5.0 RESULTS AND DISCUSSION

5.1 Boreal Woodland Caribou

The monitoring program involves three boreal woodland caribou ranges (P-Bog, N-Reed, Wabowden) intersected by the Bipole III Transmission Project and one reference population (Charron Lake) (Figure 4-1-1). Population status assessment was initiated in Year 1 (2014/15) of the monitoring program using non-invasive genetic CMR methods to assess population size and to inform population models to calculate λ. The next CMR survey is scheduled to occur in Year 3 (2016/17).

Annual aerial survey methods were used to assess winter calf recruitment and population structure. Locations from GPS satellite collars were used for range and fine scale assessment of winter core use areas, habitat use patterns, movement and mortality rates/sources (for collared adult female caribou).

5.1.1 Satellite Telemetry

5.1.1.1 Range Use

The average home range and seasonal range use size for caribou varied across ranges in the as illustrated by the high variation around the average sizes for each range type (Table 5-1-1). The average home and over-wintering range for caribou in Charron Lake caribou was significantly larger than those for any other ranges ($P<0.05$) in both the pre-construction and construction phases. Range sizes between N-Reed, Wabowden and P-Bog caribou were not significantly different. Calving areas in all ranges were not significantly different from each other in size (Table 5-1-1) in the pre-construction phase. However, in the construction phase, Charron Lake calving areas were larger than P-Bog and N-Reed ranges but not significantly different from Wabowden ($P<0.05$). Over wintering areas are not significantly different across ranges or Project phases with the exception of Charron Lake which has significantly larger overwintering areas than the other ranges in both Project phases. Range sizes in the construction phase will continue to be monitored and then statistically compared in more detail to the reference population at Charron Lake in 2017/2018 after suitable data accumulation through multiple Project phases.

Annual 90% kernel home ranges (Figures 5-1-1 to 5-1-4) and 70% overwintering ranges (Figures 5-1-5 to 5-1-8) for individual collared caribou overlap considerably in all four ranges. The 70% kernel calving ranges for individual collared have some level of overlap but are more spread out that than observed during the winter (Figures 5-1-9 to 5-1-12). In 2015, the seasonal range use null models corroborated this pattern, revealing that from May to September, collared cows are more spread out from each other than during the winter months (Amec Foster Wheeler 2016).

5.1.1.2 Site Fidelity

Site fidelity analysis was not updated for this current report. A comprehensive analysis of site fidelity was undertaken for the Year 1 (2014/15) monitoring report (Amec Foster Wheeler 2016) and will be updated again in 2017 once more data for the construction phase has accumulated across multiple years.

5.1.1.3 Resource Selection and Zone of Influence

Wabowden Range

Significant predictors of habitat selection for the seasonally based habitat models for Wabowden included the following wetland and forested communities; treed wetland, shrub wetland, herb wetland, dense coniferous stands, open coniferous stands, shrub stands and water (Figure 5-1-13). Other potential predictors such as mixedwood or deciduous stands were not significant or were removed because they were unstable variables or rare (<5%) on the landscape. Generally, the probability of caribou occurrence in any season significantly increased with the availability of wetland communities and open coniferous stands and decreased in association with dense coniferous stands, shrubs and water (Figure 5-1-13). Base habitat models displayed a good fit to the data as determined by K-fold cross validation (r >0.9 for all seasonal models).

Each habitat model was applied to the EOSD landscape to generate a predictive surface depicting low to high areas of predicted occurrence for caribou for each season (Figures 5-1-14 to 5-1-19). The LANDSAT imagery used for EOSD varies considerably in when it was generated from 1999 to 2005 and therefore represents the distribution of vegetation communities during the pre-disturbance phase. For the Wabowden range the model was generally a good fit to the data and the real caribou locations from both telemetry and aerial surveys (early winter season) occurred in areas of predicted high occurrence for each season.

The results suggest that there was a short ZOI of approximately 1 to 2 m for the pre-existing linear corridor present during the pre-construction phase, as well as widened corridor created through Project construction across all seasons (Figures 5-1-20 to 5-1-29). This suggests that caribou did not increase their avoidance of the linear corridor once construction was initiated and did not seasonally alter their response to construction. It was hypothesized that stronger avoidance of the Project may occur in the spring (compared to other seasons) during both the pre-construction and construction phases. Although Manitoba Hydro avoids construction during the calving period, the spring is known to be a very sensitive time for caribou. This lack of change in response level during the calving period may reflect the effectiveness of this timing window mitigation strategy and will continue to be monitored as more data accumulate.

In addition, there are caribou in the Wabowden range (n = 12) who were monitored for a period during the pre-construction phase to the construction phase. The location data from these specific individuals was qualitatively assessed to determine the extent to which it could be used to refine the ZOI via individual level responses from the pre-construction to construction phase. Examining the distances to ROW for these individuals when they were <10 km from the ROW revealed very similar distances for the pre and during construction phases for most individuals. This suggests that at the individual level, there is no significant difference in the distance of each individual to the ROW from the pre-construction to construction phase reflecting similar results described above (Figure 5-1-30).

Results suggest that caribou in the Wabowden range were already exhibiting avoidance of 1 to 2 km to the existing linear corridor that was in place prior to the implementation of the Project. This response appears to be not have been significantly altered during the construction phase, likely due to some level of habituation to this feature. There is mixed evidence suggesting a habituation effect for ungulates (Stankowich 2008), some studies reporting weak effects (Cote et al. 2013) or lack of behavioral habituation (Bleich et al. 1994, Frid 2003). Johnson & Russell (2014) identified a large ZOI of 38 km of the Porcupine Herd around human disturbance footprint using a long term, 27 year data set and assessed levels of habituation. Boulanger et al. (2012) found temporal variation in the avoidance response of caribou but no obvious habituation effect. However, reindeer have been found to habituate to power lines shortly after their construction when the lines are not accompanied by other human activity such as vehicular traffic (Reimers et al. 2000).

The results of the ZOI analysis are comparable to previous studies. As caribou were already avoiding this linear corridor prior to the installation of the Project there is currently no evidence that their local core use areas have shifted significantly as a result of construction. As was the case in 2015, caribou locations were fewer near the Project ROW than areas farther away peaking in abundance at distances 10 to 15 km from the Project. As sample sizes are low within 0 to 2 km of the Project, the level of confidence with which the ZOI can be drawn at 1 km versus 2 km is uncertain but will continue to be assessed as data accumulates. Therefore very small changes (<1 km) in ZOI may have occurred, however, there are not enough locations to detect these shifts.

P-Bog Range

Significant predictors of habitat selection for the seasonally based habitat models for Wabowden included the following wetland and forested communities; treed wetland, shrub wetland, herb wetland, dense coniferous stands, open coniferous stands and water (Figure 5-1-31). Other potential predictors such as mixedwood or deciduous stands were not significant or were removed because they were unstable variables or rare (<5%) on the landscape. Generally, in this range, the probability of caribou occurrence in any season significantly increased with the availability of treed wetlands and decreased in association with dense coniferous stands and water (Figure 5-1-31). Caribou occurrence also increase with the availability of herb wetlands in the spring and summer and decreased with this same variables in the fall and winter (Figure 5-1-31). Base habitat models displayed a good fit to the data as determined by K-fold cross validation (r >0.9 for all seasonal models) as was expected given the conditional logistic regression modelling approach.

Each habitat model was applied to the EOSD landscape to generate a predictive surface depicting low to high areas of predicted occurrence for caribou for each season (Figures 5-1-32 to 5-1-37). The LANDSAT imagery used for EOSD varies considerably in when it was generated from 1999 to 2005 and therefore represents the distribution of vegetation communities during the pre-disturbance phase. For the P-Bog range the model was generally a good fit to the data and the real caribou locations from both telemetry and aerial surveys (early winter season) occurred in areas of predicted high occurrence for each season. However, there were areas within the outer boundaries of this range where the model was predicting low occurrence. This is likely due to the higher heterogeneity of landscape variables across the P-Bog range when compared to the Wabowden range. The conditional logistic regression is designed to predict relative occurrence when compared to the surrounding landscape (max of approximately 9 km buffer). However, the RSF predictive maps are relative occurrence compared to mean values across the entire P-Bog range. Thus, some raster cells are predicted to be poor habitat when compared to these mean values, but would be considered good habitat if only compared to the areas surrounding that cell. This should not impact the ZOI results, as all models were validated with the cross-validation, which does account for these regional differences.

The results suggest that there has been a short ZOI of approximately 1 km during the construction phase (Figures 5-1-38 to 5-1-42). There is evidence suggesting that avoidance may have increased to 3 km during the spring and summer as the log-likelihood plots which describes the fit of the model (i.e., higher log-likelihood equates to better fit) illustrated larger ZOI for these seasons (Figures 5-1-40 and 5-1-41). This indicates that caribou may have been more sensitive to the Project during the calving period. Although Manitoba Hydro avoids construction during the calving period, caribou may have been responding to the change in vegetation cover as the Project created a new disturbance on the landscape from vegetation clearing activities in the winter. This pattern will continue to be assessed as more data accumulates through 2017.

The results of the ZOI analysis are comparable to previous studies. As was the case for the Wabowden range, caribou locations in the P-Bog range were fewer near the Project than areas farther away peaking in abundance at distances 10 to 15 km away. As sample sizes are low within 0 to 2 km of the Project, the level of confidence with which the ZOI can be drawn at 1 km versus 2 km is uncertain but will continue to be assessed as data accumulates.

Most regional studies have revealed that caribou reduce their use of areas within 1 to 10 km of a development (Murphy & Curatolo, 1987, Wolfe et al. 2000, Nellmann et al. 2001, Mahoney & Schaefer 2002, Cameron et al. 2005, Joly et al. 2006, Weir et al. 2007, Vistnes & Nellmann 2008, Polfus et al. 2011). Boulanger et al. (2012) detected a ZOI of 14 km, however, the study was focused on a large open pit mine which from a noise and disturbance perspective is much different than a transmission line. Johnson et al. (2005) also found a large area of avoidance near mines and communities with the avoidance response varying seasonally. Caribou have varying disturbance threshold responses to linear disturbances, ranging from ≤250 m from seismic lines and trails (James & Stewart-Smith 2000, Dyer et al. 2001, Hebblewhite et al. 2010) to ≥500 m for well-traveled roads and highways (Environment Canada 2012, Haskell et al. 2006, Hebblewhite et al. 2010, Cameron et al. 2005). Studies of caribou and hydro-electric projects suggest diminished habitat use within 3 km following construction (Mahoney & Schaefer 2002) and up to 5 km if the power line is associated with roads (Nellemann et al. 2003, Vistnes & Nellemann 2008).

Woodland caribou are affected by cumulative disturbance within a range (Environment Canada 2012) and behavioral responses to the Project could be affected by other disturbances within the range. In 2015, AIC analysis revealed that models which included both the distance to other linear features such as highways and distance to the existing linear corridor fit the data better than when they were included separately (Amec Foster Wheeler 2016). These responses could be explored and quantified through a more complex RSF model that was not focused on defining the ZOI around the Project in future reports, if needed.

5.1.1.4 Crossing Analysis

After the completion of the ZOI analysis, caribou behavior was further assessed on a more local scale by evaluating the extent to which the Project acted as a barrier to local movements. This crossing analysis differs from the ZOI analysis in that it evaluates the local movement responses of individual caribou to Project construction whereas the ZOI analysis quantifies the overall avoidance response by all collared caribou in a given range. The crossing analysis specifically assesses the extent to which the Project acts as a barrier to individual local movements by caribou whereas the ZOI analysis examines overall distribution of caribou on the landscape relative to the installation of the Project.

Both linear and mixed models were run for the crossing analysis in both the Wabowden and P-Bog ranges to control for individual level responses. Mixed models control for individual level effects without having to compare mean numbers of crossings. As both models provided comparable results we only report the results for the linear model.

In the Wabowden range, there was no significant increase in the level of avoidance from the pre-construction to construction phase (df = 1, 76; $p = 0.22$) indicating that widening of the ROW through the installation of the Project did not significantly alter caribou crossing behavior. After combining the pre- and during construction phases, collared caribou were found to cross the ROW less frequently than random crossings suggesting they significantly avoided crossing the ROW overall (df = 77, $p < 0.0001$).

In the P-Bog range, there was no significant increase in the level of avoidance from the pre-construction (no ROW present) to construction phase (df = 1, 81; $p = 0.31$) indicating that addition of the ROW has not significantly altered caribou crossing behavior. Overall, collared caribou were not significantly avoiding crossing the ROW, as crossings occurred as frequently as those generated by simulated trajectories (df = 82, $p = 0.50$).

