Stantec

Manitoba-Minnesota Transmission Project: Mammal Monitoring

FINAL REPORT

Prepared for: Manitoba Hydro

Date: July 16, 2018

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Prepared for:

Manitoba Hydro

Prepared by:

Stantec Consulting Ltd.

Project No: 111420045

Sign-off Sheet

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Approved by

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1.0 INTRODUCTION

As part of the proposed Manitoba-Minnesota Transmission Project (MMTP, or the Project) Environmental Impact Statement (EIS), aerial surveys and camera trap surveys were conducted in 2014 and 2015 to help characterize baseline conditions for key mammal species and meet the objectives outlined in the EIS. Manitoba Hydro made commitments in the monitoring plan to continue gathering baseline mammal data as part of the pre-construction monitoring program.

The purpose of this report is to summarize the results of the 2016-2018 aerial and camera trap survey programs and compare/contrast key findings to existing baseline data reported in the EIS. Information gathered will also be used in the future to assess potential Project effects.

2.0 PROJECT OVERVIEW

Manitoba Hydro is proposing construction of the MMTP, which includes construction of a 500 kilovolt AC transmission line in southeastern Manitoba (anticipated in service date of mid-2020). The transmission line would originate at the Dorsey Converter Station northwest of Winnipeg, continue south around Winnipeg within the Existing Transmission Corridor, the Southern Loop Transmission Corridor and the Riel–Vivian Transmission Corridor, to just east of Provincial Trunk Highway 12. The new transmission line would then continue southward on a new right-of-way (ROW) across the rural municipalities of Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn and Piney to the Manitoba–Minnesota border crossing south of the community of Piney. The Project also includes the construction of terminal equipment at the Dorsey Converter Station, electrical upgrades within the Dorsey and Riel converter stations, and modifications at the Glenboro South Station requiring realignment of transmission lines entering the station.

3.0 MAMMALS OVERVIEW

White-tailed Deer

White-tailed deer are the predominant ungulate in the Project area. Transmission line corridors create habitat edges for white-tailed deer that provide an ecotone with high quality forage resources and accessible hiding cover in adjacent forest (Reimers et al. 2000). Disturbed vegetation is favoured by white-tailed deer because of the high diversity of plants in those areas (Stewart et al. 2011). Riparian areas, edge habitats, and linear features function as important habitats for travel and forage. Therefore, white-tailed deer are not particularly susceptible to the effects of habitat fragmentation but may be susceptible to increased mortality associated with moving through higher risk areas created by habitat loss and degradation of matrix quality (Stewart et al. 2011).

The EIS identified a potential Project effect of increased mortality risk from hunters and predators by enhanced access to white-tailed deer habitat in eastern portions of the Project, however the effect is expected to be minimal with no measurable effect on abundance anticipated. In that portion of the Project, white-tailed deer concentrations were noted in areas near Ste. Genevieve, Richer, Sundown, Piney, and in the Watson P. Davidson and Spurwoods WMAs. The deer population in the area is considered to be stable. Habitat loss and sensory disturbance effects from

ROW clearing are considered minimal and short-term, ultimately resulting in a positive effect of enhanced deciduous browse forage and increased edge habitat during the operation phase.

Elk

As described in the EIS, the Vita elk population in Manitoba (fall/winter range) is shared with Minnesota (summer range) and is the only elk population with potential to interact with the Project. Long-term census data in Manitoba for this elk population are limited, with a stable population estimate of 100-150. Annual surveys (2004-2008) conducted in Minnesota estimated the population at 112 – 215 elk (MDNR 2009). The Vita elk range in Manitoba may overlap an eastern portion of the Project Regional Assessment Area (RAA; a 15 km buffer around the Project footprint) in areas near Vita and Caliento, however, EIS field studies did not detect elk occurrence within the ROW or Local Assessment Area (LAA; a 1 km buffer around the Project footprint), or RAA. The closest observations during baseline surveys were 20 km from the final preferred route. The ROW avoids the core areas known to support elk near Vita and Arbakka, with no anticipated significant adverse Project effects on the population. Since the filing of the EIS, Manitoba Hydro has joined with the RM of Stuartburn, MSD and the Nature Conservancy Canada to form the Vita Cross-Border Elk Monitoring Partnership. This new partnership is aimed to understand movements and home range size of elk by utilizing GPS collar technology in southeast Manitoba but is not part of this monitoring report.

Moose

Moose were a common ungulate species in southeastern Manitoba prior to the 1990s but populations in the region have since collapsed (Leavesley 2015, pers. comm., Rebizant 2015, pers. comm.). Despite the presence of suitable moose habitat (e.g., shrubby wetlands, alder swamps, sub-climax deciduous forest; Banfield 1974), moose are rare in southeastern Manitoba due to a combination of factors such as habitat fragmentation, predation by wolves, parasites, fire suppression, and unregulated harvest (Leavesley 2015, pers. comm., Rebizant 2015, pers. comm). The areas south of the Watson P. Davidson Wildlife Management Area heading southeast to the Spur Woods WMA and south of Piney, in the RAA was identified as containing moose habitat, especially near Piney (Black River First Nation, Long Plain First Nation and Swan Lake First Nation 2015).

Black Bear

Black bears favor high landscape connectivity and are sensitive to significant habitat changes and disturbances that affect access to, and availability of, food resources (Rogers and Allen 1987, Gunson 1993, Kindell and Van Manen 2007). They are widely distributed as a consequence of food resource availability both spatially and seasonally (Gunson 1993, Costello and Sage 1994, Pelton et al. 1999, Pelton 2000), but local abundance may be variable depending on annual severity of weather and food availability. Bears may avoid linear development with active human activity, particularly during denning (Forman et al. 1997, Linnell et al. 2000).

The EIS indicates the black bear population within the RAA is stable (possibly increasing), with common occurrence and widespread distribution throughout areas supporting forest habitat; particularly at the forest-agricultural habitat interface, primarily east and south of the Watson P. Davidson WMA. Field studies identified bear activity within the vicinity of the proposed D604I ROW, along existing transmission line M602F, and other forested parts of the RAA, occupying forested areas near the communities of Richer, Marchand, Sundown, and Piney.

Black bears are an important species to subsistence users (First Nations and Metis) and to the livelihood of local commercial outfitters. The Project footprint will contribute to habitat fragmentation of natural habitat patches that may

affect bear habitat availability, occurrence, and distribution. Measurable changes in abundance are not anticipated as a result of Project activities or disturbance because of routing and scheduling of construction activities.

Predators

The ROW and Project access development may enhance predator mobility into areas that were previously secure habitat for prey species, decrease predator search times for prey, and/or make prey escape more difficult. Predators such as wolves and coyotes may benefit from enhanced access, leading to increased predation of ungulates.

4.0 MAMMAL PRE-CONSTRUCTION MONITORING PLAN OVERVIEW

Monitoring focused on validating EIS predictions, verifying the implementation of mitigation measures, and assist in determining if Project-related access has altered distribution and occurrence of ungulates and predators, resulting in altered mortality-risk from hunters and predators, relative to baseline state (pre- versus post-disturbance). No specific monitoring for moose is being considered, however all moose observations from aerial and camera trap surveys are be documented. The primary objective of the pre-construction monitoring program is to expand the baseline knowledge of occurrence, distribution and abundance of ungulates, predators, and black bears that have the potential to interact with the Project.

5.0 METHODS

5.1 AERIAL MAMMAL SURVEY

5.1.1 Survey Methods

Aerial mammal surveys were conducted on March 7-9, 2016, February 8-9, 2017, and February 8-10, 2018. Surveys were conducted:

- along 400-m-wide, east-west transects spaced 1 km apart that comprise 40% (421 km^2) of the 1055 km^2 overall survey area (Map 1);
- using a Bell 206 Jet Ranger helicopter and four observers: the front-left and rear-right observers acted as primary observers on their respective sides while the data recorder in the rear-left and pilot in the front-right acted as secondary observers; and
- at approximately 120 m above ground level at speeds between 90-110 km/h during good environmental conditions:
    - temperature -20 to -30°C;
    - wind 10-20 km/h;
    - cloud ceiling >150 m;
    - no precipitation;
    - no fog or hoar frost;
    - adequate daylight (from one half hour after sunrise to one half hour before sunset); and
    - with a snow base of ≥25 cm (MCWS 2015, unpublished).

As suggested by MSD, the surveys focused on counting individuals as opposed to counting both tracks and individuals, as was done in 2014-2015, as counting tracks has the potential to decrease detection rates of observers. Track observations were collected for species such as gray wolf and coyote where possible.

