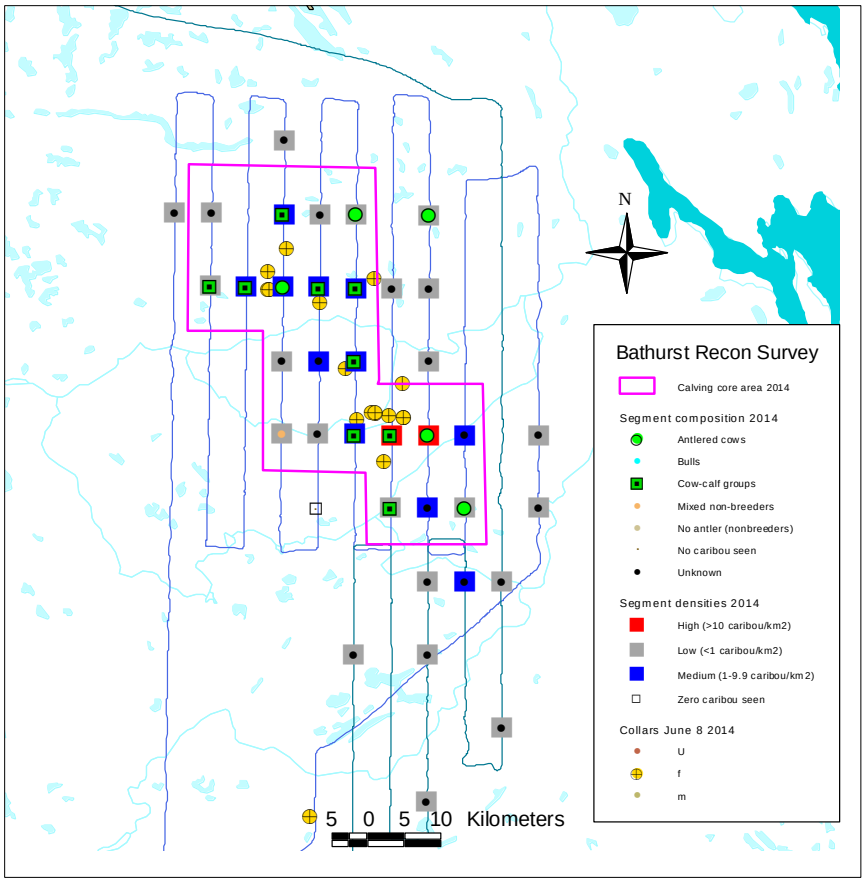

Figure 2: Survey coverage, segment densities, and composition for the 2014 Bathurst reconnaissance survey flown on June 8 and 9th 2014. Transect spacing was 5 kilometers. The position of collared caribou on June 8th (when the majority of the survey was flown) are displayed

The number of caribou observed per segment ranged from 1 to 143 with 2 segments being classified as high density (>80 caribou observed per 8 km^2 segment cell) (Figure 3). The rest of the segments were classified as medium density (9), low density (9) or no caribou observed (1). In total, 575 caribou were observed which resulted in an estimate of 3,594 (± 2,133 (CI)) caribou in the core area when the count was divided by the survey coverage of 16% (575/0.16).

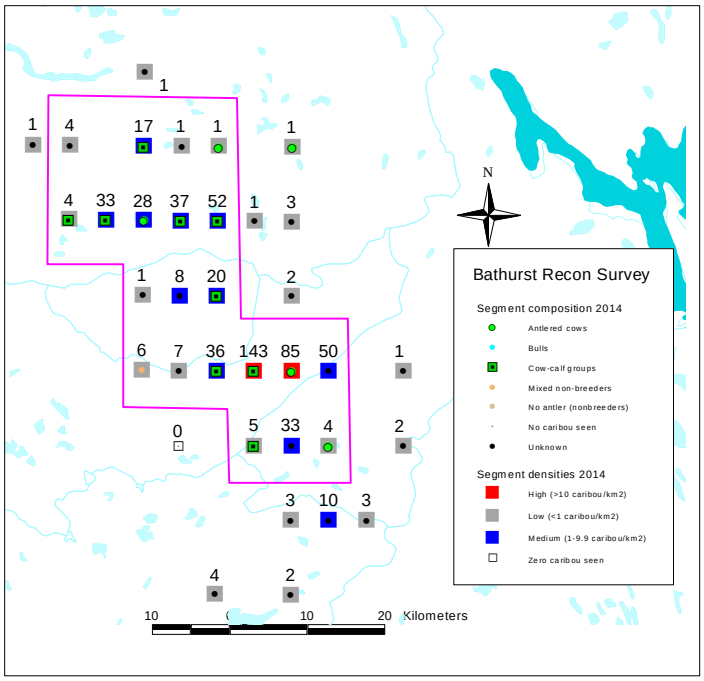

Figure 3: Segment densities, composition, and number of caribou counted per 10X0.8km segment box on the 2014 Bathurst survey.