Analysis was only undertaken with animals who had crossed the Project ROW at least two times, excluding animals who were farther from the corridor (that may never have interacted with this linear feature). As the simulated random walk trajectories were also based on the same starting location as the paired real animal, the random expectation was also derived from simulations that could have crossed the ROW.

Both linear and mixed models were run for the crossing analysis in both the Wabowden and P-Bog ranges to assess the degree to which individual level responses contributed to the result. Mixed models control for individual level effects. As both models provided comparable results, the coefficients from the linear model were selected for inclusion in the report as there was no evidence that individual level responses were biasing the results.

In the Wabowden range, collared caribou significantly avoided crossing the ROW during both the pre-construction and construction phases (df = 77, $p < 0.0001$). There was no significant increase in the level of avoidance from the pre-construction to construction phase (df = 82, $p = 0.51$) indicating that widening of the ROW through the installation of the Project did not significantly alter caribou crossing behavior.

In the P-Bog range, collared caribou are not significantly avoiding crossing the ROW, crossings occurred as frequently as those generated by simulated trajectories.

Summary of ZOI versus Crossing Analysis Results

Wabowden Range - the crossing analysis revealed that in the Wabowden range, there was no significant increase in the level of avoidance to the Project from the pre-construction to construction phase by collared caribou. This is comparable to the results of the ZOI analysis which revealed that the ZOI around the Project did not increase as a result of Project construction (i.e., widening of the corridor). Although not tested directly, these results may be a result of habituation by local caribou to this linear corridor. The crossing analysis also revealed that collared caribou crossed the Project less frequently than randomly generated crossings suggesting that caribou are avoiding crossing the Project even though there may be a level of habituation to the linear corridor.

Therefore, caribou do avoid the Project by a buffer of 1 to 2 km throughout the year, irrespective of Project phase. The Project is also a semi-permeable barrier to movement, it does not completely prevent local movement on the landscape, however, it does reduce the frequency. Caribou who choose to cross the Project, do not cross as frequently as would be expected by random. Some caribou still do cross the ROW and this behavior has not been not altered by construction. The 2017 report will assess the extent to which vegetation mitigation applications in this range have been effective in mitigating impacts to local caribou movements.

P-Bog Range - the crossing analysis revealed that there was no significant change in local movement behavior by collared caribou during the construction phase of the Project. During construction, individual collared caribou continued to move across the Project in similar locations to those used in pre-construction. The crossing analysis also revealed that in the P-Bog range, individual collared caribou were not significantly avoiding crossing the ROW; crossings occurred as frequently as those generated by simulated random trajectories indicating that the Project did not act as a barrier to movement to these individuals. This may be the result of the mitigation provided by installation of vegetation mitigation areas and will continue to be assessed as more data accumulates.

The crossing analysis results for the P-Bog range does not contradict the ZOI results which indicated an overall avoidance buffer of approximately 1 to 3 km by caribou to the Project. Overall collared caribou did not occur as frequently within 1 km of the Project during construction as areas farther away. However, individual caribou who decided to cross Project, were doing so as frequently as what would be expected randomly. This indicates that the Project has not been a complete barrier to local movements and may be the result of effective installation of vegetation mitigation areas.

5.1.1.5 Effectiveness of the Vegetation Mitigation Strategies

Overall, in P-Bog Range in both the pre-construction (df = 31, $p<0.0001$) and construction (df = 24, $p<0.0001$) phases, individuals were crossing at mitigated areas at a higher proportion of the time (Figure 5-1-43). This was confirmed by examining the bursts of individuals in both phases (Figures 5-1-44 and 5-1-45). Although the Project (and thus mitigated vs unmitigated locations) did not exist in the pre-construction phase, these results suggest individuals have not altered their movement patterns in this range as a response to the construction and also that mitigated areas were put in place where caribou would naturally cross the ROW.

5.1.2 Population Dynamics

5.1.2.1 Abundance Estimates and Trend (λ)

Population estimates for each monitored woodland caribou range (P-Bog, N-Reed, Wabowden and Charron Lk) in Year 1 (2014/15) via non-invasive genetic sampling (NGS) for capture mark-recapture (CMR) population estimation are presented in Table 5-1-4. NGS was not conducted in Year 2 (2015/16) of monitoring, but is scheduled to be repeated in Year 3 (2016/17) in all four monitored woodland caribou ranges. The objective for sampling in Year 3 is to obtain winter population estimates to assess population state (abundance, trend (λ), and sex ratio). No phylogenetics or kinship/pedigree analyses are planned for this monitoring study. No population genetic structure/health assessments are planned to assess inbreeding, genetic diversity, genetic variation or genetic drift for any of the monitored populations.

The low recapture rate for Charron Lake during Year 1 (2014/15) may have been a result of movement dynamics for this population which is situated on the boreal shield ecozone. Typically, boreal shield caribou populations are less sedentary and wider ranging than boreal plain populations, which could compromise the assumption of demographic closure for the survey area. Alternatively, the results of the CMR may in fact be accurate, with the population size being larger that thought with respect to the MB Government guesstimate (Table 5-1-4). A repeat of the CMR survey for Charron Lake in Year 3 will contribute to confirming actual population abundance. Genetic population structure analyses indicate the Charron Lake population has a large proportion of the eastern migratory haplotype lineage mixed with smaller proportions of barren-ground and western and southern Manitoba haplotype lineages (Klütch et al. 2012, Manseau et al. 2014).

5.1.2.2 Population Structure and Calf Recruitment

Calf mortality is greatest during the first six months after birth, with survival increasing to adult levels after six months (Gustine et al. 2006, Pinard et al. 2012, Traylor-Holzer 2015). Estimation of calf recruitment provides valuable insight into population state and provides a measure of calves produced and surviving to a point where they are considered recruited into the yearling/adult caribou population. Assuming annual adult survival is >85%, populations are likely growing if the proportion of calves (% Calves) in winter is >15%, stable if 12 to 15%, or in decline if <10% (Bergerud 1974, Stuart-Smith et al. 1997, Dzus 2001, Arsenault 2003). A population viability analysis conducted by Environment Canada (2008, 2011) suggests calf recruitment rates >28.9 calves/100 cows indicates a stable to increasing population (assuming annual adult female survival is ≥85%). If calf recruitment drops below this threshold and/or annual female survival rates are <85%, the population is likely declining.

Calf recruitment estimates (Table 5-1-5) were obtained from aerial surveys conducted in January 2016. **Annual adult female survival** was estimated from telemetry data for each boreal woodland caribou range (Table 5-1-5) using the Kaplan-Meier method of survival analysis (Pollock et al. 1989) with a staggered entry design to account for multiple collar deployments. The telemetry data were right-censored with time-at-risk based on the number of months since the animal was live-captured. Kaplan-Meier plots for each boreal woodland caribou are presented in Figure 5-1-46 and were used to determine adult female survival rates to 12 months.

5.1.2.3 Population Trend

Direct estimates of population trend (lambda; λ) will be made once additional genetic CMR estimates are obtained for each monitored boreal woodland caribou range in Year 3 (2016/17) of the monitoring program. However, winter calf recruitment estimates (% calves and calves/100 cows) and Kaplan-Meier adult female survival rate estimates (Table 5-1-5) are consistent with stable populations in the P-Bog, Wabowden and Charron Lake ranges, and a decreasing population in the N-Reed range. Recent widespread fire in the N-Reed core winter range during the study period may be a contributing factor for the suspected declining population trend (Arlt et al. 2015) and subsequent lower adult female survival relative to the other monitored ranges (Figure 5-1-46).

5.2 Forest-Tundra and Barren-ground Caribou

The **Qamanirjuaq** (barren ground) caribou population has declined from 349,000 ±44,900 SE (2008 estimate) to 264,000 (2014 estimate), accompanied by a downward trend in cow:calf ratios indicative of reduced annual calf recruitment (Biodivcanada 2016, Campbell *et al.* 2010). This population annually migrates from Nunavut in fall to overwinter in northern Manitoba, and then return to Nunavut in spring to calve. Periodically a small component of the population (usually consisting primarily of bulls) may overwinter as far south as the northern extent of the Bipole III Project area (proximate to N1 construction segment). The last known occurrence in the Project area (proximate to the N1 construction segment) was in 2004 (approx. 10,000 caribou) (WRCS 2016).

The **Pen Islands** caribou population was estimated to total 10,800 in 1994 (Abraham & Thompson 1998). The population summers along the Hudson Bay coast of Ontario and Manitoba and overwinters inland near the boundary of the Hudson Plain and Boreal Shield ecozones (Biodivcanada.ca 2016). The population in recent years is thought to be decreasing with the population range shifting eastward. However, recent satellite telemetry data (2010 to January 2015) indicates there are movements as far west as the Nelson River proximate to the southeast edge of Split Lake and York Factory First Nation in Manitoba (Figure 5-2-1). Typically <300 caribou from this population occur in the general Project area, although large winter migrations are known to have occurred in 2001, 2005 and February 2013 (LaPorte et al. 2013, WRCS 2016).

The **Cape Churchill** caribou population is considered to be stable with a minimum population size estimate of about 3,000 caribou (Abraham *et al.* 2012, Biodivcanada 2016). This population resides on Coastal Hudson Bay Lowland ecoregion west of Hudson Bay between the Churchill and Nelson Rivers (Trim 2015), and will seasonally migrate southward occasionally as far as the Bipole III Project in proximity to the N1 construction segment northeast of Stephens Lake (Figure 5-2-1). Satellite telemetry data (2010 to January 2015) indicates the majority of their activity occurs north of the Nelson River (Figure 5-2-1). Typically <50 caribou from this population overwinter in the general Project area in most winters (WRCS 2016).

Pen Islands and Cape Churchill caribou are a forest-tundra ecotype, also referred to as coastal caribou (Trim 2015). A collaborative project to study these populations was initiated in February 2010 involving MB Government, MB Hydro and the Fox Lake, Split Lake and York Factory Resource Management Boards. The project has a telemetry, aerial population demographic, and genetic analysis components to assess population spatial structure (including range extent), movement dynamics relative to landscape disturbance, mortality sources, changes in population demographics and population genetic relatedness. Calf recruitment results for the project are presented in Table 5-2-1.

The following summarizes forest-tundra (Pen Islands and Cape Churchill populations) and barren-ground (Qamanirjuaq population) caribou recent occurrence in the Project area:

- **Pre-disturbance** - A large migration of forest-tundra woodland caribou (Pen Islands population) occurred in the project area in winter of 2012/13 (LaPorte *et al.* 2013).

- **Year 1 (2014/15)** - No forest-tundra woodland caribou or barren-ground (Qamanirjuaq population) caribou occurrences were noted in proximity of the project during winter clearing/construction activities in 2014/2015 (MB Government, V. Trim, Pers. Comm., February 22, 2016).

- **Year 2 (2015/16)** – Caribou believed to be from the Cape Churchill population were harvested along Highway 280 between Gillam and Bird (Fox Lake Cree Nation) in January 2016 (MB Hydro, T. Barker, Pers. Comm, October 11, 2016).

5.3 Moose

Three sensitive moose ranges were identified for long-term monitoring (Manitoba Hydro 2015) which include: Tom Lamb Wildlife Management Area (GHA 8), Moose Meadows (portion of GHA 14) and Pine River (GHA 14A/19A). Figure 4-3-1 illustrates the locations of each sensitive moose range relative to adjacent reference moose populations. All three sensitive ranges occur in the boreal plain ecozone.

5.3.1 Population Dynamics

Trends in regional moose population dynamics are important to understand in order to provide context to the baseline condition of each sensitive moose range, and to ascertain through long-term monitoring whether the Bipole III Transmission Project will cause a significant positive or negative incremental effect on population performance of any of the sensitive moose ranges. Current population size is a function of past abundance and the demographic processes of survival, productivity, immigration and emigration (Skalski *et al.* 2005). These processes and their relative interactions affect population growth and abundance. Multiple surveys of winter populations across years provides a sequential time series of population abundance estimates that can be used to model population trend and change. The finite rate of population change (λ) characterizes the relative change in population abundance over time. Population trend modelling allows an assessment of various population performance metrics, including λ.