A handheld GPS (Garmin® GPSMAP® 62SC) was used to collect a waypoint for each individual or track observation.

5.1.2 Analytical Methods

To accommodate a future Before-After-Control-Impact (BACI) data analysis, the 2016-2018 survey data are divided into smaller survey units (Map 1). Two survey units include the Final Preferred Route (FPR) plus a 1 km buffer to represent potentially affected post-construction units (survey units A and B) (Linnell *et al.* 2000; Benitez-Lopez *et al.* 2010), while five survey units are control units not expected to be impacted post-construction (survey units C-G). The conceptual data structure of a BACI analysis indicating no post-construction impact versus a post-construction impact are illustrated in Figures 1 and 2, respectively.

Georeferenced survey data are summarized and mapped using ArcGIS® ArcMap 10.5 (ESRI 2012). Until post-construction data is available, pre-construction data are summarized by survey unit and year and presented below. White-tailed deer density is calculated as the number of individuals observed per unit area surveyed.

5.2 CAMERA TRAP SURVEY

5.2.1 Survey Methods

Large mammals, particularly white-tailed deer, elk, and black bear, are the primary targets of the camera trap study, but incidental observations of other species (i.e., moose) and human activity were also recorded. In this study, infrared (IR) camera trap arrays are used to monitor mammal activity along the FPR (i.e., potentially affected sites) and adjacent control areas (>500 m from the FPR).

Survey efforts focused on large, contiguous patches of intact forested habitats between Provincial Highway 12 and the Canada-U.S. border that are most likely to be affected by habitat fragmentation. The LAA in this extent includes softwood forest (36% total area), hardwood forest (18%), and mixedwood forest (4%). Site selection aimed to sample each forested habitat equally in both potentially affected sites and control sites; however, the lack of mixedwood forest within the LAA limited its inclusion.

A total of 23 camera trap arrays were used in the camera trap study, with 12 cameras located in potentially affected areas along the FPR and 11 cameras located in reference or control areas (Map 2). To maintain the BACI survey design implemented during the baseline data collection and to adjust for alignment of the FPR, the pre-construction monitoring included: 9 old camera trap sites (4 potentially affected and 5 control sites) that were surveyed in either 2014, 2015, or 2016 and 14 new camera trap sites (8 potentially affected sites and 6 control sites). These 23 sites will continue to be surveyed during pre-construction, construction, and operation monitoring phases.

The eight new potentially affected survey sites were randomly selected within a series of 1x1 km grid cells overlying the center of the FPR. These grid cells are considered potentially affected due to their proximity to the FPR. In these areas, IR camera traps were located within 500 m of the FPR and within the dominant habitat type found within the selected grid cell. The six new control sites are located ≥500 m from potentially affected sites to maintain

independence and to increase efficiency of IR camera trap deployment and maintenance. Randomly selected survey sites that could not be reasonably accessed by foot were excluded (e.g., require helicopter access or >1.5 km from the nearest trail) as were sites not located on crown lands.

For pre-construction monitoring, the IR camera traps were generally deployed in June and left to collect data for 1 or more years (Appendix A Table 1). The level of effort covers approximately 67% of accessible crown lands traversed by the FPR and exceeds standards for minimum camera-days suggested for wildlife studies (Rovero et al. 2013).

IR cameras were attached to trees at approximately 1 m from ground level and all vegetation that might falsely trigger or obscure the camera view was removed within at least 5 m where possible. Reconyx™ cameras were used in continuous photo capture mode (i.e., a 2-photo burst with no time delay) and using compact flash type I/II or SD memory cards.

5.2.2 Analytical Methods

All photographs were classified using Manitoba Hydro's Camera Trap Data Classification Guide (Manitoba Hydro 2014) to identify the number, age, sex, and species involved in each camera event. A camera event is considered to be any number of individuals of a particular species captured on camera within a one-hour time period. An annual relative abundance index (RAI; number of photo events / camera-days) is calculated for key species (i.e., white-tailed deer, black bear, gray wolf, and coyote), year, and season (summer [May-October] and winter [November-April]) at each of the 23 IR camera trap sites. Analyses were not constrained to a minimum number of operational days per site/season combination. Box plots of annual RAIs are be used to visualize differences between IR camera trap treatments (i.e., potentially affected sites vs. control sites). A two-sample T-test was used to test for differences between RAI treatment means of each species (after a F-test was used to determine equality of sample variances).

6.0 RESULTS

The following sections describe the results of pre-construction aerial mammal and camera trap surveys conducted between 2016 and 2018. In some instances, pre-construction data have been grouped into treatment categories (e.g., potentially affected) to facilitate future comparisons with data gathered during the construction and/or operation phases.

6.1 AERIAL MAMMAL SURVEY

Ungulates

Results from the 2017 and 2018 surveys are assumed to be representative of white-tailed deer populations in the survey area, while data from the 2016 survey should be interpreted with caution due to the late timing of the survey and poor snow conditions (Table 1; Maps 3-5). As such, comparisons of the annual data will focus on 2017 and 2018 only. There were no elk observations in 2016-2018 and moose observations were limited to three tracks in 2018, in the southeast corner of the survey area (Map 5).

Table 1. Summary statistics of white-tailed deer individuals observed in 2016-2018.

Year	No. of Observations	No. of Individuals	Min. Group Size	Max. Group Size	Density (deer/km^2)
2016	45	83	1	5	0.2
2017	311	978	1	16	2.3
2018	299	840	1	12	2.0

White-tailed deer densities vary by survey unit and year but in general, there were consistently higher deer densities in all survey units in 2017 to 2018 (Figure 3). Mean densities (2017-2018) were generally highest in eastern potentially affected and control survey units (survey units B, C, D, and E) with densities ranging from 2.7 – 3.5 deer/km^2 while western survey units ranged from 0.1 – 0.8 deer/km^2 (Table 2).

Table 2. Summary of white-tailed deer densities by survey treatment, unit, and year.

Survey Treatment	Survey Unit	Year	Survey Unity Density (deer/km^2)	Mean Survey Unit Density (deer/km^2)*
Potentially Affected	A	2016	0.0	0.3
		2017	0.1	
		2018	0.4	
	B	2016	0.0	2.8
		2017	3.0	
		2018	2.6	
Control	C	2016	0.4	2.7
		2017	3.5	
		2018	1.9	
	D	2016	0.3	2.6
		2017	2.9	
		2018	2.3	
	E	2016	0.2	3.5
		2017	3.5	
		2018	3.4	
	F	2016	0.0	0.1
		2017	0.0	
		2018	0.1	
	G	2016	0.1	0.8
		2017	1.2	
		2018	1.1	

* 2017 and 2018 data only.

Predators

The number of gray wolf individual and track observations vary annually and were highest in 2017 when a pack of 8 individuals was observed in survey unit F (Table 3; Map 4). While there does not appear to be a consistent pattern of geographic use by gray wolf within the study area, the majority of observations are north of the FPR with only a few observations south of the FPR in 2017 (assumed to be from the single pack described above). There were two and three kill sites observed in 2017 and 2018, respectively, and are assumed to be white-tailed deer. Coyote observations also vary annually but are most prevalent in the southeastern portion of the survey area, along the Canada – United States border.

Table 3. Summary statistics of gray wolf and coyote observations in 2016-2018.

Species	Year	Observation Type	No. of Observations	No. of Individuals	Min. Group Size	Max. Group Size
Gray Wolf	2016	Individual	0	0	0	0
		Track	10	12	1	3
	2017	Individual	4	13	1	8
		Track	8	31	1	8
	2018	Individual	2	2	1	1
		Track	4	6	1	3
Coyote	2016	Individual	1	2	2	2
		Track	18	19	1	2
	2017	Individual	5	6	1	2
		Track	6	6	1	1
	2018	Individual	4	4	1	1
		Track	0	0	0	0

6.2 CAMERA TRAP SURVEY

A total of 11,034 camera-days from 22 cameras (one camera was not retrieved prior to the development of this report) were used between 2014-2018 to assess RAI between potentially affected sites and control sites (Appendix, Table 1). There were no moose or elk observations, and data discussed hereafter pertain to white-tailed deer, black bear, gray wolf, and coyote. There was a total of 2,897 wildlife events (2560 white-tailed deer [3641 individuals], 300 black bear [366 individuals], 23 gray wolf [36 individuals], and 14 coyote [15 individuals]).

White-tailed Deer

White-tailed deer was observed at all 22 sites during summer and 20 of them in winter (Map 6 and 7). There was no significant difference between RAI means during summer with 0.24 ± 0.05 (SE) and 0.33 ± 0.06 for potentially affected and control sites, respectively (p = 0.27; Figure 4). Similarly, there was no significant difference between RAI means during winter with 0.26 ± 0.08 and 0.23 ± 0.07 for potentially affected and control sites, respectively (p = 0.78; Figure 4).