2013 survey results

A reconnaissance survey was flown on June 13, 2013 using a Turbo-beaver aircraft. The survey sighted 3,282 caribou in the core calving area with 11 high density (more than 80 caribou) segments counted (Figure 4). This survey most likely occurred after the peak of calving, as indicated by the increase in movement rates on June 13th. This may have resulted in post-calving aggregations of caribou being present on the calving grounds, therefore inflating the counts of caribou (Bruno Croft, ENR, unpublished). Post-calving aggregation can result in caribou forming groups of hundreds or thousands of animals and greater mixing of cows with calves and other segments of the herd. The estimate of caribou on the core area was 20,512 (± 19,323) which was very imprecise due to the high degree of caribou aggregation and resulting differences in caribou density between the north-south transects.

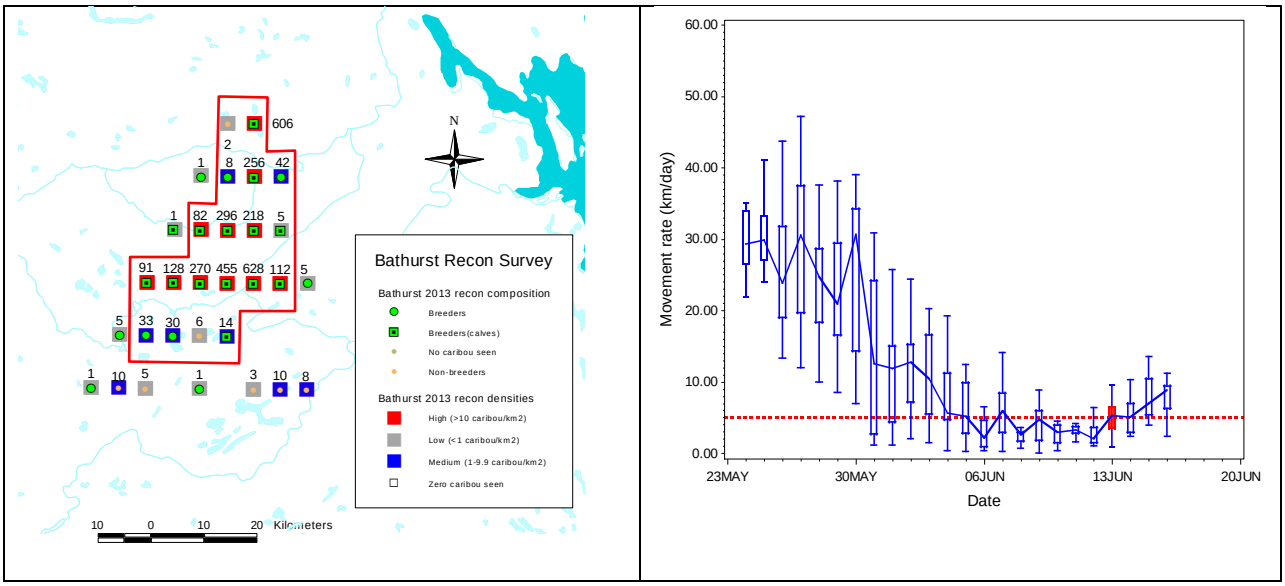

Figure 4: Segment composition, densities, and number of caribou counted on the 2013 reconnaissance survey. The movement rates during the survey are shown on the right (n=13 collared caribou)

2012 survey results

In 2012, reconnaissance surveys were conducted as part of the large photographic survey of the calving ground (Boulanger et al. 2014b). The reconnaissance surveys were conducted on June 4th and 5th which was close to the peak of calving as indicated by reduced movement rates (Figure 5). The majority of breeding caribou were contained within high and medium strata. Nine high density segments with 2,515 caribou were counted within the two strata which resulted in an estimate of 14,390 (±6,109) caribou in the core area. Unlike the 2013 survey, this survey was probably not affected by post-calving aggregations and is therefore most comparable to the 2014 survey.