5.3.1.1 Tom Lamb WMA (GHA 8)

The Saskatchewan River Delta is an extensive alluvial landscape feature straddling the Saskatchewan-Manitoba border, consisting of upper and lower portions separated by The Pas Moraine, and totals about 10,000 km^2 in area. The delta landscape is significantly affected by two hydro-electric dams, E.B. Campbell Dam in Saskatchewan (upstream side at the outlet of Tobin Lake) and Grand Rapids Dam in Manitoba (downstream side at the outlet of Cedar Lake). Extremes of flood events are moderated by the dams since their construction in the 1960's. Mean annual hydrographic outflow from the delta have declined by 25 to 30% since records began in 1913, largely attributed to upstream irrigation consumption along the South Saskatchewan River. Collectively, the moderated flood regime and decline in hydrographic flow have likely affected the delta ecology, including vegetation succession, moose habitat suitability and predator-prey dynamics. Tom Lamb WMA/GHA 8 includes a large portion of the lower Saskatchewan River Delta (CEC 2013). Survey data indicates a moose population trend with a history of fluctuation (Figure 5-3-1) affected by unsustainable harvest regimes and periodic flooding events (2005, 2007 and 2011) affecting distribution (Kent Whaley, 2015 GHA 8 Moose Survey Proposal, June 2, 2015).

The Year 1 Mammals Monitoring Report (Amec Foster Wheeler 2016) assessed regional moose populations proximate to Tom Lamb WMA/GHA 8. The assessment (Amec Foster Wheeler 2016) indicated a general regional population decline in moose population abundance in recent years (prior to Bipole III disturbance), including for the Tom Lam WMA/GHA8 sensitive moose range.

During Year 2 of the Bipole III Mammals Monitoring Program, a winter population survey was conducted by MB Government in January 2016 that yielded an estimate of 339 ±18.5% moose (0.107 moose/ km^2) . There was no significant change in winter moose abundance detected since the previous survey (317 ±32.0%, 0.101 moose/km^2) conducted in January 2012), suggesting that the declining trend in moose population abundance may have stabilized at a lower level of abundance, currently at 48% below the long-term (1971 to 2016) winter population mean (Table 5-3-1, Figure 5-3-1). The winter population structure estimates indicate an increase in the proportion of adult cows from 43.2% (January 2012) to 47.5% (January 2016) and calves from 20.2% (January 2012) to 24.8% (January 2016) in the winter population relative to adult bulls (36.6% in January 2012 to 27.4% in January 2016). This suggests the population has a slightly improved capacity for potential growth (greater reproductive capacity and greater calf recruitment into the adult population) compared to January 2012, assuming there are sufficient numbers of bulls in the population to allow effective breeding during the rut. Twinning rate also increased from 8.0% (January 2012) to 12.9% (January 2016).

5.3.1.2 Moose Meadows (Portion of GHA 14)

Moose Meadows (also referred to as Bellsite Swamp; Shared Values Solutions 2015) is a low lying area considered to be a sensitive winter foraging refuge (Manitoba Hydro 2014) for moose moving off of the east slopes of the Porcupine Hills, as well as a spring moose calving area (Shared Values Solutions 2015). An additional habitat patch referred to as Novra Swamp lies immediately to the south of Moose Meadows (Shared Values Solutions 2015). Both swamps are adjacent to, the east edge of the Porcupine Hills. The Bipole III ROW passes between Moose Meadows and the Porcupine Hills, paralleling a segment of Highway 10 that links the communities of Whitmore and Mafeking. Moose Meadows is contiguous with the western portion of the Interlake Plain Ecoregion. Swan Lake and farmland lie to the south of Moose Meadows.

The Porcupine Hills are a large landscape hill complex mainly in Saskatchewan but extending into Manitoba. Historically, the Saskatchewan portion of the population was relatively stable across decades at about 5,300 moose (0.763 moose/km^2), with significant recent decline below the long-term mean. The Manitoba portion of the population is much smaller and appears to be stable at about 800 moose in recent decades (Figure 5-3-1, Table 5-3-1). As a moose population management unit (MMU), the Porcupine Hills MMU population trend has been stable across decades with recent decline during the past 10 years to a level below the long-term mean.

Moose Meadows represents a small portion of GHA 14 which tends to fluctuate in numbers depending on snow conditions in the Porcupine Hills (MB Government, K. Rebizant, Pers. Comm., November 3, 2014). However, there is no empirical evidence (telemetry) to confirm this habitat condition mediated movement. There are no specific moose population surveys of Moose

Meadows, as it is a portion of GHA 14. Typically GHA 14 has been surveyed by MB Government on its own, or in association with GHA 14A. As a moose population monitoring unit (Swan-Pelican MMU), moose in GHA 14/14A have experienced a significant decline beginning in the early-1990's (approx. 3,300 moose; 0.687 moose/km^2) to the current level of about 150 moose (0.030 moose/km^2) based on population surveys conducted in January 2011 and January 2014 (Table 5-3-1, Figure 5-3-1). Moose population trend in Moose Meadows is more reflective of the Swan Lake MMU than that of the Porcupine Hills MMU. A moose population survey led by MB Government was recommended to occur in Year 3 (2016/17) for the Swan-Pelican MMU population (GHA 14/14A) in January 2017 as part of the Bipole III Mammals Monitoring Program. However, MB Government advised (MB Government, V. Harriman, Pers. Comm. November 4, 2016) that this population is not on the 2016/17 moose population survey schedule.

5.3.1.3 Pine River (GHA 14A/19A)

Pine River (GHA 14A/19A) represents a sensitive local moose population that potentially interacts with the Bipole III ROW. Moose population demographic data is limited for this population, but based on modelling of available survey data, it appears the population significantly declined from a high of 1,047 moose (0.336 moose/km^2) in January 1992 to 213 (0.068 moose/km^2) in January 2002, and has remained at a low level. The winter population in January 2014 was assessed by MB Government to be about 100 ±19.0% moose (0.032 moose/km^2). A moose population survey led by MB Government (in collaboration with MB Hydro) was recommended for this population in January 2017 as part of the Bipole III Mammals Monitoring Program. However, MB Government advised (MB Government, V. Harriman, Pers. Comm. 4 Nov 2016) that this population is not on the 2016/17 moose population survey schedule.

GHA 14A is considered to be sensitive because it is an area of winter use in an area of limited remote habitat adjacent to the northeast side of the Duck Mountains (Manitoba Hydro 2014). Highway 10 passes between the Duck Mountains and Pine River (GHA 14A/19A). Swan Lake and Pelican Lake are at the north edge of GHA 14A, and Lake Winnipegosis is on the east edge (Figure 4-3-1). GHA 14A and GHA 19A are transected by a section of Highway 20 linking the communities of Cowan and Camperville. GHA 19A has higher levels of anthropogenic disturbance and access development.

Regional moose population trends are similar to that reported in previous sections with decline in recent years. The Duck Mountain (GHA 18/18A-18C) moose population appears to be in steady decline since the early 1990's from a high of about 3,300 moose (0.452 moose/km^2) in 1993 to about 1,450 moose (0.257 moose/km^2) in 2012 (Figure 5-3-1). The Riding Mountain (GHA 23/23A) moose population is situated to the south of Pine River (GHA 14A/19A) and has experienced a population decline from about 4,030 moose in 2001 to 2,570 moose the following year. Since that decline the population has remained below the long-term mean (1971 to 2016) of 3,087 moose.

5.3.1.4 Additional Moose Surveys

GHA 11 Moose Population Survey – GHA 11 and 12 constitute the Red Deer-Bog MMU. During January 2016 (Year 2 of the Bipole III Mammals Monitoring Program), MB Government conducted a moose survey of GHA 11, which is intersected by the Bipole III ROW and overlaps the P-Bog Boreal Caribou monitored population. No previous moose population surveys have been conducted for this area, with population size guesstimated by MB Government to be about 100 moose (0.43 moose/km²). Survey results were not available from MB Government at the time this report was prepared.

Keeyask GS Moose Population Survey – During January 2015 (Year 1 of the Bipole III Mammals Monitoring Program), a moose population survey was conducted by MB Hydro as a component of their Terrestrial Effects Monitoring Plan for the Keeyask Generation Project. A portion of the survey area (specifically Study Zone 5, which straddles the Nelson River from Thompson, through Split Lake to Stephens Lake) overlaps the Bipole III Transmission Project ROW. Most of the survey area occurs in the eastern portion of GHA 9, with lesser portions in adjacent GHAs 1, 3 and 3A and 9A. A population trend model for this area suggests the population is stable and possibly increasing. Comparison of population abundance survey data obtained from MB Hydro indicates no significant difference between January 2010 (961 ±21.0%) and January 2015 (1,349 ±22.6%) because the confidence intervals of both estimates overlap (Figure 5-3-1). However, the 2015 abundance estimate is larger, suggesting the population is growing at a 10-yr mean $\lambda = 1.022$.

5.3.2 Additional Moose Monitoring Studies

A **moose telemetry study** that overlapped two sensitive moose areas (Moose Meadows and Pine River) was proposed by MB Hydro in consultation with MB Government for potential implementation in Year 2 (2015/16) of the Bipole III Mammals Monitoring Program. The study was intended to assess spatial structure and seasonal movements of moose in relation to the Bipole III ROW through the construction and initial operation phases of the Project. Local stakeholder opposition was encountered during consultation led by MB Government, which resulted in cancellation of the proposed moose telemetry study.

Non-invasive genetic studies (NGS) of moose were proposed by MB Hydro as an alternative to the invasive telemetry study. NGS was proposed as an alternative method to assess population size and structure (sex ratio), winter range distribution, population inter-relatedness of sensitive moose ranges with adjacent populations, and to assess genetic health to determine if there are any existing barriers to moose movement resulting in inbreeding effects or population isolation (reduced heterozygosity, genetic drift), or in relation to declined population abundance. MB Government was not interested in pursuing NGS studies; no NGS survey efforts were undertaken.

Moose sightings and activity data were collected concurrently with the Boreal Caribou Calf Recruitment Surveys and *P. tenuis* Deer Pellet Sample Collection attempt during Year 2 (2015/16) monitoring efforts. This data is useful to assess moose distribution relative to the ROW and predator-prey dynamics (e.g., wolf predation risk [Section 5.6.2.2]).

Discussions between MB Hydro and MB Government are ongoing regarding what (if any) additional moose studies are required as a component of the Bipole III Mammals Monitoring Program to monitor predicted effects of the project on moose populations interacting with Project infrastructure and activities, and to ensure the Project commitments, approval conditions and EA License requirements are met with respect to moose monitoring.

5.4 Deer and Elk

Presence/absence and distribution of deer and elk were monitored using several methods which included:

- Annual winter distribution surveys conducted concurrently with the woodland caribou winter calf recruitment survey; no white-tailed deer or elk ingress into woodland caribou range was detected during the Year 1 or Year 2 surveys.

- Aerial transect surveys of two *P. tenuis* surveillance blocks (Figure 4-4-1) in Year 2 (February 2016). White-tailed deer were detected at 3 locations in Surveillance Block 1 and at 3 locations in Surveillance Block 2. No elk or elk sign were detected in the survey. See Section 5.6.5 for further discussion.

- Multi-species Aerial Survey conducted by Alaskan Trackers; preconstruction survey in February 2014 and during monitoring Year 2 (Jan/February 2016); numerous deer and a few elk observations were made during these survey efforts, all of which occurred within the expected local ranges of these two ungulate species. Eleven observations of white tailed deer occurred in proximity of the ROW on construction segment N4 east of Reed Deer Lake; most of these observations fall within P. tenuis Surveillance Area 2 and are immediately adjacent to the P-Bog woodland caribou range (Figure 5-4-1).

- Winter Ground Transect Surveys – 1 white-tailed deer track was recorded on transect N2-10 in monitoring Year 2 (February 2016).

- Remote IR Camera traps (Section 5-5-2). White tailed deer were detected during Year 1 at cameras placed near the ROW on transect N3-05 and N3-06, on transect N3-06 1.5 km from the ROW, and at the BPIII_ACCESS_003 human access monitoring location. No elk have been detected at the Year 1 camera deployment locations.

Figure 5-4-1 provides an overview of deer and elk observations and distribution relative to the ROW collected from various survey methods.

Mortality monitoring:

- Monitoring harvest was to be accomplished using annual MB Government harvest statistics. Deer and elk harvest statistics from licensed hunting and rights-based hunting are not readily available; see Section 5.6.3 for further discussion.

- Project-related vehicle collisions - No deer or elk collisions have been documented for Year 1 or Year 2 related to the Project.

5.5 Furbearers

5.5.1 Winter Ground Transect Surveys

Winter ground transects surveyed in 2015 (N2 and N3 construction segments) and 2016 (N1, N2 and N3 construction segments) detected most of the expected furbearing species including marten/fisher (genus *Martes*), wolf, fox, otter and mink, as well as ungulate species including moose and caribou (Figures 5-5-1 and 5-5-2). Each species distribution was modelled separately to assess levels of occurrence as a function of the distance to the Project, results are summarized for each target below (Tables 5-5-1 to 5-5-9).