Black Bear

Black bear was observed at all 22 sites during summer (no data for winter months as black bears typically hibernate during this period; Map 8). There was no significant difference between RAI means with 0.07 ± 0.02 and 0.03 ± 0.01 for potentially affected and control sites, respectively (p = 0.09; Figure 5).

Gray Wolf and Coyote

Gray wolf was observed at 9 of 22 sites during both summer and winter (Map 9) and coyote was observed at 12 sites in each period (Map 10). The limited number of gray wolf and coyote observations precludes formal analyses.

7.0 DISCUSSION

The distribution of ungulates and predators observed during the pre-construction monitoring aerial winter surveys is consistent with the findings of the EIS. Most notably, white-tailed deer densities are highest in eastern portions of the survey area where dense forested habitats are more prevalent compared to the more open habitats to the west. Dense forested habitats are important for overwintering white-tailed deer, particularly during the latter part of winter when snow is deepest, and the weather is coldest. Gray wolves continue to be observed throughout the study area and their distribution is likely a function of prey availability (including livestock) as opposed to habitat type. The greatest number of coyote observations is consistently observed in the southeastern part of the study area along the Canada – United States border in more open habitats. However, it should be noted that the number of coyote observations in more forested habitats is likely underrepresented due to the difficulty of detecting individuals amongst the timber.

Unsurprisingly, the results of the pre-construction monitoring camera trap study showed no difference in RAI between potentially affected sites and control sites for both white-tailed deer and black bear. This is expected as there is no Project footprint yet and suggests there is no systematic difference between the two treatments. The lower number of camera events for predators is a function of fewer individuals on the landscape and it may not be possible to attain a suitable number of observations to permit formal analyses as is done with white-tailed deer and black bear. It may be more appropriate to qualitatively assess ROW use by predators during the post-construction phase.

8.0 FUTURE MONITORING

Due to the uncertainty of the 2016 aerial winter survey data, it is suggested that the survey be conducted once again in 2019 prior to construction, if possible. This would provide three consecutive years of pre-construction surveys over the same survey area that would assist in establishing a baseline with increased accuracy.

Similarly, data quality can be enhanced if the camera trap study is continued throughout the pre-construction period.

9.0 SUMMARY

Overall, pre-construction monitoring efforts have helped to confirm the EIS findings and have expanded the baseline knowledge of occurrence, distribution and abundance of ungulates, black bears, and predators that have the potential to interact with the Project. Currently there is no reason to believe the FPR is located within an area more significant to mammals than what is available in the surrounding landscape. Furthermore, mammal monitoring data did not reveal the need for additional mammal mitigation measures beyond what is proposed in the EIS. The continuation of the pre-construction monitoring into the construction and post-construction phases of the Project will provide the data necessary to meet the objectives outline in the MMTP Environmental Monitoring Plan.

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11.0 FIGURES

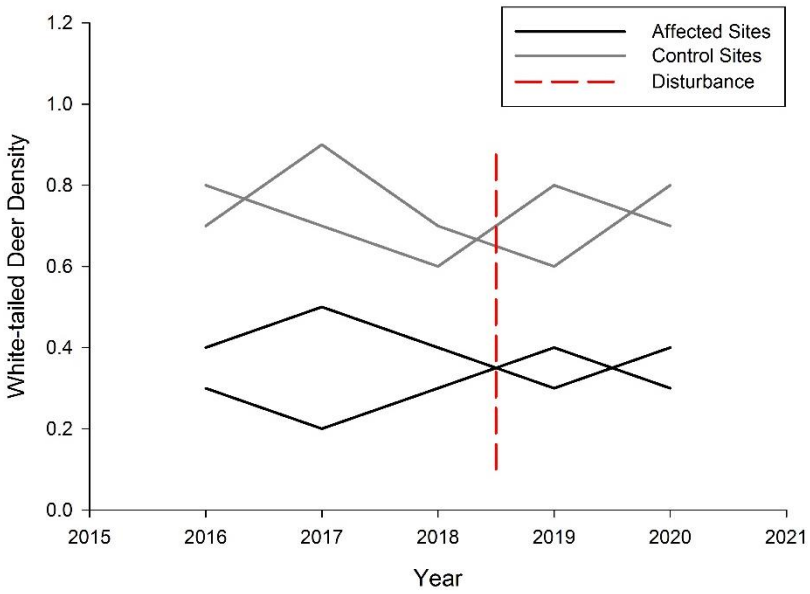


Figure 1. Conceptual data structure for a BACI survey design showing no observable post-construction impact.

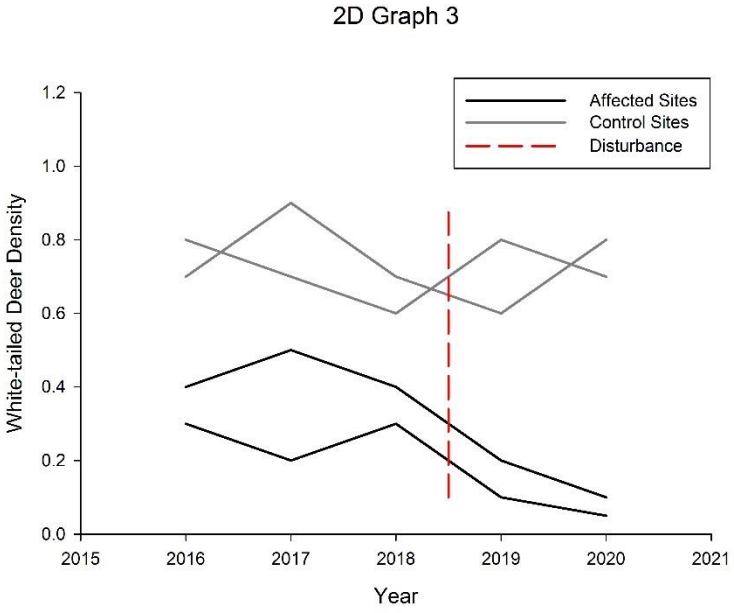
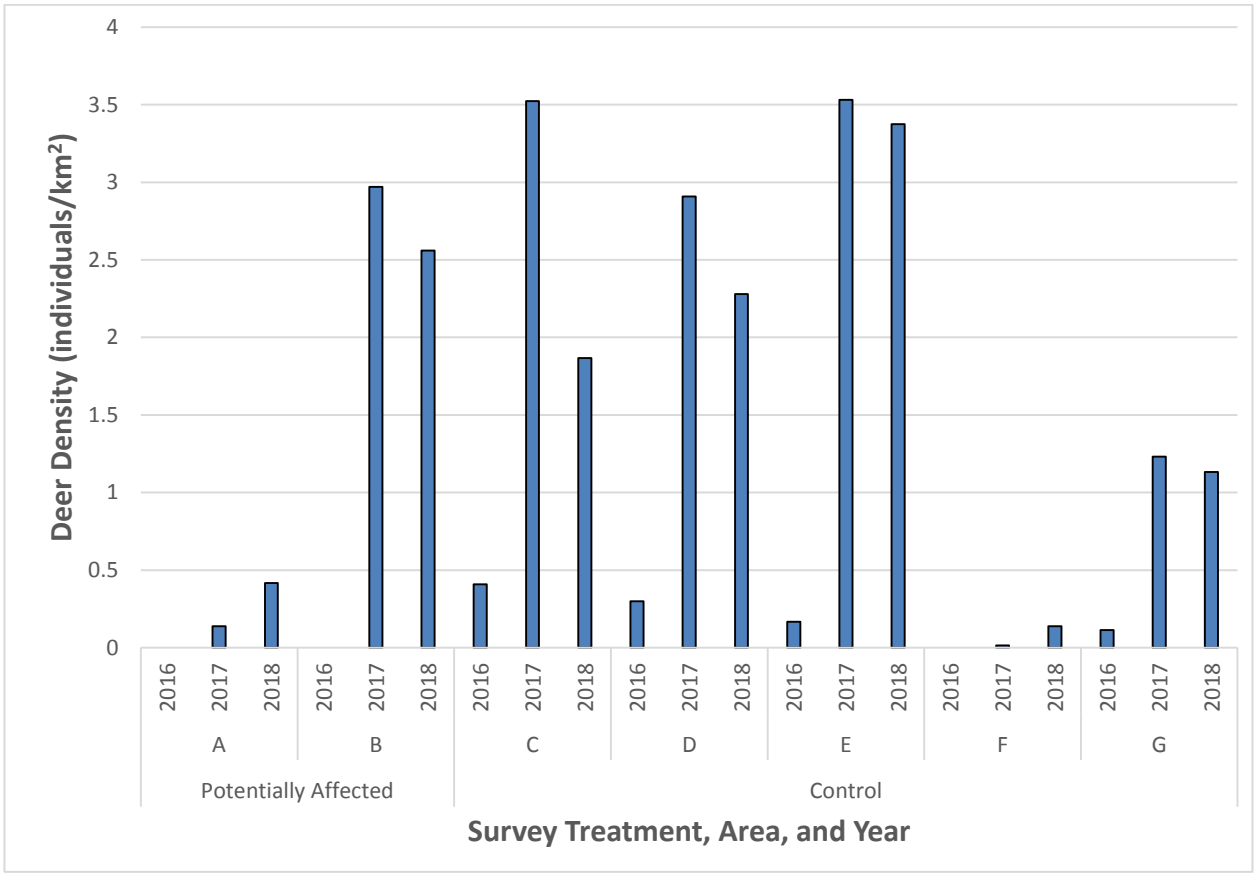


Figure 2. Conceptual data structure for a BACI survey design showing an observable post-construction impact.