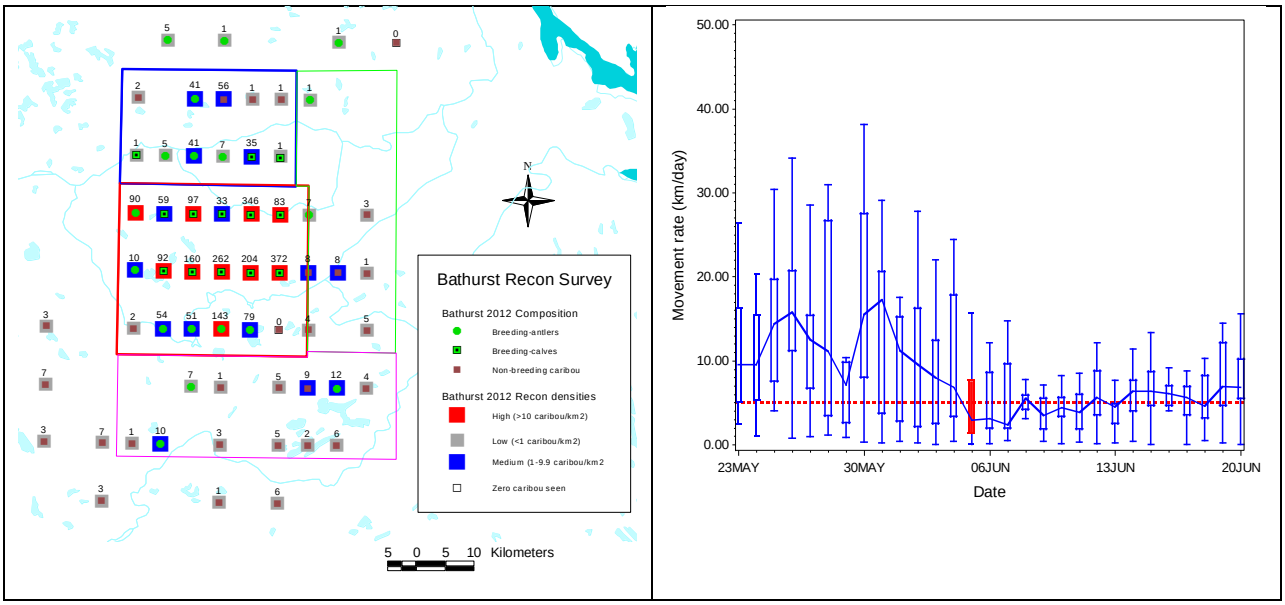

Figure 5: Segment composition, densities, and number of caribou counted on the 2012 reconnaissance survey. The movement rates during the survey are shown on the right (n=18 female collared caribou).

Estimates of trend

Estimates of caribou within the core area from 2006 to 2014 indicate a decline from 2006 to 2009 (previously documented), followed by a relatively stable trend up to 2013 and then an abrupt drop in estimates for 2014. The change in estimates from 2012 to 2014 was significant at α=0.1 (t-test, t=-2.34, df=5, p=0.076). It could be argued that the 2013 estimate was inflated due to post-calving aggregation in which case the 2012 estimate would be more comparable. In this case the difference between the 2012 and 2014 estimate, which suggests a 73.4% decline (95% CI=53.4-93.3%) over 2 years is also significant (t-test, t=-3.98, df=6, p=0.008). Estimates from the 2011 reconnaissance survey were not included in the comparison due to issues with defining the core calving ground with the 2011 survey.

Yearly estimates of caribou on the core calving area will contain both sampling variance and biological variation in trend. In this context, the more appropriate interpretation is estimation of longer-term trend based upon the time series of estimates. Longer term trend was estimated for the period of 2009 to 2014 which corresponded to the time period in which a potential recovery could have occurred. We used weighted least square regression to obtain an estimate of longer term trend (lambda or λ) of 0.91 (CI=0.73-1.11) from 2009 to 2014 which suggests an overall declining trend in herd size. Estimates of lambda overlap 1, due to the low precision of the reconnaissance survey estimates.

The steep decline from 2006 to 2009 followed by the relatively stable trend from 2009 to 2012 was also indicated by estimates from survey strata counted using the photo plane in 2006, 2009, and 2012. The estimates derived from the photo plane survey were higher than the estimates from the reconnaissance surveys, presumably due to counting bias in the high density segments counted visually during the reconnaissance surveys. Precision of reconnaissance surveys was also relatively low compared to photo surveys due to decreased coverage (8% before 2011 and 16% after 2011) of the reconnaissance surveys.