Power analysis were conducted with and without model covariates. For some species, models including covariates resulted in very low effect sizes (<0.02) which were not practical for inclusion in the power analysis. In these instances, the effect sizes from the model where covariates were not included were used in the power analysis. For animals that are wide-ranging with large home ranges (e.g., wolf, wolverine) the assumption of independence of detection data from different sample units is likely to be violated (Webb & Merrill 2012). Estimates of abundance will be highly skewed, with low precision when detections are sparse (e.g., <10 detection occasions) (Chandler & Royle 2013, Ramsey *et al*. 2015). Accordingly, the number of transects required for analysis varied across species. Occurrence as a function of the distance to the Project also varied across species.

Coyote

There is insufficient data to statistically assess the distribution of coyotes.

Ermine/Weasel

The best fit model was that which included mixed forest vegetation as a covariate:

log(Track Density) ~ Distance + Mixed Forest + (1 |Transect)

Year was not included in the weasel model since only a single track was observed in 2015. No correlation was found between track density and distance to the Project or between tracked density and vegetation community as confidence intervals for these variables incorporate zero (Table 5-5-1).

Power analyses were run using the effect size for 'Distance to Project' and excluding covariates (effect size = 0.2). When the effect size is 0.2, detecting tracks at 32 transects would give a power of 80%. A total of 55 transect surveys were conducted during 2015 and 2016, for which only 16 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/16*32 = 110 transects.

Fisher/Marten

The best fit model was that which included mixed forest vegetation as a covariate:

log(Track Density) ~ Distance + Mixed Forest + (1 |Transect)

Results showed a significant positive relationship between track density and distance to the Project, as well as mixed forest vegetation. Track density increased as a function of distance from the Project (Table 5-5-2), marten/fisher tracks were observed more frequently in areas father away from the Project. Assuming an effect size of 0.06, power for the current model for this species is already at 80%. Therefore no additional transects are needed to sufficiently detect Fisher or Marten.

Fox

The best fit model was that which included dense cover as a covariate:

log(Track Density) ~ Distance + Year + Dense_Cover + (1 |Transect)

Track density was positively correlated with distance to Project (Table 5-5-3), more fox tracks were observed at greater distances from the Project. Power analyses were run using the effect size for 'Distance to Project' and excluding covariates (effect size = 0.2). With an effect size of 0.2, tracks would need to be detected on 50 transects in order to reach a power of 80%. A total of 55 transect surveys were conducted during 2015 and 2016, for which only 11 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/11*50 = 250 transects.

Wolf

The best fit model was that which did not include year or any of the covariates:

log(Track Density) ~ Distance + (1 |Transect)

Track density was positively correlated with distance to ROW (Table 5-5-4), more tracks were observed at distances farther from the Project. Power analysis was run using the effect size for 'Distance to Project" (effect size = 0.1). Results showed that tracks would need to be detected on

20 transects in order to reach a power of 80%. A total of 55 transect surveys were conducted during 2015 and 2016, for which only 13 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/13*20 = 85 transects.

Hare

The best fit model was that which included temperature and elevation as covariates:

log(Track Density) ~ Distance + Year + Temperature + Elevation + (1 |Transect)

Track density differed between years and was higher in 2016 compared to 2015. Track density was positively correlated to distance from the ROW. Results showed a significant positive correlation with distance to the (Table 5-5-5). Power analysis was conducted using the model but excluding covariates. Using an effect size of 0.1, power for the current analysis is at 99% and therefore sufficient power has been attained and no additional transects are required to detect hare.

Lynx

The best fit model was that which included temperature and stand age as covariates:

log(Track Density) ~ Distance + Temperature + Stand Age + (1 |Transect)

Though this model did not include Year as a fixed effect, only three observations of tracks on a single transect (N1-11) were noted for 2016. No correlation was found between track density and distance to the Project, temperature, or stand age as the confidence intervals for their estimates span zero (Table 5-5-6).

Power analyses excluded covariates (effect size = 0.25). Using an effect size is 0.25, detecting tracks at 35 transects would give a power of 80%. A total of 55 transect surveys were conducted during 2015 and 2016, for which only 13 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/13*35 = 148 transects.

Moose

The best fit model was that which included stand age and elevation as covariates:

log(Track Density) ~ Distance + Year + Stand Age + Elevation + (1 |Transect)

No correlation was found between track density and distance to the Project but there was a significant effect of year and elevation on track density (Table 5-5-7).

Power analysis included covariates (effect size = 0.15). A power of 80% was attained when tracks were observed on 55 transects. A total of 55 transect surveys were conducted during 2015 and

2016, for which only 13 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/13*35 = 233 transects.

Squirrel

The best fit model was that which included noise level as a covariate:

log(Track Density) ~ Distance + Year + Stand_Age + Elevation + (1 |Transect)

Track density did not significantly differ between years and so 'Year' was not retained in the model. No correlation was observed for distance to ROW but a positive correlation was observed for noise level (Table 5-5-8).

Power analysis included covariates (effect size = 0.02). To obtain a power of 80%, tracks would need to be observed on 350 transects. A total of 55 transect surveys were conducted during 2015 and 2016, for which 30 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/30*350 = 641 transects. This large number is likely due to the very small effect size for 'Distance to ROW'. There is insufficient data so far for this species to accurately predict the sample size required to achieve a result with 80% power.

Woodland Caribou

The best fit model was a simple model with only distance to ROW as a fixed effect:

log(Track Density) ~ Distance + (1 |Transect)

No correlation was observed for track density and distance to the Project (Table 5-5-9).

Power analysis was conducted for the model above (effect size = 0.02). Based on this model, to obtain a power of 80%, tracks would need to be observed on 650 transects. A total of 55 transect surveys were conducted during 2015 and 2016, for which only 7 had tracks. Therefore, an approximate number of transects that would need to be surveyed to obtain a power of 80% is 55/7*650 = 5,107 transects. This large number is likely due to the very small effect size for 'Distance to ROW' and the very small sample size with which the model was built. There is insufficient data so far for this species to accurately predict the sample size required to achieve a result with 80% power.

5.5.2 Remote IR Camera Traps

During Year 1 (2014/15) of monitoring, camera traps (n = 37) were deployed in construction segments N2 and N3 during March 2015, and were serviced in January 2016. ROW clearing progress and access restrictions prevented camera deployment in N1 during Year 1, however, cameras were deployed (n = 20) in Year 2 (January 2016). Camera traps have not yet been deployed on N4 because of access restrictions, but is anticipated to occur in Year 3 (2016/17 winter), concurrent with camera servicing in N1, N2 and N3.

Memory cards were retrieved in February 2016 from camera traps that were deployed in association with the winter ground track transects during Year 1 (February/March 2015) on construction segments N2 and N3. Camera images were classified by an independent consultant on behalf of MBHydro. The cameras captured images of most of the expected mammal species, however, sample sizes were low for many of the mammal species, preventing meaningful statistical analysis for most for this current report (Table 5-5-10, Table 5-5-11).

5.5.3 Furbearer Harvest Statistics

Trapping has limited economic impact compared to decades prior to the 1980’s, but it does influence social and economic programs of Manitoba through its northern registered trapline legacy (Berezanski 2004). MB Hydro actively works with trappers and mitigates to potentially reduce disruption of trapping activities when new power distribution lines (≥115 Kv) affect the trapline (Berezanski 2004, MB Hydro Trapper Notification/Compensation Policy, MB Hydro presentation to the MB Clean Environment Commission). The Bipole III Project directly intersects 42 registered traplines including 5 community traplines (Table 5-5-12, Figure 4-4-1). In addition, there are 3 community/youth traplines (Fox Lake Cree Nation, Tataskweak Cree Nation and Opaskwayak Cree Nation) in proximity to, but not directly intersected by the Bipole III alignment, that are part of MB Hydro’s Community Trapline Monitoring Program.

Annual furbearer harvest statistics are used to monitor effects of Bipole III on fur harvest from registered traplines intersected by the transmission line by comparing pre-Bipole III disturbance harvest statistics (by species and construction segment) to post-disturbance. There is a significant lag in MB Government furbearer harvest statistics availability, therefore only baseline data from 2001/02 through 2013/14 are presented in this report, along with 2014/15 (i.e., Year 1 of Project disturbance). However, data received from MB Government for 2012/13 was incomplete at time of preparation of this report. The furbearer harvest data will be updated in a future annual monitoring report prior to evaluating the significance of project effects on furbearer harvest before and after disturbance.

Four furbearer species (beaver, marten, wolf, wolverine) were identified in the EIS as having particular concern because of potential Project disturbance effects (i.e., access resulting in overharvest, direct habitat loss and/or sensory disturbance). Harvest statistics for these species in particular will continue to be monitored and assessed as annual harvest data becomes available. The majority of annual harvest for these four species is variable across construction segments (Table 5-5-13). This is in part due to differences in the number (and physical extent) of traplines within each construction segment that are physically intersected or directly adjacent to the ROW. The same pattern is evident in the harvest rates for these species (Table 5-5-14) and means (Table 5-5-13 and Table 5-5-14).

Annual harvest (Table 5-5-13) and harvest rate (Table 5-5-14) of many of the other furbearer species from the monitored traplines appears to be limited and highly variable, which is likely related to a combination of factors including:

- Trapping effort - some traplines have no or limited harvest records in some years, which is likely related to trapping conditions in a particular year, trapper interest, trapping success, and pelt prices (Todd & Boggess 1999).

- Variable fur prices - reduced trapping effort during low fur pelt prices.

- Cyclical population fluctuations (Wolfe & Chapman 1999) – e.g., lynx have a classic population cycle linked to prey (hare) availability (Seton 1911, Elton 1924), marten in Manitoba cycle at 4-year intervals (MB Government, D. Berezanski, Pers. Comm. 1 September 2015).

- Species distributions - some species are rare or absent as a function of their latitudinal distribution or habitat requirements (e.g., coyote, wolverine) relative to the project location (Allen 1999, COSEWIC 2003).

5.6 Altered Mortality

The mammals monitoring program study design includes cause-specific direct mortality hazards for various mammal VECs using several methods (discussed in the subsequent report sections):

- Telemetry collar mortality signal investigations of boreal woodland caribou.

- Winter predator-prey distribution surveys conducted concurrently with annual boreal caribou winter calf recruitment surveys, and periodic moose aerial population surveys.

- Harvest monitoring (furbearer trapping statistics, ungulate licensed harvest surveys) obtained from MB Government, The ungulate licensed harvest data are not collected at a resolution sufficient to monitor at a GHA scale and are more appropriately applied at a larger regional scale (V. Harriman, Pers. Comm. 6 October 2016). Therefore, provincial ungulate hunter harvest statistics are not useful as a component of the Bipole III Mammals Monitoring Program applicable at a spatial scale needed to monitor for potential harvest mortality effects resulting from ROW access.

- Incidental ungulate harvest monitoring during the project construction phase by MB Hydro environmental monitors.

- Documentation of project-related wildlife-vehicle collisions during the Project construction phase by MB Hydro environmental monitors.

- Ungulate disease/parasite monitoring specifically for *Parelaphostrongylus tenuis* (*P. tenuis*; meningeal brain worm) prevalence and occurrence in white-tailed deer populations associated with the ROW.

- Remote IR camera studies, winter ground transects and incidental observations during wildlife aerial surveys to document potential annual changes (e.g., ingress) in white-tailed deer occurrence in proximity to the ROW relative to other ungulate species.

- Remote IR camera studies of non-project construction related human access of the ROW a main access points and along construction segments N1 through N4).

5.6.1 Telemetry Collar Mortality Signal Investigations

5.6.1.1 Woodland Caribou

Observed mortality (for adult female boreal woodland caribou fitted with biotelemetry collars) involved investigation of mortality location and probable cause. Investigations were conducted as soon as possible after receipt of a mortality signal. Mortality investigations conducted by MB Hydro to date suggest that predation constituted 81.6% of known mortality sources of collared adult females (n = 38), primarily by wolves (76.3%) (Table 5-6-1, Figure 5-6-1).

All documented adult female caribou predation events in monitored woodland caribou ranges intersected by the Project occurred prior to initiation of vegetation clearing activities, except for three in Wabowden range and 4 in the P-Bog range; all were from wolf predation. The closest predation mortality was 3.96 km from the cleared ROW in Wabowden Range (WAB1404) and 3.31 km from the ROW in P-Bog Range (BOG1206); the remaining predation mortalities were >15 km from the cleared ROW (Figure 5-6-2). There was also one known caribou-vehicle collision in the P-Bog range (December 2015; Table 5-6-1, Figure 5-6-2) but it was unrelated to the ROW or project-related activities (MB Hydro, T. Barker, Pers. Comm. October 6, 2015).