12.0

Figure 3. Summary of white-tailed deer densities by survey treatment, survey unit, and year.

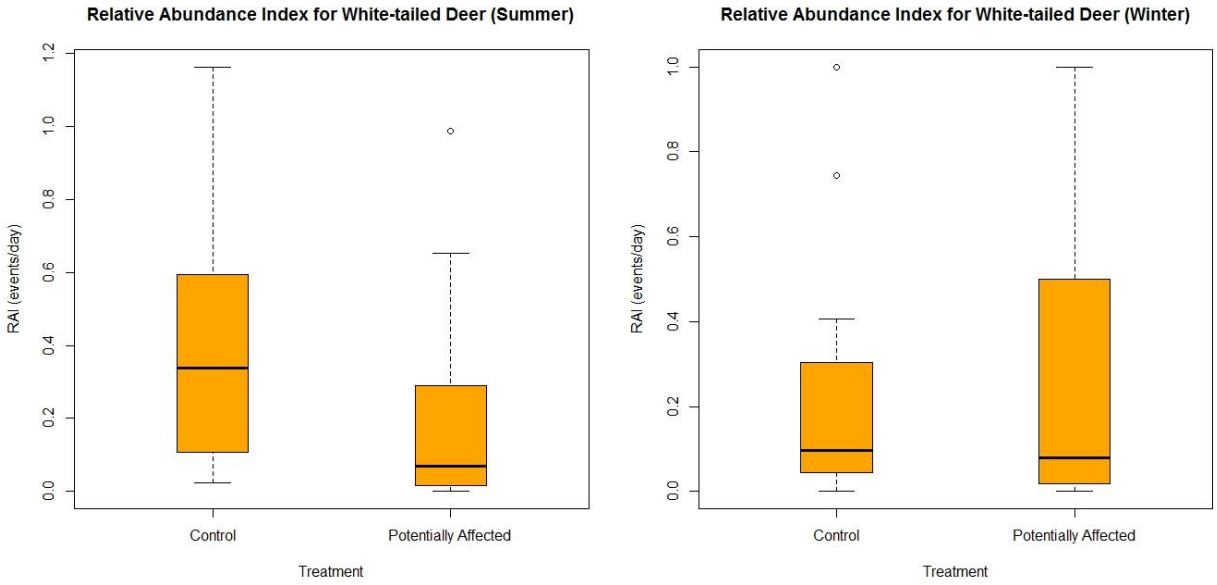


Figure 4. Box plot of white-tailed deer relative abundance index (RAI) for potentially affected and control sites.

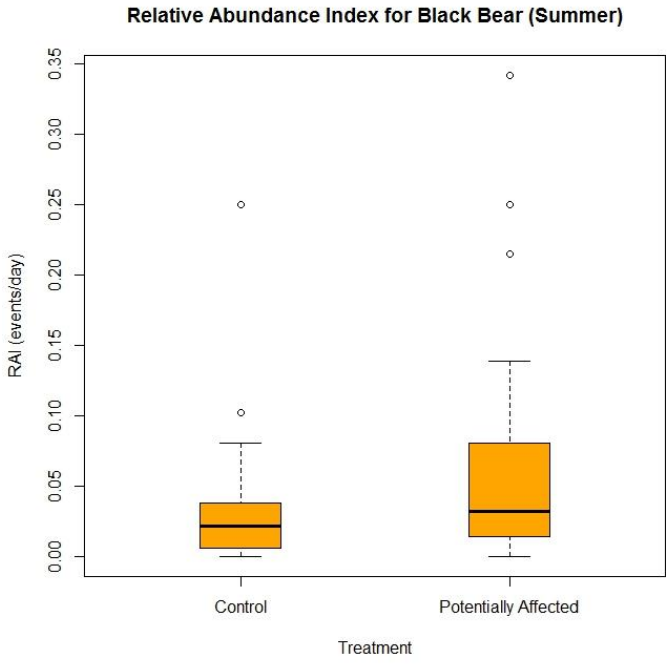
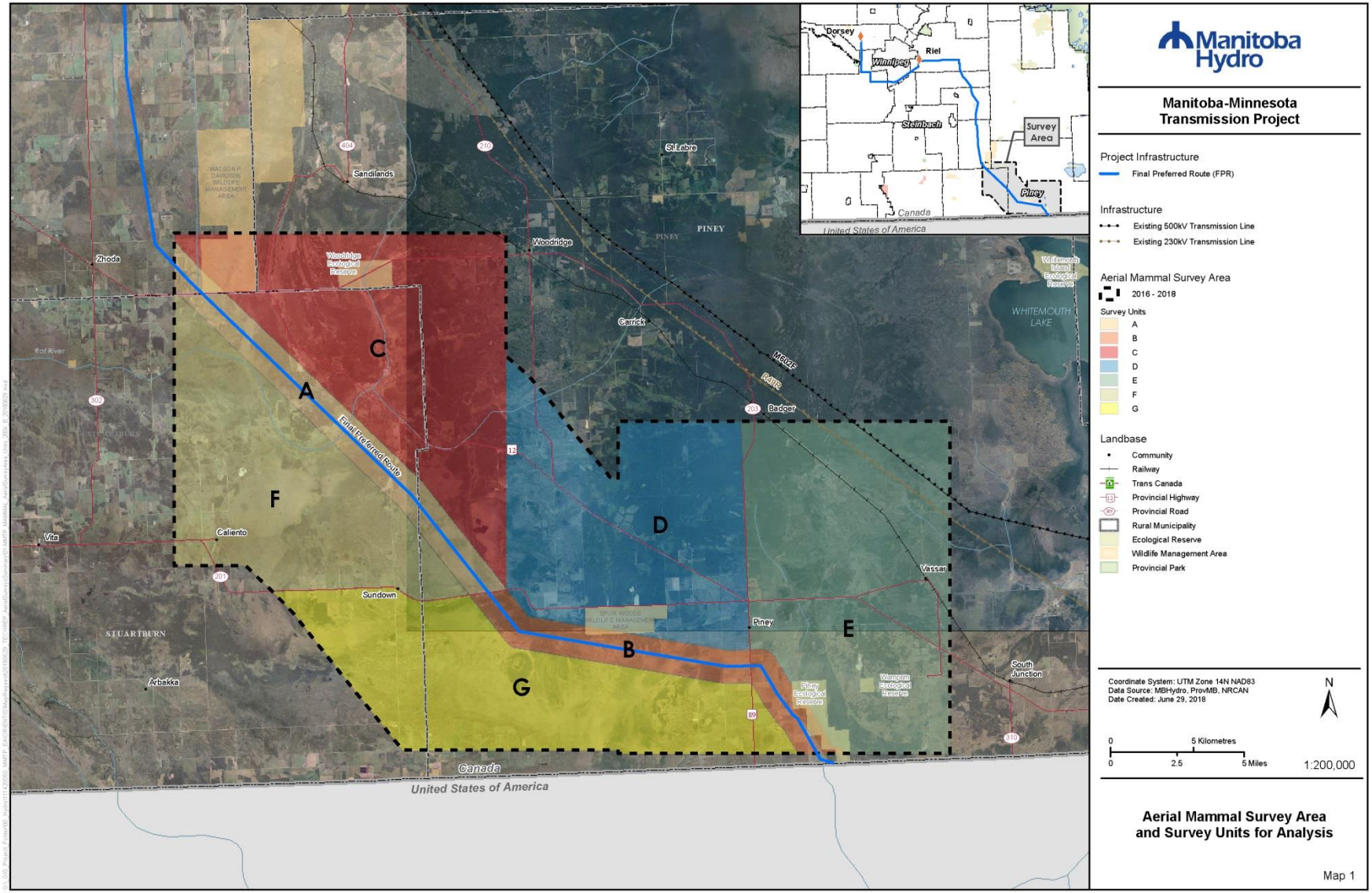


Figure 5. Box plot of black bear relative abundance index (RAI) for potentially affected and control sites.