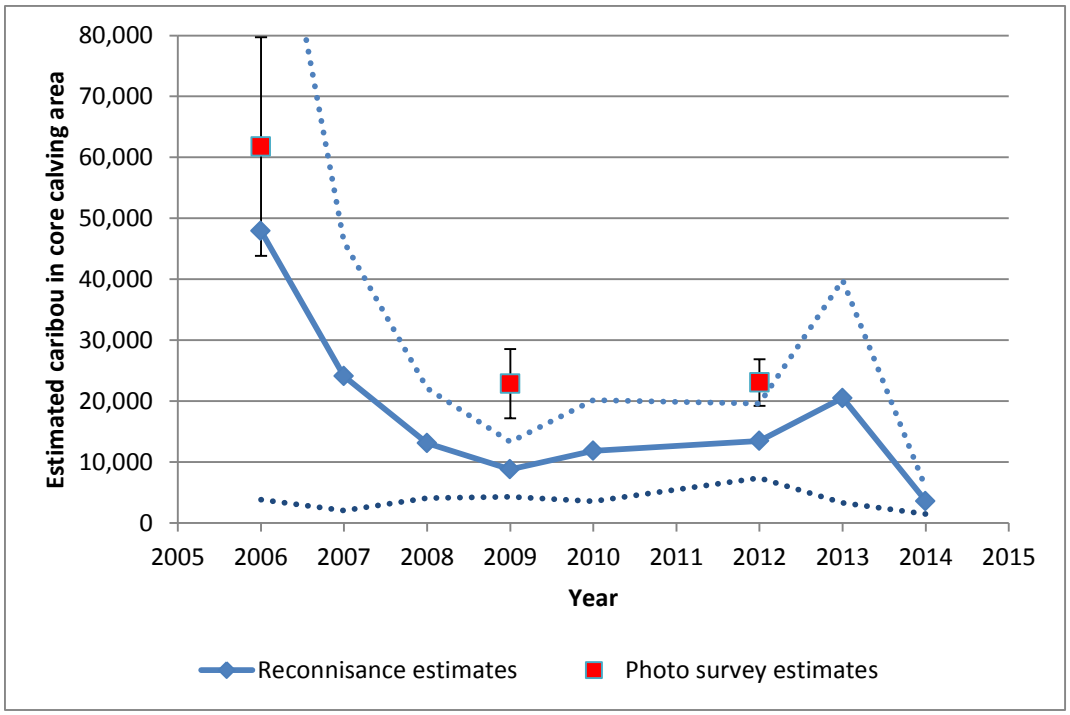

Figure 6: Comparison of estimates of caribou in the core calving area for the Bathurst herd from 2006 to 2014. Estimates from the photo plane from surveys in 2006, 2009 and 2012 with confidence limits are shown for comparison as red squares. The upper confidence limit for the 2006 reconnaissance survey estimate (119,161) is not shown.

Two other notable trends are apparent from the Bathurst herd calving ground data set. First, densities of caribou from segments in the core calving area decreased from 2006 to 2010 then increased in 2012 and 2013 with the reduction in overall size of the core calving ground area (Figure 7). In 2014, the observed densities were similar to densities observed from 2007 to 2010. However, the size of the core calving area was smaller and therefore the estimate of caribou in the calving area is smaller.