5.6.1.2 Forest-tundra Caribou

Telemetry collar mortality assessments have been conducted for the Pen Islands and Cape Churchill Caribou Range Distribution Project (Trim 2015). The mortality assessment investigations (n = 36) identify mortality sources to consist of a mixture of wolf kills (confirmed and suspected), black bear kills (suspected) and hunter harvests (Trim 2015). Some mortalities could be confirmed as non-predator mortalities, but it could not be determined whether the deaths were attributed to natural causes (e.g., old age, disease or malnutrition) or some other cause (Trim 2015). Trim (2015) reported that the majority of mortalities investigated occurred in the spring and summer months when female caribou incur the greatest demands from calving, calf rearing and predation avoidance.

5.6.2 Altered Predator-Prey Dynamics

5.6.2.1 Predator-Prey Ecology

Carnivores play a vital role in ecological communities by cascading trophic effects, stabilizing and destabilizing food webs, and by affecting energy and nutrient transfer processes (Lesmeister et al. 2015). Predators select areas where prey are not only more abundant, but are also easier to capture (Keim et al. 2011, Messier 1985, Andruskiw et al. 2008). Anthropogenic disturbance can result in substantive changes in predator-prey dynamics by altering prey carrying capacity and predator-prey encounter rates (Leclerc et al. 2012, Wittmer *et al*. 2007, Festa-Blanchet et al. 2011). The synchronous birth of calves in ungulate populations provides a predictable and relatively stable food resource pulse (Rayl et al. 2015), which may be more accessible by anthropogenic disturbance. Black bear and gray wolf are the primary large mammal predators monitored for the Bipole III Transmission Project.

Black bears are generalist consumers (omnivores) that can effectively exploit pulsed resources because of their capacity to switch to alternative resources (Rayl *et al*. 2015). They are known to be predators of ungulate neonates (Tigner et al. 2014) particularly during the first few weeks following birth (Zager & Beecham 2006, Dussault et al. 2012). Consequently, bears can have an additive effect on neonate mortality before calf body condition mediates vulnerability to predation (Zager & Beecham 2006, Rayl et al. 2015). Black bear effect on prey populations is highly variable and is dependent on prey population size, bear population size, prey population resilience to predation intensity, and bear-ungulate neonate encounter rates (Bastille-Rousseau et al. 2011, DeCesare 2012, Hebblewhite et al. 2005**).** Black bear foraging decisions are determined by food resource availability both spatially and seasonally (Costello & Sage 1994, Gunson 1993, Pelton et al. 1999, Pelton 2000). Although less predatory than wolves, their population density can be an order of magnitude greater that wolves, and therefore can have a significant effect on ungulate neonate mortality in some populations (Tigner et al. 2014). Predation rates are thought to be facilitated by linear development. However, bears will avoid linear development with active human activity. They are active foragers in all seasons except during winter hibernation.

Gray (timber) wolves are large carnivores and habitat generalists that can have population level effects on ungulates, despite their relatively sparse distribution (Ausband et al. 2014). Wolf predation on adult ungulates can be especially high for low-density prey populations residing in landscapes where alternative ungulate prey support predators at high densities (DeCesare et al. 2010, Wittmer et al. 2013). Wolf pack territory spatial requirements are dictated by access to sufficient prey to sustain the wolf pack (Messier 1985), which ultimately limits wolf population size and distribution at a landscape scale (Messier 1995, Allen 1999, Fuller et al. 2003, Klaczek et al. 2015). They will alter territory size in response to local variation in habitat quality, to balance trade-offs between territorial defense costs and energetic gains from prey acquisition (Kittle et al. 2015).

Predators respond to prey abundance through several interactive processes (Messier 1995, Rayl et al. 2015):

- **Functional response** - increased consumption rate of prey where prey are locally concentrated (e.g., pulsed resource such as an ungulate calving ground).

- **Demographic numerical response** - increased predator population growth via change in reproduction and/or survival rates due to increased prey density (e.g., moose responding to increased browse from landscape disturbances from fire or logging; lynx population response to hare population).

- **Aggregative numerical response** – change in predator population via immigration (distributional shift) to an area of concentrated prey (e.g., deer yarded by deep snow).

5.6.2.2 Predation-risk

Predation is the proximate limiting factor of woodland caribou populations (Environment Canada 2012, Wittmer et al. 2005). The susceptibility of boreal woodland caribou to predation has led to habitat use and predator avoidance strategies that separate caribou from other ungulate species in the same geographic area (Wittmer et al. 2005).

Landscape Scale

At the **landscape scale**, winter distribution surveys of ungulate species, wolf and wolverine were conducted in each boreal woodland caribou study area concurrent with the caribou recruitment survey in 2016 to collect data on relative distribution, as this may provide insight into predation-risk. This data will is compared annually to assess spatial variation in distribution in order to track annual changes is extent of winter range of these species relative to the Bipole ROW. A reduction in range extent for a population may indicate a declining population and potential diminished probability of population persistence (Makenzie & Nichols 2004, MacKenzie 2005).

Ungulate predation-risk was assessed within each boreal woodland caribou study area using ungulate/wolf distribution survey data by comparing the distance of observed moose and caribou from recent wolf sign and observed wolves (Table 5-6-2, Figures 5-6-1 to 5-6-3):

- In the Wabowden study area, moose were at greater wolf predation-risk than woodland caribou with respect to distance to wolves in Year 1 and Year 2. Among boreal woodland caribou ranges, predation-risk to caribou in Year 1 and Year 2 was lowest in the Wabowden study area relative to the other woodland caribou study areas (Table 5-5-2, Figure 5-6-3) as a function of caribou distance to wolf.

- In P-Bog study area, there was no statistically detectable difference between woodland caribou vs moose with respect to wolf predation-risk in Year 1 and Year 2 (Figure 5-6-3). Wolf observations/sign were the lowest of all caribou study areas in both survey years, suggesting a low wolf population within the P-Bog study area, which is likely due to low overall ungulate prey densities to support higher wolf numbers.

- In the N-Reed study area the survey data for Year 1 (2014/15) and Year 2 (2015/16) suggests that predation risk to boreal woodland caribou was significantly greater than for moose (Figure 5-6-3). Among boreal woodland caribou ranges, predation-risk to caribou in Year 1 and Year 2 was greatest in the N-Reed study relative to the other woodland caribou study areas (Table 5-6-2) as a function of caribou distance to wolf.

- In the Charron Lake study area the survey data for Year 1 (2014/15) and Year 2 (2015/16) suggests that predation risk to boreal woodland caribou was significantly greater than for moose (Figure 5-6-3). In addition, there were substantially less observations of moose in Year 1 and Year 2 relative to woodland caribou, further supporting the notion that wolves were likely focusing on caribou as primary prey.

- Overall, wolf distance to ungulate prey was consistently less in Year 2 compared to Year 1 (Table 5-6-2), which may indicate overall greater wolf population size in all monitored caribou study areas in Year 2, as well as greater wolf predation risk to ungulates.

Relative density surfaces were developed for each boreal woodland caribou range to visually assess areas with greatest overlap of ungulate prey and wolf occurrence, with the intention of understanding relative predator-prey distribution and locations of greatest predation-risk in relation to the Bipole III ROW (Figures 5-6-2 through 5-6-5). In Wabowden survey area there was greater overlap of wolves with moose relative to woodland caribou (Figure 5-6-2); wolf overlap with moose was in an area of greatest moose occurrence. In the N-Reed survey area, wolf distributional overlap with woodland caribou was greater than with moose (Figure 5-6-4); the overlap of both ungulate species with wolf was at the same location in the N-Reed survey area where both ungulate species had greater density. In the P-Bog survey area, wolf distributional overlap was greater with woodland caribou relative to moose (Figure 5-6-3). In the Charron Lake survey area, wolf distributional overlap with woodland caribou was greater relative to moose (Figure 5-6-5); wolf overlap with woodland caribou was in areas of highest woodland caribou density. In each woodland caribou survey area the overlap of highest wolf densities corresponded to areas of greater relative ungulate prey density, which is consistent with studies of wolf occurrence being influenced by prey abundance (Messier 1995, Allen 1999, Fuller et al. 2003, Klaczek et al. 2015). Areas of highest wolf predation-risk to woodland caribou or moose did not appear to be related to the ROW at the landscape scale.

Local Scale

At the **local scale**, winter ground track transects and remote IR cameras were deployed to collect data on ungulates and associated predators relative to the ROW across seasons. Remote IR cameras deployed in March 2015 indicate wolves occurred more frequently on the ROW relative to areas 1.5 km from the ROW (Amec Foster Wheeler 2016); black bears indicated a greater preference for areas away from the ROW. However, these remote camera trap results are considered preliminary because of small sample size; additional years of data are required for a more rigorous analysis.

Wolf distribution along the Project was associated more strongly with the distribution of moose rather than caribou along the ROW in both the northern and southern portions of the Multi-species Aerial Survey sampling area in 2014 and 2016 (Figures 5-6-8 to 5-6-10). Wolf occurrence and densities appear to have increased in frequency from 2014 to 2016 in the southern portion of the study area (Figure 5-6-8 and 5-6-10). These patterns will be statistically evaluated in the next report where additional sample years may be available to include to allow for more robust assessment.

5.6.3 Harvest Mortality

Ungulate licensed harvest data is not readily available from MB Government and has not been substantively collected in recent years. There are no reliable sources of rights-based subsistence harvest data for ungulates available for the project area. Therefore, no monitoring of licensed hunting or rights-based subsistence hunting is possible as a component of the mammals monitoring for Bipole III transmission Project.

Furbearer harvest statistics are reported in Section 5.5.3 of this report.

5.6.4 Wildlife-Vehicle Collisions

No project-related wildlife vehicle collisions were reported to date for the Bipole III project. However, one of the collared caribou (BOG1408) in the P-Bog range was killed on December 25, 2014 as a result of a wildlife-vehicle collision; the mortality location was 18.1 km from the Bipole III ROW (Figure 5-6-1) and was not associated with a Project access road.

5.6.5 Disease/Parasite Monitoring

In recent decades, research attention to movement corridors has increased, concurrent with concerns related to habitat fragmentation, and the spread of invasive species and disease vectors Panzacchi *et al*. 2015). Climate change may facilitate northward range expansion of white-tailed deer (Dawe 2011) with certain types of anthropogenic disturbances (including power line corridors) providing ecotones with excellent ungulate browse resources and accessible hiding cover in adjacent forest (Reimers *et al.* 2000, Wunschmann *et al.* 2015), and functioning as corridors for range expansion.

Parelaphostrongylus tenuis (*P. tenuis*; meningeal brain worm) was identified in the Bipole III EIS and Biophysical Monitoring Plan (Manitoba Hydro 2015) as the primary focus for monitoring. *P tenuis* is a long-lived ungulate nematode parasite that can persist in adult form in the ungulate host for many years, which facilitates continual shedding of first stage larvae in fecal mucosa (Slomke *et al.* 1995). White-tailed deer have built up a resistance to the parasite, but other ungulate species (moose, elk and caribou) are less resistant (Lankester 2010). Gastropods (snails and slugs) ingest the first stage larvae when they feed on the mucosa. While in the gastropod host, the larvae develop into second and third stage larvae which are capable of infection. Infected gastropods residing on ungulate forage are incidentally ingested by the ungulate host, at which point the larvae move to the ungulate host's stomach wall, enter the central nervous system and brain where they develop into the third (adult) stage and lay eggs to complete the life cycle. *P tenuis* transmission is related to deer population density and gastropod host abundance (mediated by temperature and climate). Transmission period is variable and related to the amount of time that ground snow cover is absent.

5.6.5.1 Biological Sample Collection

Diagnosis of P. tenuis can be conducted by analyzing deer fecal pellets for first stage larvae, and by post-mortem necropsy of the deer brain cavity to detect present of adult parasites (Wasel et al. 2003, Duffy et al. 2002, Slomke et al. 1995). Forrester & Lankester (1997) present a commonly used technique to generate quantitative estimates of prevalence (proportion of animals passing protostrongylid larvae) and mean intensity of infection (mean number of larvae passed/infected individual) using ungulate fecal samples.

The following is a summary of the *P. tenuis* biological sample collection effort by year:

- **Year 1 (2014/15)** - No deer fecal collection, or collection of harvested adult white-tailed deer heads, was undertaken in of the Bipole III Mammals Monitoring Program as that aspect of the Biophysical Monitoring Plan (Manitoba Hydro 2015) had not yet been approved by MB Government.