13.0 MAPS


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Aerial Mammal Survey Area
2016 - 2018
Survey Units
A
B
C
D
E
F
G
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: June 29, 2018
N
0 5 Kilometres
0 2.5 5 Miles
1:200,000
Aerial Mammal Survey Area and Survey Units for Analysis
Map 1
Dorsey
Riel
Winnipeg
Steinbach
Survey Area
Piney
Canada
United States of America
Sandilands
St Labre
Woodridge
Zhoda
Carrick
Badger
Vita
Caliento
Sundown
Vassar
Piney
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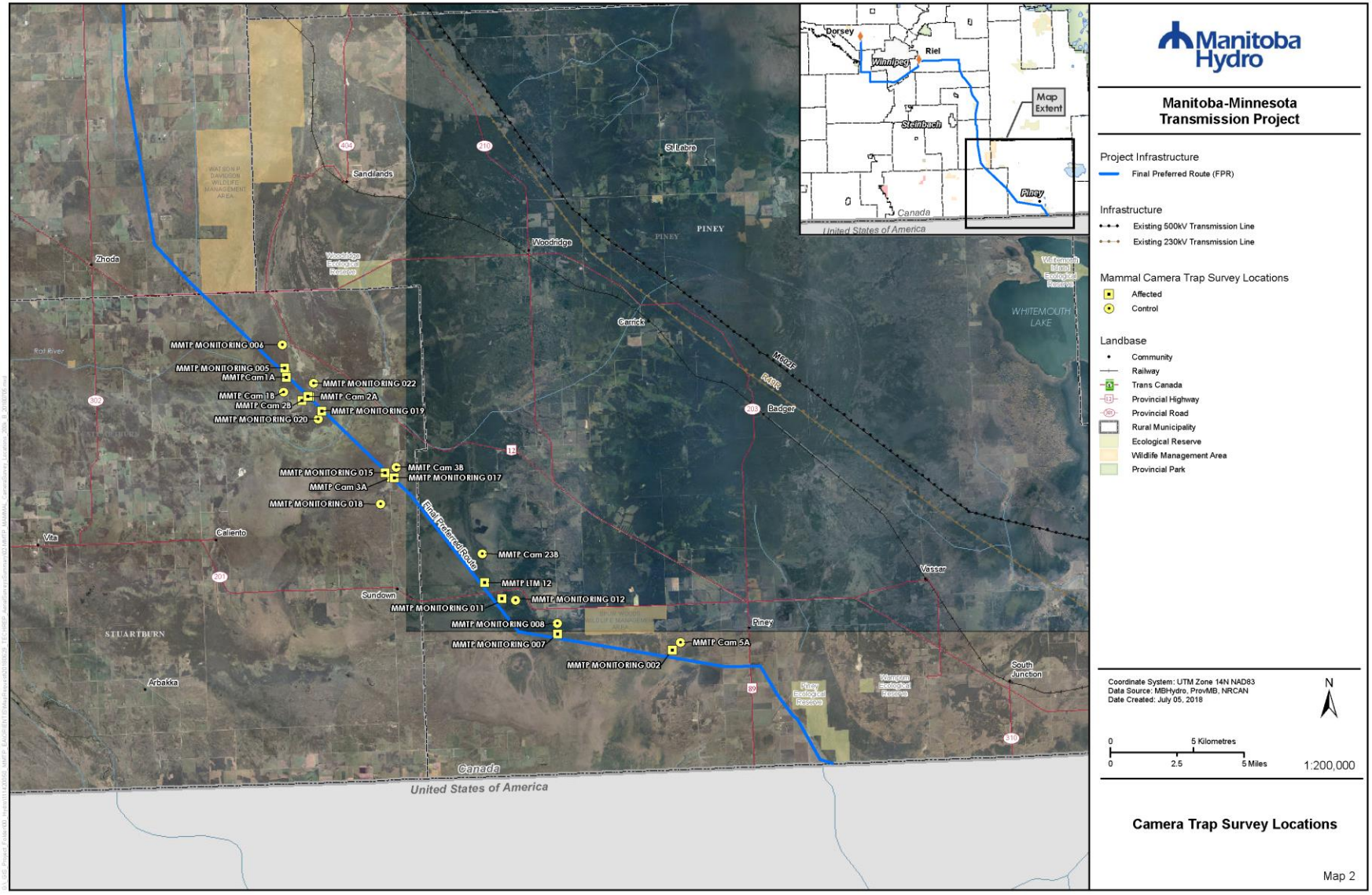
Manitoba Hydro
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Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
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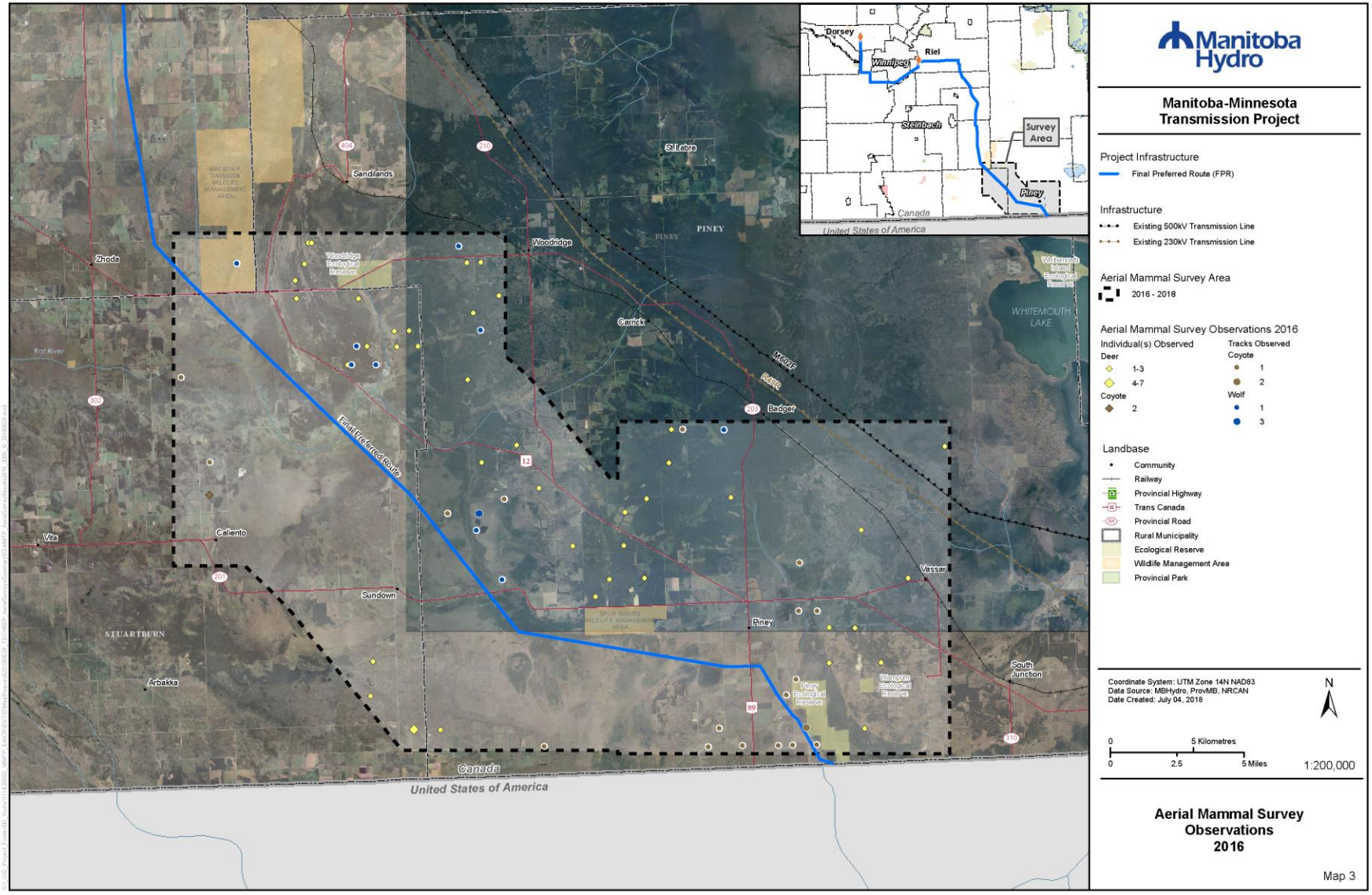
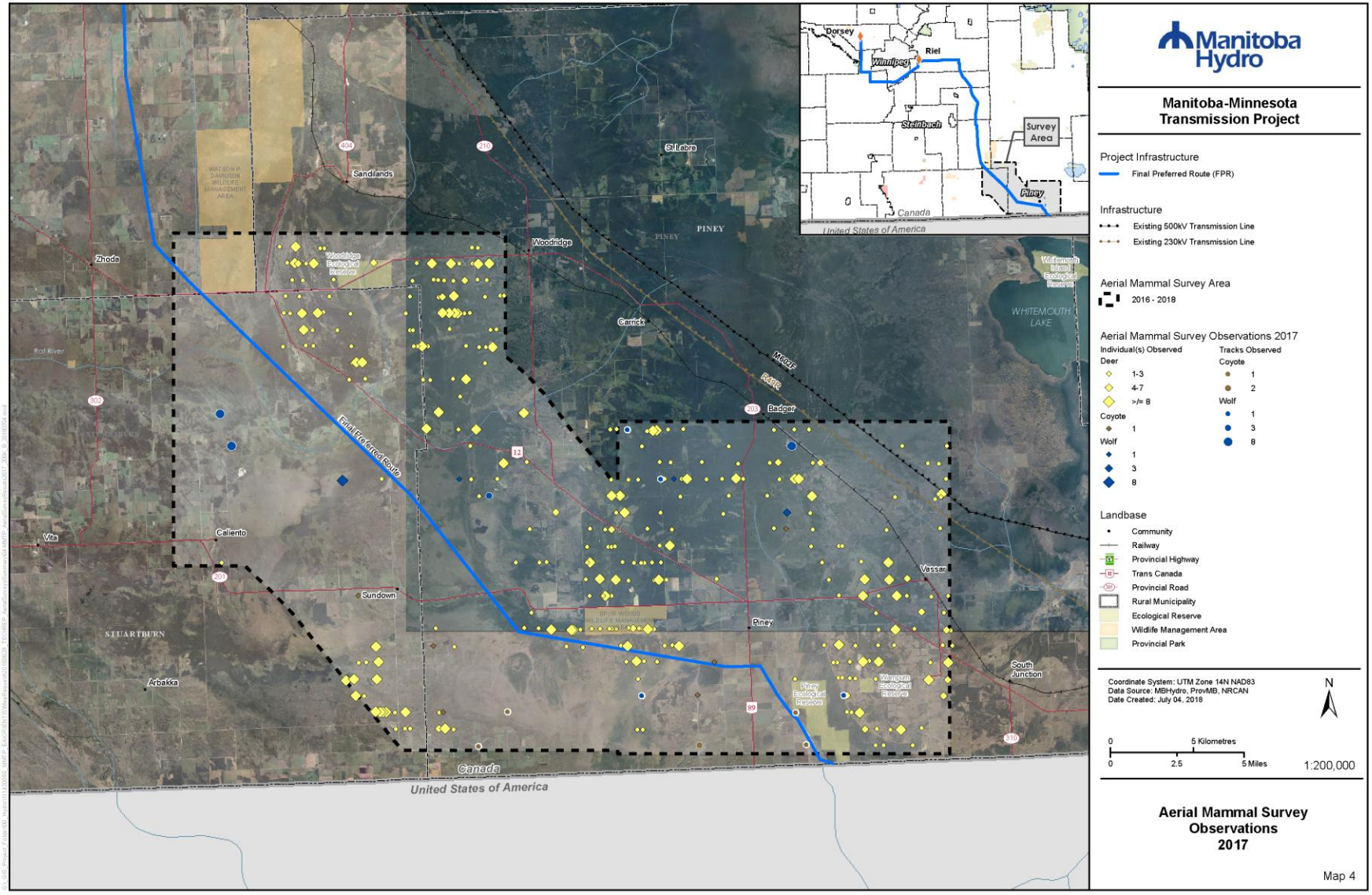
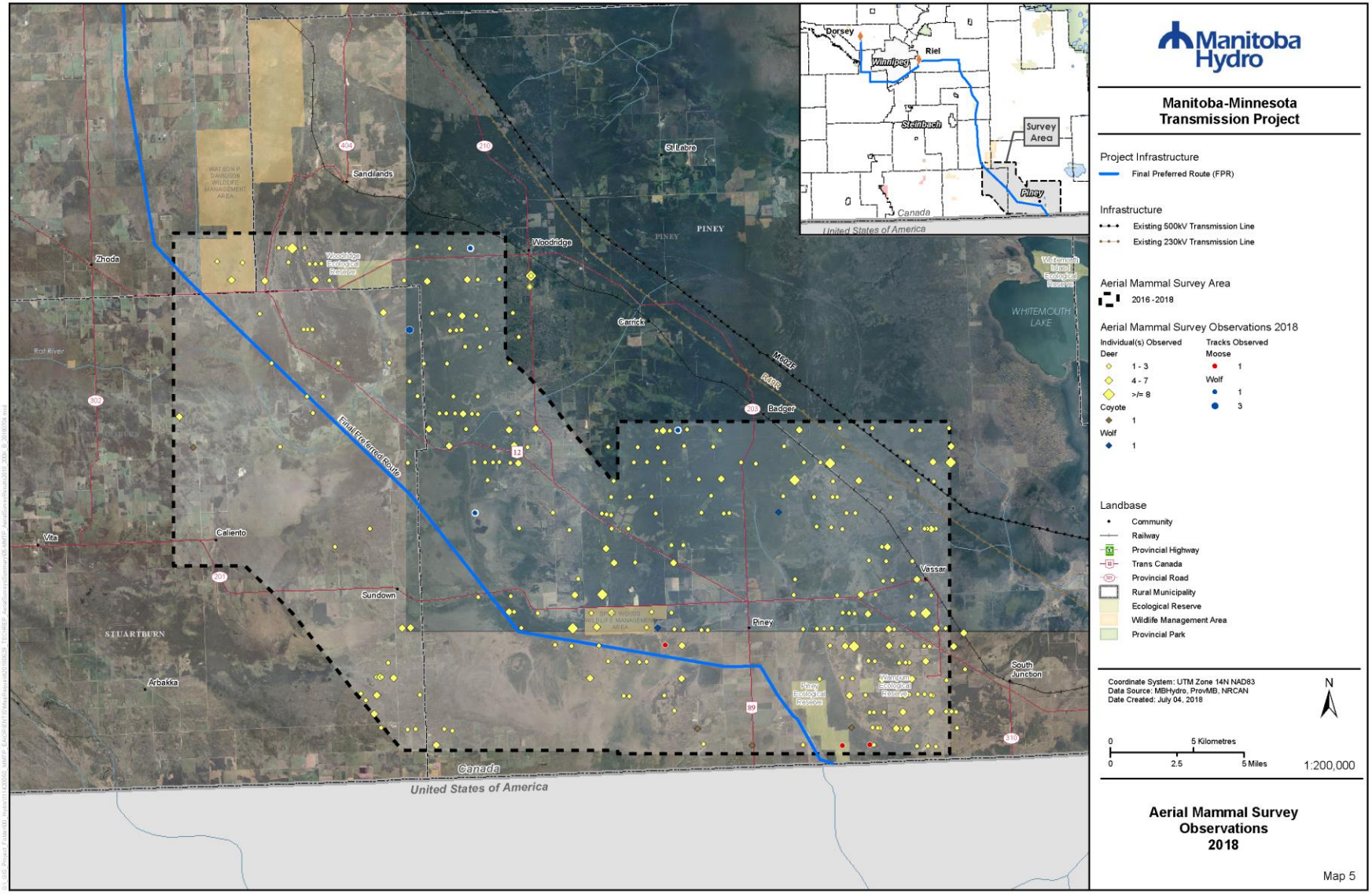
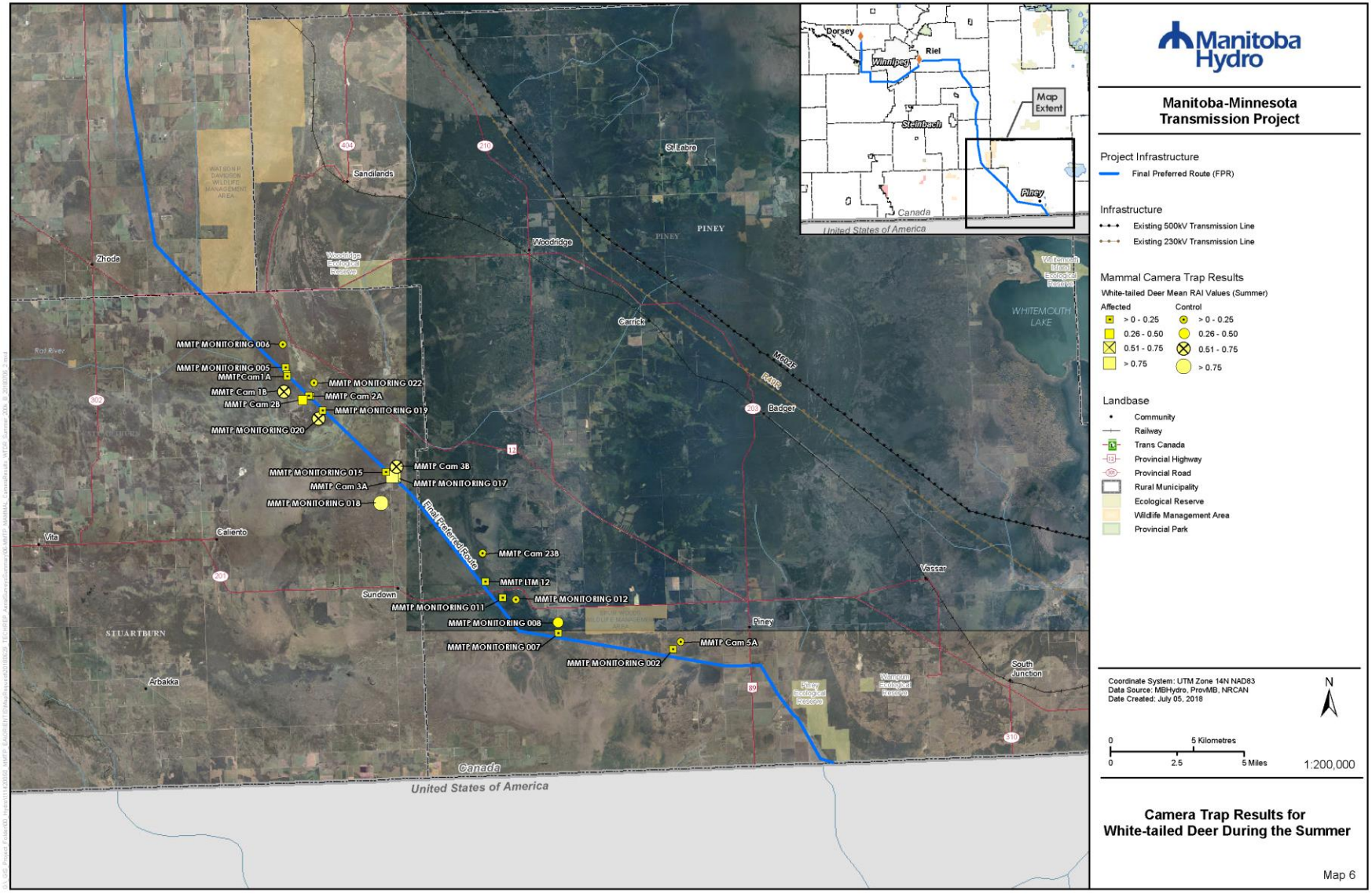
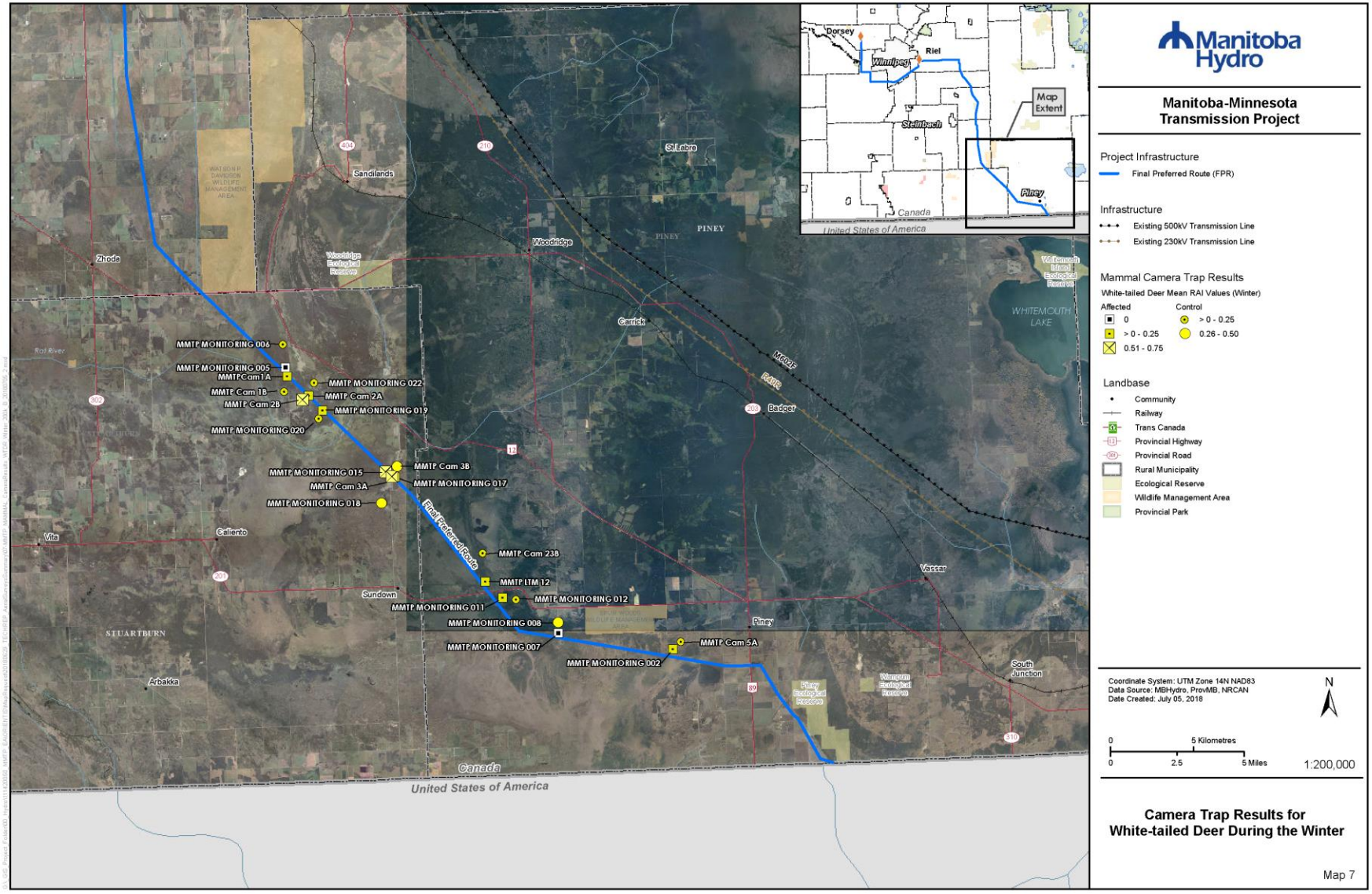
Dorsey
Riel
Winnipeg
Steinbach
Piney
Canada
United States of America
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam 1A
MMTP MONITORING 022
MMTP Cam 1B
MMTP Cam 2A
MMTP Cam 2B
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3B
MMTP MONITORING 017
MMTP Cam 3A
MMTP MONITORING 018
Final Preferred Route
MMTP Cam 23B
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
STUARTBURN
Arbakka
South Junction
WHITEMOUTH LAKE
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
N
0 5 Kilometres
0 2.5 5 Miles
1:200,000
Camera Trap Survey Locations
Map 2