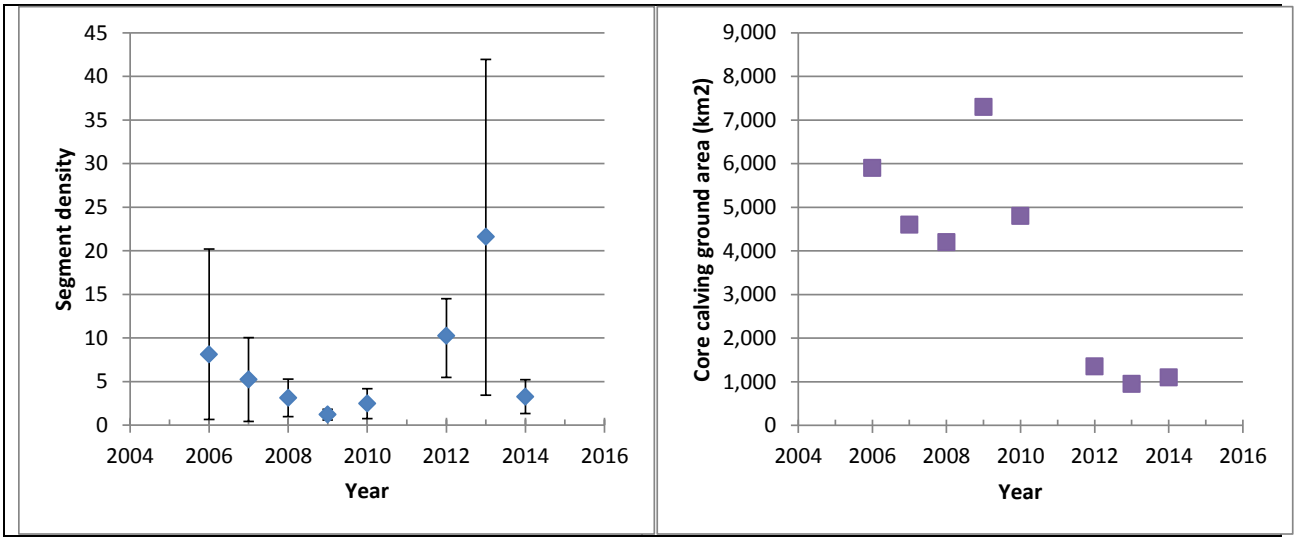

Figure 7: Trends in estimated segment densities and size of core calving areas from 2006-14 for the Bathurst herd.

Discussion

The results of the 2014 reconnaissance survey suggest that the Bathurst herd is declining. Even with the limitations of low survey coverage, the general lack of larger groups on the calving grounds during the 2014 survey, as evidenced by only 2 segments with higher densities of caribou (Figures 1 and 2), is of concern. With the exception of the 2013 reconnaissance survey, previous Bathurst calving reconnaissance surveys have paralleled the trend in breeding female numbers documented more fully from less frequent calving photo surveys (Fig. 6); thus, the very low numbers of caribou found in 2014 may be indicative of serious decline since 2012.

This result should be interpreted with some caution given the relatively low coverage and low precision of the reconnaissance surveys compared to photographic surveys. For example, the number of replicate transects sampled for each year ranged from 6 to 10. In general, at least 10 transects are needed to estimate variance of estimates and therefore it is likely that estimates might change with higher survey coverage. The reduction of size of the Bathurst calving ground (Figure 7) along with aggregation of caribou challenges reconnaissance methods. The line spacing was reduced from 10 to 5 kilometers in 2012 to increase coverage given the decreasing area of the core calving area. Further reductions of line spacing may be required to ensure adequate survey coverage of core calving areas if the current trend in calving ground size continues. The 2014 reconnaissance survey assumed that the core area was identified by concentrations of female collared caribou. We believe this area contained the vast majority of breeding caribou. In 2012 the core was of similar size (Figure 7) and extensive surveys in neighboring areas failed to detect breeding caribou. A stratified calving ground photo- survey is planned in June 2015 to verify the findings of this reconnaissance survey and as part of the long term monitoring program for the Bathurst herd.

The effect of low coverage was explored by Boulanger et al. (2014) as part of the analysis of the 2012 Bathurst calving ground survey. For this analysis, transect lines were randomly resampled from the photo-survey data of the high density stratum (Figure 8). At lower coverage (i.e., 16%) a large range of estimates was possible compared to higher levels of coverage. The main message from the resampling analysis is that higher coverage is required when caribou are aggregated into larger groups.

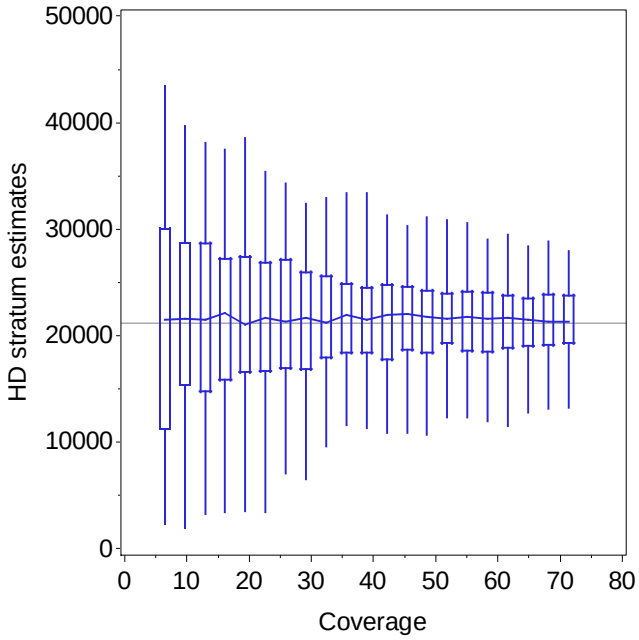

Figure 8: Effect of sample coverage on range of estimates from randomized resampling of the 2012 Bathurst high density photo stratum (Boulanger et al. 2014b). Boxplots show the mean value, estimates between the 25th and 75th percentile, and the range of estimates