- **Year 2 (February 2016)** - An attempt was made in to acquire white-tailed deer pellet samples along the ROW from two surveillance areas using a systematic aerial transect survey method to detect deer activity (Figure 5-4-1). However, sample acquisition was substantially hindered by inaccessibility to private land on portions of the ROW that deer sign was observed. There was also very little deer sign detected in the areas surveyed. Consequently, no samples were collected. No deer pellet samples were detected during the winter ground track transect survey, nor by MB Hydro environmental monitors along the ROW during winter construction.

- **Year 3 (2016/17)** - MB Hydro plans to lead a winter (February or March 2017), ground-based community sample collection effort using students from UCN (University College of the North) and OCN (Opaskwayak Cree Nation) in an attempt to acquire deer pellet samples in portions of the surveillance areas with road/trail access, including private land. Samples will also be opportunistically collected during the Winter Track Transect Survey effort and along the ROW by MB Hydro Environmental Monitors during winter construction activities.

5.6.5.2 White-tailed Deer Ingress

A combination of winter aerial transect surveys, winter ground track transects and remote IR cameras are used monitor potential for project-related white-tailed deer ingress and occurrence across seasons into areas transected by the ROW that historically have limited or no deer occurrence (Section 5.4). The following summarizes deer occurrence and distribution results relative to the ROW by monitoring year:

- **Year 1 (2014/15)** – Winter aerial species distribution surveys were conducted in the P-Bog N-Reed and Wabowden Woodland Caribou Range survey areas; no white-tailed deer observations or deer sign were detected. Winter track transects were conducted along N2 and N3 construction segments, including deployment of remote IR during March 2015 to monitor deer presence along the N2 and N3 portions of the ROW and within 1,500 m of the ROW; no deer evidence was detected during the winter ground transect/camera deployment effort.

- **Year 2 (2015/16)** – Winter species distribution surveys were repeated in P-Bog, N-Reed and Wabowden woodland caribou range survey areas with no evidence of deer presence detected. Winter species aerial distribution surveys were conducted in two deer surveillance areas (Figure 5-4-1) along the ROW on either side of the P-Bog woodland caribou survey area; deer were detected on private land portions of the survey area in areas of historical occurrence. The Alaskan Trackers conducted the Multi-species Aerial Survey using transects spaced parallel to the ROW at 0.25 km, 1.25 km, 3.25 km, 5.25 km and 10.25 km (in proximity of Moose Meadows, Tom Lamb and Pine River sensitive moose areas, and along the ROW from Thompson to the Keewatinohk Converter Station) intervals; they detected deer in areas of historical occurrence, including in proximity of the P-Bog woodland caribou range along the ROW east of Red Deer Lake (Figure 5-4-1). Winter Ground Track Transects were conducted in N1, N2 and N3, with no evidence of deer detection outside of areas of historical occurrence; there was one deer record of occurrence on N2-10). Remote IR Cameras deployed during Year 1 along N2 and N3 detected deer activity on transect N3-05 and N3-06, as well as at the BPIII_ACCESS_003 human access monitoring location.

There is no evidence to date of white tailed deer ingress into areas outside of historical occurrence as a result of the ROW and associated project disturbance.

5.7 Direct Habitat Effects

Mammal-habitat relationships are fundamental to mammal ecology because of their central role in species distribution and biogeography, population dynamics, state and vital rates and individual life histories and behavioral ecology (Aldridge & Boyce 2008, Allen 1999, Cooper & Millspaugh 1999, Leblond et al. 2014).

Annual progress of ROW clearing activities are illustrated in Figure 5-7-1.

5.7.1 Mineral Licks

Mineral licks provide a source of sodium (Na) and minerals such as sulfur (S), calcium (Ca, and magnesium (Mg) to ungulates. Mineral lick use occurs year-round and are related to mineral loss in females due to pregnancy, parturition and lactation and for males related to demands of antler production on mineral balance (Atwood & Weeks 2003). Dietary requirements for these elements are also obtained from natural forages, but mineral licks provide a concentrated source.

Several sources of information were used for mineral lick detection which included Traditional Local Knowledge, baseline surveys conducted for the EIS, Multi-species Aerial Survey of the

ROW (by Alaskan Trackers), ungulate-wolf winter distribution surveys in woodland caribou ranges (Wabowden, N-Reed, P-Bog), numerous overflights of the ROW, and incidental observations via environmental monitors. The Manitoba Métis Federation commissioned a Metis land occupancy and use study (Shared Values Solutions 2015) which identified 27 ungulate salt lick locations within the geographical extent of their study area. The majority of those locations are distant from the project ROW and would not be affected by project activities. However, a few locations (i.e., 4002-15, 5004-22, and 3001-27) are in near proximity to the ROW and require additional field investigation. It is unclear from the report as to which sites are dry salt licks versus wet mineral seeps. The following is a summary of mineral lick detections by year:

- **Pre-monitoring Phase (Prior to 2014/15)** - No mineral licks were detected in proximity to the project prior to implementation of the 2014/15 mammals monitoring program.

- **Year 1 (2014/15)** - No mineral licks were detected during field survey monitoring efforts in proximity to the Project. Numerous mineral licks were identified in the region of the Bipole III ROW by the Manitoba Metis Federation (Shared Values Solutions 2015). The three closest locations identified were situated east of Red Deer Lake along construction segment N4 (Figure 5-7-1) and included 5004-22 (678 m from ROW), 4002-15 (961 m from ROW) and 3001-27 (1,003 m from ROW), none of which are anticipated to have a significant interaction with the Project, or be directly impacted by construction activities, nor during the Project operation phase.

- **Year 2 (2015/16)** - One mineral lick (wet mineral seep) was detected during aerial surveys on 28 February 2016 at: 14U 362682E 5823496N. The location was 2,408 m from construction segment N4 of the ROW (Figure 5-7-1), and was not in a location that would be disturbed by the Bipole III ROW construction or operation activities.

5.7.2 Dens

5.7.2.1 Black Bear

Black bears are particularly sensitive to noise disturbance within 200 m of overwintering dens, with effects as great as 1 km, and may abandon the den in response to disturbance, especially early in the denning period (Linnell et al. 2000). Dens are seldom re-used in consecutive years, therefore, loss of a single denning site from human disturbance is not deleterious if alternative sites are available within the home range (Linnell et al. 2000).

The following is an annual summary of bear dens encountered during Project construction:

- **Year 1 (2014/15)** - One bear hibernation den was encountered during winter construction clearing activities (mulching) on February 2, 2015 at the north end of construction segment C2 near tower station 5016 (UTM: REDACTED (Figure 5-7-1). See Amec Foster Wheeler 2016 for further details.

- **Year 2 (2015/16)** - No bear dens were encountered during winter construction (MB Hydro, T. Barker, Pers. Comm., October 11, 2016).

5.7.2.2 Wolverine

Wolverines have specific habitat requirements for natal and maternal den sites; multiple dens may be used in sequence through the duration of maternal litter care. Dens are constructed in boulders, under deadfall, or in snow tunnels, with individuals reoccupying den sites or denning habitats in successive years (COSEWIC 2003). They are snow-dependent in order to den. Den sites may also function as rendezvous sites between females and their kits (COSEWIC 2003). Denning females are sensitive to disturbance, potentially resulting in relocation or litter abandonment. Wolverines mate in summer but fertilized egg implantation is delayed until winter. Typically <50% of adult females will produce a litter in a given year, making them demographically vulnerable and susceptible to disturbance impacts (Inman et al. 2012, COSEWIC 2003). Gestation is about 45 days long with peak parturition occurring between February and mid-March (Inman et al. 2012). Lactation period occurring over about a 10 week period from February to April (Inman et al. 2012). Young are nutritionally independent from the mother by fall, and will on average make exploratory dispersal movements by 11 months of age (Inman et al. 2012). The natal den is occupied for a few weeks before the litter is moved to a maternal den.

No wolverine dens were encountered during Project construction during Year 1 (2014/15) or Year 2 (2015/16). Locations of wolverine sign (tracks) and observations are summarized in Figure 5-7-1. Occurrences of wolverine varied from 227 m to 8,247 m from the ROW, with a median distance of 3,266 m (n = 58 observations).

5.7.2.3 Wolf

Wolf den locations are generally randomly situated within the pack territory, with the outer 1 km periphery avoided; the larger the territory, the closer the den is to the center (Mech & Boitani 2003, Packard 2003). Rendezvous site are usually located in the general denning region. Pack foraging excursions may be up to 48 km from the den or pups. Several dens within each home range may be used for pup rearing, with natal dens usually located near water (Packard 2003). Peak of parturition occurs near the end of April through early May. Pups are highly associated with the den for their first 8 weeks. Den proximity to human disturbance is dependent on whether they have experienced negative interactions with humans. Disturbance is unlikely to have an effect unless it is widespread and intensive (Fuller et al. 2003). Dens and rendezvous sites have been documented within 1 to 2 km of active roadways and as close as 400 m to paved roadways (Fritts et al. 2003).

The timing of winter clearing and winter project construction activities in boreal habitats occupied by wolves mitigates potential for negative effects on wolf den disturbance. Consequently, no den searches were necessary because there was no overlap of winter project construction activities with spring wolf denning activities. No conflicts occurred with respect to wolf den or rendezvous sites and project construction were reported for Year 1 or Year 2 (MB Hydro, T. Barker, Pers. Comm., October 11, 2016).

5.8 Human Access Monitoring

MB Hydro placed trail cameras at several all-weather access points to monitor human access of the ROW at those locations from Jul 2014 through March 2016. In addition, camera traps associated with the winter ground track transects along the ROW in construction segments N2 and N3 also captured human access from March 2015 through February 2016. Results of the sampling effort (Table 5-8-1) indicates the vast majority of ROW access and use is related to Project construction with very limited local access for recreation or resource use.

5.9 Mitigation Effectiveness Monitoring

Clearing activities relevant to mammals monitoring were undertaken in the majority of construction segment N3 from February through March 2014, and in N2, south portion of N3 and N4 (primarily centerline clearing), prior to initiation of Year 1 (2014/15) of the mammals monitoring programs in January 2015. Clearing activities along the N3 and N4 ROW construction segments was completed during Year 2 (2015/16).

This report concentrates on analysis from both the pre-construction to construction phase of the Project for the various mammal VECs being monitored at local and/or landscape scales through each project phase. Assessment of use on mitigation areas within P-Bog range was undertaken as data on the location of each vegetation leave area was available. Caribou did use the vegetation leave areas to cross the Project during the construction phase. Caribou used these same locations during the pre-construction phase, suggesting that the placement of these mitigation areas was well informed on local caribou movement dynamics. As caribou continued to use these areas during the construction phase, they have been effective in ensuring that caribou continue to move across the landscape in the same ways as before construction, reducing disruption to local movement dynamics.