Acknowledgements

The 2014 Bluenose-East and Bathurst calving reconnaissance surveys were led by Dean Cluff (Regional Biologist, ENR-North Slave Region, GNWT, and a number of individuals from various agencies participated, including: Angus Charlo (Yellowknives Dene First Nation), Roy Judas (Tłı̨chǫ Government), Lisa-Marie LeClerc (Department of Environment-Kitikmeot Region, Government of Nunavut), George Mandeville (NWT Métis), and Boyan Tracz (Wek'èezhìı Renewable Resources Board). Adrian Rivard (Summit Air) piloted the Turbo Beaver used for the surveys. Participants in previous surveys are listed in previous calving ground survey reports as cited. Jan Adamczewski (ENR-Yellowknife) provided valuable comments on earlier drafts of this report and prepared the Plain Language Summary. This analysis was funded by Environment and Natural Resources, Government of Northwest Territories.

Literature cited

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DOMINION DIAMOND

Information Request Number:	DAR-MVEIRB-22
Source:	MVEIRB Jay Project Adequacy Review Item 9.6
Subject:	Effects Assessment
DAR Section(s)	Appendix 8F

Preamble:

Maps 8F2.2-1 and 8F2.2-2 are missing in the pdf submission of Appendix 8F making it difficult to understand the results of the analyses.

Request:

Please provide maps 8F2.2-1 and 8F2.2-2

Response:

The absence of these maps in the DAR was an inadvertent oversight. Please find maps 8F2.2-1 and 8F2.2-2 provided in the following pages of this document.

Discharge To Diked Area[a]	
Month	Outflow (m^3)
Jan	1,116,000
Feb	1,044,000
Mar	1,116,000
Apr	1,080,000
May	1,116,000
Jun	4,680,000
Jul	4,836,000
Aug	4,836,000
Sep	4,680,000
Oct	4,836,000
Nov	1,080,000
Dec	1,116,000

(a) Monthly outflows are from the year of maximum seepage (2032).

Seepage To Diked Area[a]	
Month	Outflow (m^3)
Jan	366,482
Feb	331,016
Mar	366,482
Apr	354,660
May	366,482
Jun	354,660
Jul	366,482
Aug	366,482
Sep	354,660
Oct	366,482
Nov	354,660
Dec	366,482

(a) Monthly outflows are from the year of maximum seepage (2029).

Precipitation And Evaporation	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	20,565
Apr	197,700
May	2,255,568
Jun	25,410,102
Jul	-3,838,104
Aug	3,208,130
Sep	4,662,118
Oct	727,353
Nov	0
Dec	0

LDS Watershed Discharge	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	58,110,515
Jul	53,197,694
Aug	39,615,522
Sep	34,878,717
Oct	17,226,742
Nov	0
Dec	0

Runoff From WRSA	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	253,742
Jul	76,695
Aug	100,952
Sep	82,765
Oct	0
Nov	0
Dec	0

Discharge From Diked Area[a]	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	0
Apr	0
May	4,836,000
Jun	4,680,000
Jul	4,836,000
Aug	624,000
Sep	0
Oct	0
Nov	0
Dec	0

(a) The diked area is drained in 2019.

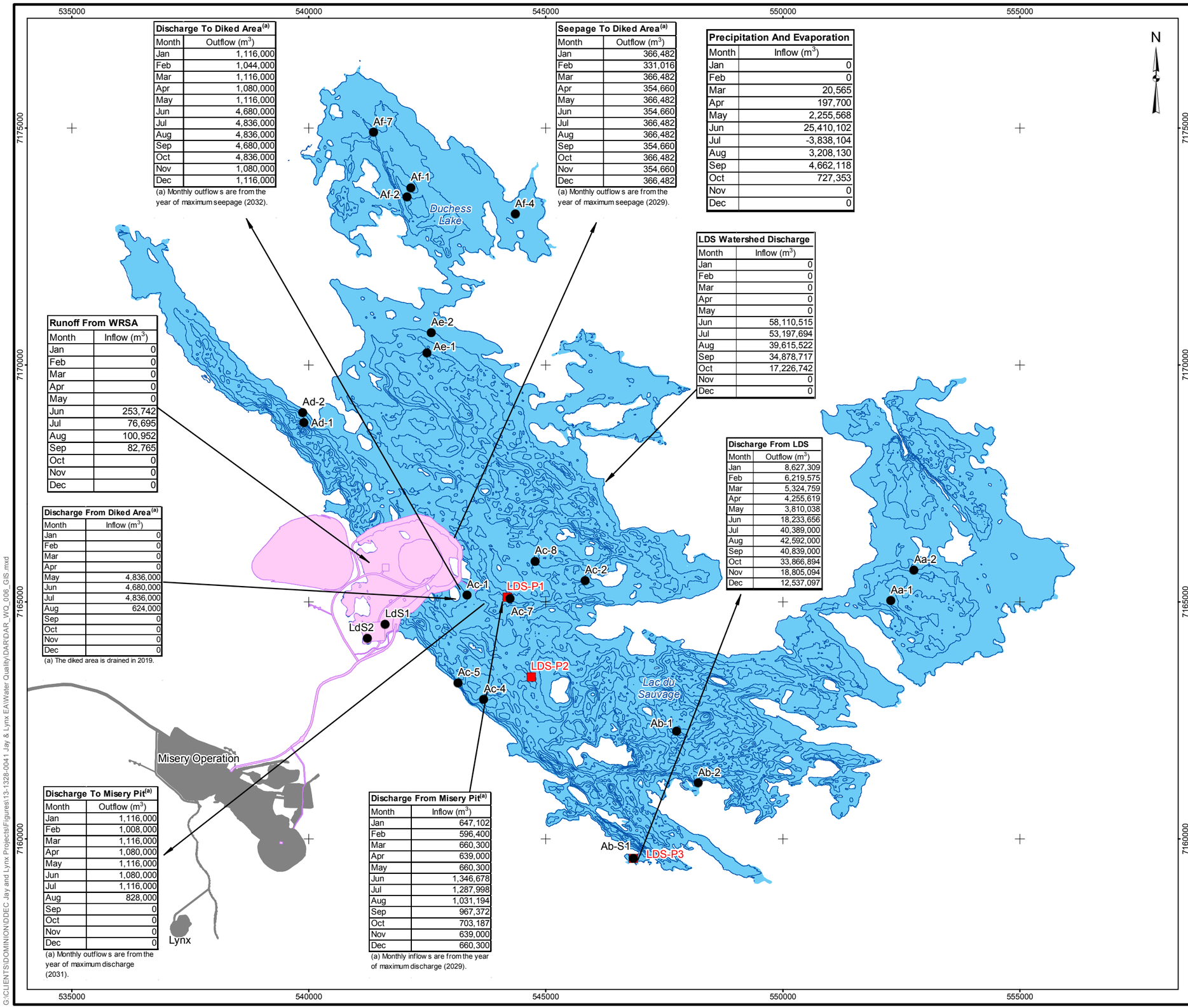
Discharge From LDS	
Month	Outflow (m^3)
Jan	8,627,309
Feb	6,219,575
Mar	5,324,759
Apr	4,255,619
May	3,810,038
Jun	18,233,656
Jul	40,389,000
Aug	42,592,000
Sep	40,839,000
Oct	33,866,894
Nov	18,805,094
Dec	12,537,097

Discharge To Misery Pit[a]	
Month	Outflow (m^3)
Jan	1,116,000
Feb	1,008,000
Mar	1,116,000
Apr	1,080,000
May	1,116,000
Jun	1,080,000
Jul	1,116,000
Aug	828,000
Sep	0
Oct	0
Nov	0
Dec	0

(a) Monthly outflows are from the year of maximum discharge (2031).

Discharge From Misery Pit[a]	
Month	Inflow (m^3)
Jan	647,102
Feb	596,400
Mar	660,300
Apr	639,000
May	660,300
Jun	1,346,678
Jul	1,287,998
Aug	1,031,194
Sep	967,372
Oct	703,187
Nov	639,000
Dec	660,300

(a) Monthly inflows are from the year of maximum discharge (2029).