Table 5-1-1: Average Annual and Seasonal Home Range Sizes for each Woodland Caribou Range by Project Phase

Range	Annual Home range (km^2)*	Overwintering Areas (km^2)*	Calving Areas (km^2)*
Pre-construction Phase			
Wabowden	512.2 +/- 360.6 (n = 44)	103.4 +/- 67.7 (n = 25)	25.4 +/- 49.9 (n = 94)
N-Reed	384.9 +/- 428.5 (n = 30)	110.35 +/- 121.8 (n = 20)	28.1 +/- 63.4 (n = 38)
P-Bog	469.7 +/- 278.4 (n = 52)	62.02 +/- 60.1 (n = 44)	24.7 +/- 30.4 (n = 111)
Charron Lake	1166.9 +/- 890.01 (n =34)**	152.17 +/- 91.2 (n = 61)**	29.4 +/-38.6 (n =76)
Construction Phase			
Wabowden	618.5 +/- 337.8 (n = 21)	121.1 +/- 68.0 (n = 19)	21.9 +/- 23.4 (n = 20)
N-Reed	374.8 +/- 247.2 (n = 15)	86.4 +/- 52.0 (n = 14)	4.3 +/- 2.1 (n = 11)
P-Bog	545.6 +/- 320.6 (n = 20)	36.6 +/- 18.6 (n = 16)	12.4 +/- 17.6 (n = 21)
Charron Lake	958.5 +/- 644.0 (n = 21)**	198.9 +/- 101.1 (n = 17)**	28.5 +/- 30.5 (n = 21)

Notes:
* Annual home range estimates based on 90% kernel estimates, overwintering and calving areas based on 70% kernel estimates
** Significantly different from all of the other ranges (P <0.05)

Table 5-1-4: CMR Population Abundance Estimates of Boreal Woodland Caribou Winter Ranges, Year 1 (2014/2015)

Caribou Range	Survey Area					Range			MB Government's Caribou Population Size Estimate (as of 2015)
	Survey Area Size (km²)	# Unique Genotypes (from 2015 CMR sampling)	Minimum Count (from January 2015 winter calf recruitment survey)	CMR Population Estimate ±95% CI (Darroch (1961) estimates in brackets)	CMR Density Estimate (Caribou /km²)	100% MCP Size (km²)	Projected Population Size	Projected Population Density Estimate (Caribou/km²)	
P-Bog	2,224	72	82	120 ± 4 (118 ±23)	0.0529	5,476	149	0.0272	175-200
N-Reed	1,822	99	81	276 ± 12 (292 ±99)	0.1516	6,329	331 (boreal plain portion)	0.0524	125-150 (boreal plain portion) 250-300 (entire range)
Wabowden	2,130	82	100	108 ± 2 (111 ±15)	0.0504	3,919	130 (boreal plain portion	0.0332	130 (boreal plain portion) 150-200 (entire range)
Charron Lk	2,032	126	87	714 ± 41 (846 ±425)	0.3514	n/a	1,550	0.0983	300-500

Notes:

Adjusted range abundance estimates for P-Bog, N-Reed and Wabowden were proportionately calculated based on the amount of winter core area of occupation based on a 70% kernel probability isopleth estimator within each study area, relative to the amount occurring within the Boreal Plain Ecozone for each respective caribou range. A 20% correction factor was then applied to account for potential caribou occurrence on the remaining unaccounted portion of non-core winter range occurring within the Boreal Plain Ecozone for each respective caribou range. This yields a projected population estimate for the portion of each caribou range occurring on the Boreal Plain Ecozone (i.e., excludes the portion of range occurring on the Boreal Shield).

An adjusted range abundance estimate for the Charron Lake range (portion within Manitoba) was proportionately calculated based on the amount of winter core area of occupation based on a 70% kernel probability isopleth estimator within the area sampled relative to total amount within the caribou range, all of which occurs on the Boreal Shield Ecozone. The low recapture rate (9.3%) may have resulted in an inflated population estimate. The CMR survey will be repeated for each monitored caribou population in Year 3 (2016/17) with the additional objective of verifying the projected population estimate for Charron Lake.

Table 5-1-5: Summary of Population Structure and Calf Recruitment Estimates for Boreal Woodland Caribou from Mid-winter Aerial Surveys

Caribou Range	Year	Number of Caribou Observed					Bulls /100 Cows	Calves /100 Cows	Calves /100 Adults	% Calves	Adult Female Survival Rate (%)	Population Trend ***
		Bulls	Cows	Calves	Unkn*	Total						
P-Bog	Jan 23-29, 2015	12	53	13	4	82	22.6	24.5	20.0	16.7	90.0	Stable (possibly increasing)
	Feb 25-26, 2016	5	49	11	1	66 **	10.2	22.4	20.4	16.9	88.0	Stable ** (possibly increasing)
N-Reed	Jan 29-Feb 1, 2015	15	52	11	5	81	28.8	21.2	16.4	14.1	82.9	Declining
	Jan 14-15, 2016	1	25	11	0	37 **	4.0	44.0	42.3	29.7	86.7	Stable **
Wabowden	Jan 19-22, 2015	17	61	15	7	100	27.9	24.6	19.2	16.1	84.4	Stable
	Jan 12-13, 2016	24	68	14	1	107	35.3	20.6	15.2	13.2	81.5	Stable (possibly decreasing
Charron Lk	Feb 3-6, 2015	19	50	16	2	87	38.0	32.0	22.5	18.8	91.7	Increasing
	Jan 17-19, 2016	58	131	23	0	212	44.3	17.6	12.2	10.8	90.6	Stable

Notes:

* Not classified to age or sex.

** Small sample size for caribou observations; interpret with caution.

*** Demographic Indicators of Population Trend:

- Assuming annual adult survival is >85%, if the proportion of calves (% Calves) in winter is >15% the population is likely growing, stable if 12 to 15%, or in decline if <10%.
- Calf recruitment rates >28.9 calves/100 cows indicates a stable to increasing population (assuming annual adult female survival is ≥85%). If calf recruitment drops below this threshold and/or annual female survival rates are <85%, the population is likely declining.

Table 5-2-1: Summary of Winter Calf Recruitment Results for Forest-tundra Caribou Populations, 2012 to 2016 (from Trim 2015, and MB Government, V. Trim, Pers. Comm., October 10, 2016)

Caribou Range	Year	Active Telemetry Collars		Adults	Calves	Unclassified	Total	Calves/100 Adults
		Deployed	Relocated					
Cape Churchill	2012	19	18	311	64	0	375	20.6
	2013	17	17	238	33	0	271	13.9
	2014	17	17	300	35	0	335	11.7
	2015	Not Surveyed						
	2016	Not Surveyed						
	Mean							**15.4**
Pen Islands	2012	21	17	228	49	0	277	21.5
	2013	20	20	354	56	0	410	15.8
	2014	20	20	406	58	0	464	14.3
	2015	Not Surveyed						
	2016	20	17	257	41	0	298	16.0
	Mean							**16.9**

Table 5-3-1: Comparison of Long-term Mean Population Metrics and Recent (>2010) Survey Results for Modeled Moose Populations Intersected by the Bipole III Transmission Project ROW

Moose Population	Year	Winter Population (±95% CI)	Winter Density (#/km^2)	Adult Sex Ratio (M/100F)	Calf Recruitment (calves/100F)
Tom Lamb WMA (GHA 8)	**Long Term Mean (1971-2016)**	**648**	**0.206**	**61.3**	**58.9**
	January 2012	317 ±32.0%	0.101	84.5	46.6
	January 2016	339 ±18.5%	0.107	57.7	52.1
Moose Meadows (portion of GHA 14)*	**Long Term Mean (1971-2016)**	**82**	**0.443**	**35.4**	**56.1**
	January 2011	7	0.040	72.7	52.3
Pine River (GHA 14A/19A)	**Long Term Mean (1971-2016)**	**554**	**0.178**	**50.3**	**47.7**
	January 2013	104 ±12.8%	0.033	37.5	87.5
	January 2014	100 ±19.0%	0.032	138.5	76.9
Split Lake (Keeyask GS 2015 Survey Area)	**Long Term Mean (1971-2016)**	**1,104**	**0.066**	**95.1**	**53.4**
	January 2010	961 ±21.0%	0.057	118.3	35.5
	January 2015	1,349 ±22.6%	0.080	50.0	51.4
Red Deer Bog (GHA11/12)	**Long Term Mean (1971-2016)**	**506**	**0.105**	**48.1**	**50.4**
	January 2013	199 ±24.6%	0.042	31.6	34.2
	January 2016	Survey data from GHA 11 not available at time of report preparation			

Note:

* Estimates for Moose Meadows were projected (based on proportion of habitat area) from the Swan-Pelican moose population model using GHA 14 data only to gain insight on relative population size and trend

Table 5-5-1: Model Results for Ermine/Weasel

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-4.99	0.18	-27.67	-5.25	-4.65
Distance to Project	0.12	0.16	0.75	-0.24	0.38
Mixed Forest Vegetation	-0.21	0.18	-1.17	-0.48	0.13

Table 5-5-2: Model Results for Fisher/Marten

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-2.15	0.04	-59.45	-5.12	-4.79
Distance	0.06	0.02	2.94	0.05	0.22
Year	0.05	0.04	1.10	-0.08	0.30
Mixed Forest Vegetation	0.06	0.02	2.88	0.05	0.23

Table 5-5-3: Model Results for Fox

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-2.16	0.04	-56.85	-2.24	-2.09
Distance	0.05	0.02	2.36	0.01	0.09
Year	0.06	0.05	1.29	-0.03	0.15
Dense Vegetation Cover	-0.03	0.02	-1.39	-0.07	0.01

Table 5-5-4: Model Results for Grey Wolf

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-2.23	0.05	-41.38	-2.34	-2.12
Distance	0.13	0.03	4.33	0.11	0.21

Table 5-5-5: Model Results for Hare

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-1.88	0.06	-31.07	-2.00	-1.77
Distance	0.10	0.03	3.80	0.05	0.16
Year	0.25	0.08	3.32	0.10	0.40
Temperature	-0.01	0.05	-0.15	-0.09	0.08
Elevation	0.05	0.03	1.72	-0.01	0.11

Table 5-5-6: Model Results for Lynx

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-4.63	0.13	-34.45	-4.88	-4.39
Distance	0.02	0.18	0.09	-0.31	0.34
Temperature	-0.11	0.16	-0.69	-0.41	0.18
Stand Age	-0.17	0.17	-1.00	-0.49	0.14

Table 5-5-7: Model Results for Moose

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-5.26	0.23	-22.65	-5.65	-4.87
Distance	0.15	0.10	1.45	-0.02	0.32
Year	0.84	0.34	2.45	0.26	1.41
Stand Age	0.01	0.18	0.05	-0.17	0.18
Elevation	0.60	0.18	3.26	0.29	0.91

Table 5-5-8: Model results for Squirrel

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-2.08	0.02	-93.47	-2.13	-2.04
Distance	0.02	0.02	0.72	-0.03	0.06
Noise	0.05	0.02	2.21	0.01	0.09

Table 5-5-9: Model results for Woodland Caribou

	Estimate	SE	t	Lower CI	Upper CI
Intercept	-2.01	0.09	-21.69	-2.22	-1.82
Distance	-0.02	0.09	-0.28	-0.18	0.16

Table 5-5-10: Summary of Remote IR Camera Trap Deployments for Bipole III

Construction Segment	Month/ Year Deployed	Number of Cameras Deployed			Comments
		Near the ROW	1.5 km from ROW	Total	
N1	Year 1	---	---	---	No access / not sampled in 2015
	Year 2 (February 2016)	10	10	20	
N2	Year 1 (March 2015)	8	10	18	
	Year 2 (February 2016)	9	9	19	
N3	Year 1 (March 2015)	10	9	19	
	Year 2 (February 2016)	10	10	20	
N4	Year 1	---	---	---	No access / not sampled in 2015
	Year 2	---	---	---	No access / not sampled in 2016
Total	**Year 1 (March 2015)**	**18**	**19**	**37**	
	Year 2 (February 2016)	**29**	**29**	**58**	

Table 5-5-11: Comparison of Observations from Camera Trap Data, near ROW vs 1.5 km from ROW, 2016

Mammal Species	Number of Observations		Number of Transects Species was Observed (n)	Mean Number of Observations *		t-Test Paired Two Sample for Means		
	ROW	1.5 km		ROW	1.5 km	t Stat	p (1-tailed)	df
Black Bear	18	24	8	2.25	3.00	-0.3419	0.3712	7
Wolf	5	0	4	1.25	0.00	5.0000	0.0077 **	3
Coyote	1	2	2	0.50	1.00	Sample size too small for analysis		
Fox	5	2	5	1.00	0.40	0.8847	0.2132	4
Woodland Caribou	3	2	1	3.00	2.00	Sample size too small for analysis		
Moose	1	8	4	0.25	2.00	-1.5785	0.1063	3
White-tailed Deer	10	1	2	5.00	0.50	Sample size too small for analysis		
Wolverine	0	1	1	0.00	1.00	Sample size too small for analysis		
Marten	1	0	1	1.00	0.00	Sample size too small for analysis		
Fisher	1	0	1	1.00	0.00	Sample size too small for analysis		
Lynx	4	18	5	0.80	3.60	-0.8881	0.2123	4
Snowshoe Hare	2	3	3	0.67	1.00	-0.2774	0.4038	2

Notes:
* Mean Number of Observations was calculated using only transects where the species occurred in the camera trap data (either at the ROW camera trap station, or 1.5 km camera trap station, or both, on a particular transect)
** Significant difference

Table 5-5-12: Registered Traplines Intersected by Construction Segment

Construction Segment	Registered Traplines	Community Traplines	Intersected Total
N1	8	2 (Limestone 530-05, Split Lake 520-25)	10
N2	14	2 (Thicket Portage 440-10, Wabowden 430-21)	16
N3	13	1 (Cormorant 350-04)	14
N4	2	0	2
Total	**37**	**5**	**42**

Table 5-5-13: Comparison of Pre-construction 10-year Mean (2004/05 – 2013/14) Annual Harvest to Year 1 (2014/15) of Construction, by Construction Segment and Species