LEGEND

- EKATI MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- BATHYMETRY CONTOUR (5 m INTERVAL)
- WATERBODY
- CALIBRATION STATION
- PREDICTION LOCATION

REFERENCE

BATHYMETRIC DATA OBTAINED FROM AURORA, 2013
CANVEC © NATURAL RESOURCES CANADA, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

2 0 2
SCALE 1:80,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
INFLOWS, OUTFLOWS, CALIBRATION STATIONS AND PREDICTION LOCATIONS IN LAC DU SAUVAGE

Golder Associates

PROJECT	13-1328-0041		FILE No. DAR_WQ_006_GIS	
DESIGN	AS	29/09/14	SCALE AS SHOWN	REV 0
GIS	JE	16/10/14	MAP 8F2.2-1	
CHECK	AS	16/10/14		
REVIEW	KM	16/10/14		

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Discharge From Slipper Lake	
Month	Inflow (m^3)
Jan	88,501
Feb	113,677
Mar	65,265
Apr	19,069
May	914,894
Jun	10,910,441
Jul	6,857,793
Aug	2,602,961
Sept	2,899,527
Oct	1,452,596
Nov	745,322
Dec	305,102

LDG Watershed Discharge	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	120,662,416
Jul	86,163,052
Aug	60,215,882
Sept	52,727,206
Oct	22,752,600
Nov	0
Dec	0

Overflow From Misery Pit	
Month	Inflow (m^3)
Jan	0
Feb	0
Mar	0
Apr	0
May	0
Jun	56,054
Jul	0
Aug	0
Sept	11,947
Oct	0
Nov	0
Dec	0

Ekati Mine

Fox Operation

Misery Operation

Lynx

Diavik Mine

Lac de Gras

S3 S2

LdG-P6 LdG-P5

FFA-5 FFA-2

FFA-4 FFA-3 FFA-1

LdG-P4

FF1-5 FF1-1 FF1-3 FF1-2 FF1-4

LdG-P2

MF1-4 MF1-3 MF1-2 MF1-1

NF4 NF3 NF1 NF5 NF2

FF2-1 FF2-3 FF2-5 FF2-2 FF2-4

LdG-P1

MF2-4 MF2-3 MF2-2 MF2-1

MF3-1 MF3-2

FFB-4 FFB-2 FFB-5 FFB-1 FFB-3

LdG-P3

MF3-6 MF3-4

Discharge From LDG	
Month	Outflow (m^3)
Jan	46,797,000
Feb	40,064,000
Mar	39,062,000
Apr	34,360,000
May	32,510,000
Jun	51,621,000
Jul	67,393,000
Aug	71,423,000
Sept	73,174,000
Oct	66,449,000
Nov	53,200,000
Dec	51,038,000

Discharge From Diavik Mine[a]	
Month	Inflow (m^3)
Jan	2,673,750
Feb	2,501,250
Mar	2,673,750
Apr	2,587,500
May	2,673,750
Jun	2,587,500
Jul	2,673,750
Aug	2,673,750
Sept	2,587,500
Oct	2,673,750
Nov	2,587,500
Dec	2,673,825

(a) Monthly inflows are from the year of predicted maximum discharge (2020).

Precipitation And Evaporation	
Month	Inflow (m^3)
Jan	0
Feb	860
Mar	71,669
Apr	670,194
May	6,187,058
Jun	47,636,884
Jul	-33,158,469
Aug	-4,545,935
Sept	6,023,510
Oct	2,233,011
Nov	0
Dec	0

Seepage From Misery Pit	
Month	Inflow (m^3)
Jan	1,541
Feb	1,393
Mar	1,543
Apr	1,495
May	1,546
Jun	1,497
Jul	1,548
Aug	1,549
Sept	1,501
Oct	1,552
Nov	1,503
Dec	1,554

Discharge From LDS	
Month	Inflow (m^3)
Jan	8,627,309
Feb	6,219,575
Mar	5,324,759
Apr	4,255,619
May	3,810,038
Jun	18,233,656
Jul	40,389,000
Aug	42,592,000
Sep	40,839,000
Oct	33,866,894
Nov	18,805,094
Dec	12,537,097

LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- BATHYMETRY CONTOUR (5 m INTERVAL)
- WATERBODY
- CALIBRATION STATION
- PREDICTION STATION

REFERENCE

BATHYMETRIC DATA OBTAINED FROM DIAVIK, 2006
CANVEC © NATURAL RESOURCES CANADA, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

DEVELOPER'S ASSESSMENT REPORT

5 0 5
SCALE 1:200,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
INFLOWS, OUTFLOWS, CALIBRATION STATIONS AND PREDICTION LOCATIONS IN LAC DE GRAS

Golder Associates

PROJECT	13-1328-0041		FILE No.	DAR_WQ_007_GIS
DESIGN	AS	29/09/14	SCALE AS SHOWN	REV 0
GIS	JE	16/10/14		
CHECK	AS	16/10/14	MAP 8F2.2-2	
REVIEW	KM	16/10/14		

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