Species	N1 (n = 10 RTLs)		N2 (n = 16 RTLs)		N3 (n = 14 RTLs)		N4 (n = 2 RTLs)		Total (n = 42 RTLs)	
	Pre-Construction Mean ±95CL	Year 1 (2014/15) Harvest	Pre-Construction Mean ±95CL	Year 1 (2014/15) Harvest	Pre-Constructio n Mean ±95CL	Year 1 (2014/15) Harvest	Pre-Construction Mean ±95CL	Year 1 (2014/15) Harvest	Pre-Construction Mean ±95CL	Year 1 (2014/15) Harvest
Beaver	**67.9 ±26.7**	**7**	**68.2 ±48.5**	**2**	**56.4 ±26.5**	**0**	**544.9 ±119.4**	**237**	**737.4 ±175.8**	**246**
Coyote	--NR--	--NR--	0.2 ±0.3	--NR--	6.2 ±2.1	7	31.1 ±6.9	70	37.5 ±6.7	77
Fisher	0.4 ±0.4	--NR--	2.0 ±1.4	4	12.9 ±7.8	33	52.4 ±13.8	47	67.7 ±16.1	84
Fox Cross	3.4 ±2.0	--NR--	2.0 ±0.8	--NR--	0.9 ±0.7	4	0.3 ±0.4	--NR--	6.6 ±2.6	4
Fox Red	8.1 ±3.8	6	5.1 ±3.4	--NR--	10.3 ±4.4	4	6.2 ±2.3	6	29.7 ±5.8	16
Fox Sliver	0.8 ±0.7	--NR--	0.3 ±0.3	--NR--	0.8 ±0.7	1	0.1 ±.0.2	--NR--	2.0 ±1.0	1
Fox White	5.7 ±6.5	1	0.3 ±0.4	1	0.3 ±0.6	--NR--	--NR--	--NR--	6.3 ±6.8	2
Lynx	12.3 ±6.1	6	24.6 ±14.7	19	17.4 ±7.2	27	15.3 ±6.6	13	69.6 ±20.7	65
Marten	**365.7 ±111.3**	**134**	**169.4 ±89.9**	**159**	**57.8 ±21.0**	**147**	**263.3 ±63.7**	**180**	**856.2 ±156.9**	**620**
Mink	28.2 ±13.7	31	47.4 ±29.0	33	19.7 ±9.7	22	60.7 ±20.5	73	156.0 ±46.4	159
Muskrat	11.5 ±8.2	--NR--	23.3 ±39.0	26	184.1 ±170.3	150	795.3 ±452.3	89	1014.2 ±525.0	265
Otter	8.7 ±4.0	4	14.3 ±8.3	19	8.3 ±6.6	7	26.7 ±8.2	9	58.0 ±14.9	39
Squirrel	1.8 ±2.6	--NR--	2.1 ±2.5	--NR--	6.3 ±3.9	6	139.6 ±78.9	108	149.8 ±84.9	114
Weasel	3.3 ±2.6	2	18.3 ±8.6	46	19.9 ±10.4	20	137.0 ±51.3	99	178.5 ±59.7	167
Wolf	**0.9 ±0.5**	**1**	**5.1 ±1.8**	**0**	**1.0 ±0.8**	**1**	**7.7 ±3.7**	**12**	**14.7 ±4.5**	**14**
Wolverine	**1.1 ±1.0**	**--NR--**	**2.1 ±1.1**	**2**	**0.4 ±0.4**	**--NR--**	**--NR--**	**--NR--**	**3.6 ±1.6**	**2**

Notes:
Fur harvest data for the 2012/13 trap year are incomplete, therefore pre-disturbance means may change slightly for some species and construction segments
RTL = Registered Trap Line
--NR-- = no reported harvest for the period assessed

Table 5-5-14: Comparison of Pre-Construction 10-year Mean (2004/05 – 2013/14) Harvest Rate (#/license) to Year 1 (2014/15) of Construction, by Construction Segment and Species

Species	N1 (n = 10 RTLs)		N2 (n = 16 RTLs)		N3 (n = 14 RTLs)		N4 (n = 2 RTLs)		Total (n = 42 RTLs)	
	Pre-Construction Mean ±95CL	Year 1 (2014/15)	Pre-Construction Mean ±95CL	Year 1 (2014/15)	Pre-Construction Mean ±95CL	Year 1 (2014/15)	Pre-Construction Mean ±95CL	Year 1 (2014/15)	Pre-Construction Mean ±95CL	Year 1 (2014/15)
Beaver	**0.563 ± 0.208**	**0.089**	**0.652 ± 0.272**	**0.038**	**1.478 ± 0.409**	**--NR--**	**2.865 ± 1.010**	**1.992**	**1.577 ± 0.188**	**0.743**
Coyote	--NR--	--NR--	0.002 ± 0.002	--NR--	0.129 ± 0.060	0.086	0.193 ± 0.122	0.588	0.088 ± 0.026	0.233
Fisher	0.003 ± 0.003	--NR--	0.027 ± 0.015	0.077	0.279 ± 0.114	0.407	0.274 ± 0.104	0.395	0.149 ± 0.037	0.254
Fox Cross	0.028 ± 0.014	--NR--	0.024 ± 0.014	--NR--	0.020 ± 0.016	0.049	0.004 ± 0.007	--NR--	0.015 ± 0.006	0.012
Fox Red	0.062 ± 0.019	0.076	0.052 ± 0.015	--NR--	0.216 ± 0.069	0.049	0.041 ± 0.034	0.050	0.070 ± 0.021	0.048
Fox Sliver	0.007 ± 0.006	--NR--	0.004 ± 0.005	--NR--	0.018 ± 0.014	0.012	0.001 ± 0.001	--NR--	0.005 ± 0.003	0.003
Fox White	0.040 ± 0.042	0.013	0.002 ± 0.002	0.019	0.010 ± 0.014	--NR--	--NR--	--NR--	0.014 ± 0.014	0.006
Lynx	0.095 ± 0.035	0.076	0.267 ± 0.084	0.365	0.454 ± 0.181	0.333	0.080 ± 0.052	0.109	0.151 ± 0.039	0.196
Marten	**3.125 ± 1.149**	**1.696**	**1.702 ± 0.409**	**3.058**	**1.349 ± 0.373**	**1.815**	**1.567 ± 1.024**	**1.513**	**1.915 ± 0.411**	**1.873**
Mink	0.233 ± 0.104	0.392	0.596 ± 0.206	0.635	0.452 ± 0.223	0.272	0.301 ± 0.117	0.613	0.350 ± 0.089	0.480
Muskrat	0.103 ± 0.083	--NR--	0.142 ± 0.182	0.500	4.360 ± 4.446	1.852	3.501 ± 1.308	0.748	2.210 ± 1.020	0.801
Otter	0.070 ± 0.031	0.051	0.191 ± 0.067	0.365	0.246 ± 0.118	0.086	0.145 ± 0.064	0.076	0.127 ± 0.026	0.118
Squirrel	0.014 ± 0.022	--NR--	0.030 ± 0.019	--NR--	0.246 ± 0.195	0.074	0.821 ± 0.669	0.908	0.328 ± 0.153	0.344
Weasel	0.024 ± 0.018	0.025	0.292 ± 0.203	0.885	0.476 ± 0.204	0.247	0.779 ± 0.499	0.832	0.413 ± 0.137	0.505
Wolf	**0.007 ± 0.004**	**0.013**	**0.074 ± 0.043**	**--NR--**	**0.022 ± 0.017**	**0.012**	**0.048 ± 0.041**	**0.101**	**0.034 ± 0.013**	**0.042**
Wolverine	**0.011 ± 0.013**	**--NR--**	**0.022 ± 0.015**	**0.038**	**0.008 ± 0.010**	**--NR--**	**--NR--**	**--NR--**	**0.008 ± 0.003**	**0.006**

Notes:

Incorrect license numbers were used in previous report which resulted in inflated harvest rate calculations

Fur harvest data for the 2012/13 trap year are incomplete, therefore pre-disturbance means may change slightly for some species and construction segments

--NR-- = no reported harvest for the period assessed

Table 5-6-1: Summary of Boreal Woodland Caribou Mortality Source and Kaplan-Meier Annual Survival Rates for Collared Adult Female Boreal Woodland Caribou, as of August 2016

Boreal Woodland Caribou Range	Telemetry Study Duration	# of Studied Collared Caribou	# of Mortalities	Mortality Source (number)	Annual Adult Female Survival Rate (%)
B-Bog	February 2010 – August 2016	68	21	Natural cause (3) Wolf predation (11) Vehicle collision (1) Undetermined (6)	88.0
N-Reed	Jul 2010 – August 2016	55	15	Natural cause (2) Wolf predation (4) Bear predation (1) Undetermined (8)	86.7
Wabowden	January 2010 – August 2016	66	23	Wolf predation (11) Undetermined (12)	81.5
Charron Lk	January 2011 – August 2016	60	11	Natural cause (1) Wolf predation (3) Bear Predation (1) Undetermined (6)	90.6
Total		249	70	Known Source = 38 Undetermined = 32	

Table 5-6-2: Comparison of Wolf Distance to Ungulate Prey in the Monitored Boreal Caribou Survey Areas, January 2015 and January 2016

Woodland Caribou Survey Area	Monitoring Year	Mean Distance (km) from Wolf ±95%CI		Paired 2-sample t-Test for Means			
		Woodland Caribou	Moose	t Stat	P (1-tailed)	df	Predator Encounter Risk
Wabowden	Year 1 (2014/15)	11.2 ±3.06	8.2 ±1.28	-1.786	0.043	27	Significantly higher for Moose
	Year 2 (2015/16)	4.6 ±1.11	3.4 ±0.94	-2.381	0.013	25	Significantly higher for Moose
P-Bog	Year 1 (2014/15)	9.9 ±2.62	12.4 ±8.45	0.506	0.317	5	No significant difference
	Year 2 (2015/16)	4.4 ±1.70	3.0 ±1.26	-1.420	0.086	19	No significant difference
N-Reed	Year 1 (2014/15)	4.9 ±1.34	7.6 ±2.68	2.248	0.021	14	Significantly higher for W Caribou
	Year 2 (2015/16)	2.2 ±0.37	5.6 ±1.02	6.447	<0.001	61	Significantly higher for W Caribou
Charron Lk	Year 1 (2014/15)	6.9 ±1.30	24.9 ±3.10	13.470	<0.001	16	Significantly higher for W Caribou
	Year 2 (2015/16)	2.7 ±0.46	5.7 ±0.82	6.353	<0.001	71	Significantly higher for W Caribou

Note:
No other ungulate species (e.g., white-tailed deer or elk) were detected in any of the woodland caribou survey areas in either year sampled

Table 5-8-1: Number of Human Access Observations Recorded along the ROW, All Seasons Pooled

Camera Trap ID	Project-related Access (Construction, Monitoring, Maintenance)						Public Access (Resource Use, Recreation)			
	Foot	ATV/ UTV	Snow-mobile	Vehicle	Helicopter	Construction Equipment	Foot	ATV / UTV	Snow-mobile	Vehicle
MB Hydro All-weather Access Points (Jul 2014 – March 2016)										
BPIII_Access_001	2	6	2	125	0	47	0	0	0	0
BPIII_Access_003	1	2	1	53	2	52	0	0	0	0
BPIII_Access_005	0	7	8	78	1	94	0	11	0	0
Camera Traps Near ROW Associated With Winter Ground Track Transects (March 2015 - February 2016)										
N2-02_4815	1	1	2	107	2	37	0	0	0	0
N2-04_4943	2	0	1	63	0	29	1	0	0	0
N2-08_4802	1	0	0	15	1	11	0	0	0	0
N2-10_4866	1	2	2	10	0	8	0	0	0	0
N2-14_4939	2	1	2	14	0	28	0	0	0	0
N2-16_4855	1	0	0	0	1	1	1	0	0	0
N2-18_2415	2	1	0	148	1	42	0	0	0	0
N2-20_2405	2	0	0	0	0	0	0	0	0	0
N3-01_5259	1	0	0	2	0	5	0	1	0	0
N3-05_4946	1	0	0	2	0	5	0	1	0	0
N3-06_4998	2	0	0	2	1	12	0	1	0	0
N3-08_2357	2	0	0	0	0	0	0	0	0	0
N3-10_4922	1	8	0	36	0	21	0	0	0	0
N3-12_2416	1	1	0	80	0	48	0	0	0	0
N3-16_4981	1	0	0	0	0	0	0	0	0	0
N3-18_4990	2	4	2	122	0	28	1	0	0	0
N3-20_4930	0	0	0	3	1	2	0	0	0	0

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

Available in accessible formats upon request