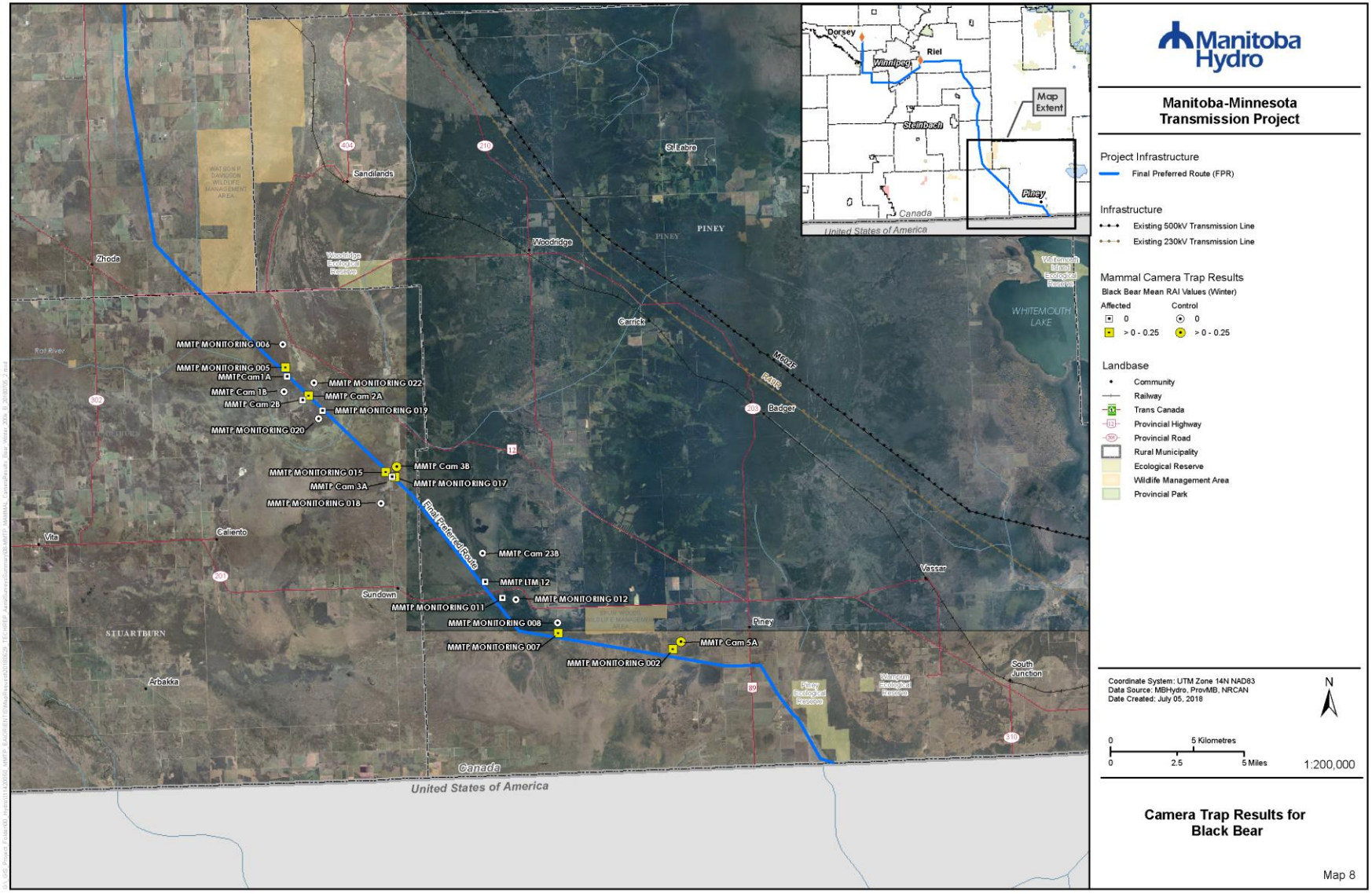

Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Aerial Mammal Survey Area
2016 - 2018
Aerial Mammal Survey Observations 2016
Individual(s) Observed
Deer
1-3
4-7
Coyote
2
Tracks Observed
Coyote
1
2
Wolf
1
3
Landbase
Community
Railway
Provincial Highway
Trans Canada
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 04, 2018
N
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Aerial Mammal Survey Observations 2016
Map 3
Dorsey
Riel
Winnipeg
Steinbach
Survey Area
Piney
Canada
United States of America
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Final Preferred Route
Caliento
Vita
Sundown
Piney
Vassar
South Junction
Arbakka
STUARTBURN
WHITEMOUTH LAKE
Canada
United States of America

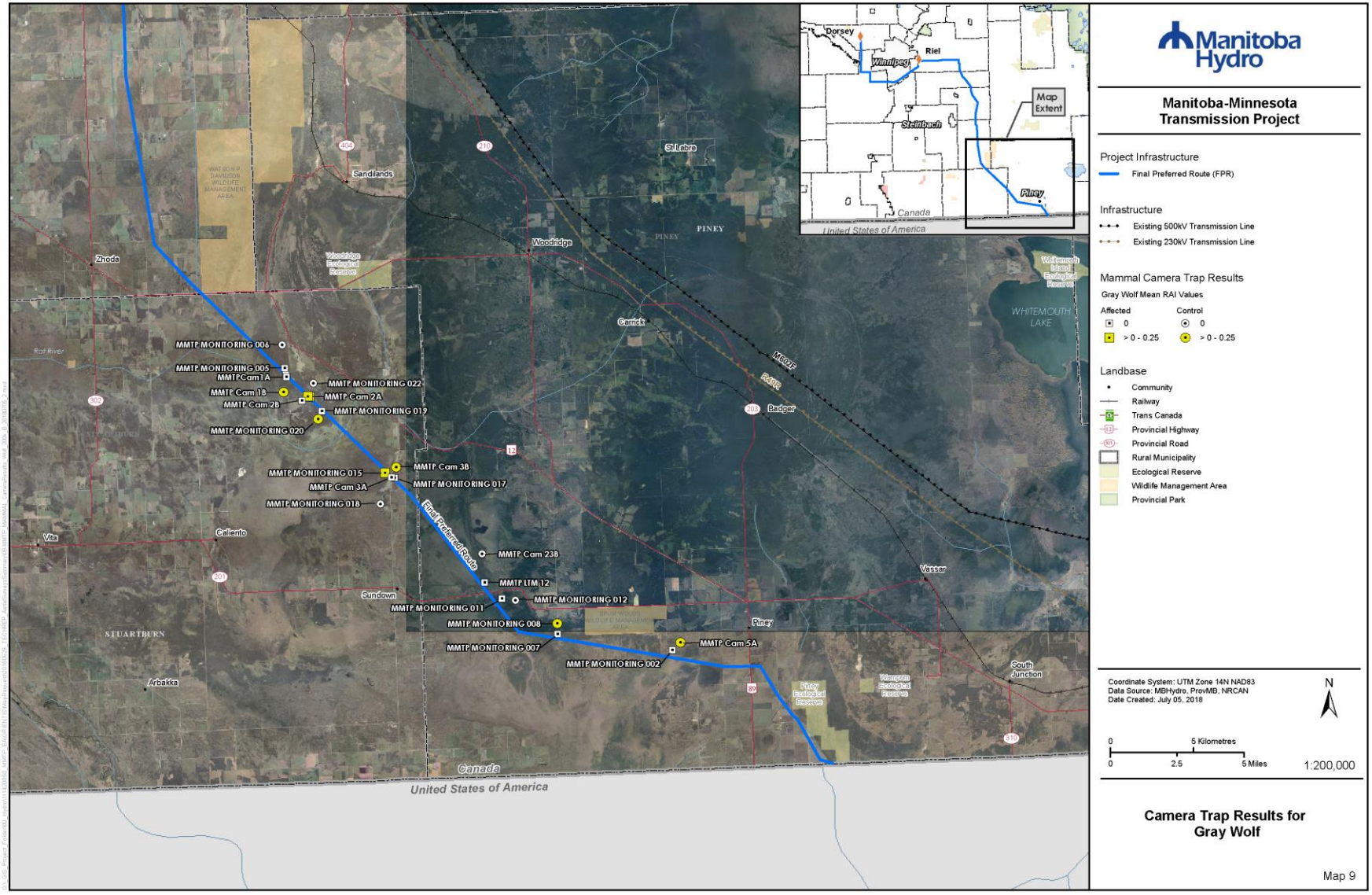

Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Aerial Mammal Survey Area
2016 - 2018
Aerial Mammal Survey Observations 2017
Individual(s) Observed
Deer
1-3
4-7
>/= 8
Coyote
1
Wolf
1
3
8
Tracks Observed
Coyote
1
2
Wolf
1
3
8
Landbase
Community
Railway
Provincial Highway
Trans Canada
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 04, 2018
N
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Aerial Mammal Survey Observations 2017
Map 4
Dorsey
Riel
Winnipeg
Steinbach
Survey Area
Piney
Canada
United States of America
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Caliento
Sundown
Vassar
Piney
South Junction
Arbakka
STUARTBURN
Final Preferred Route
WHITEMOUTH LAKE
Canada
United States of America

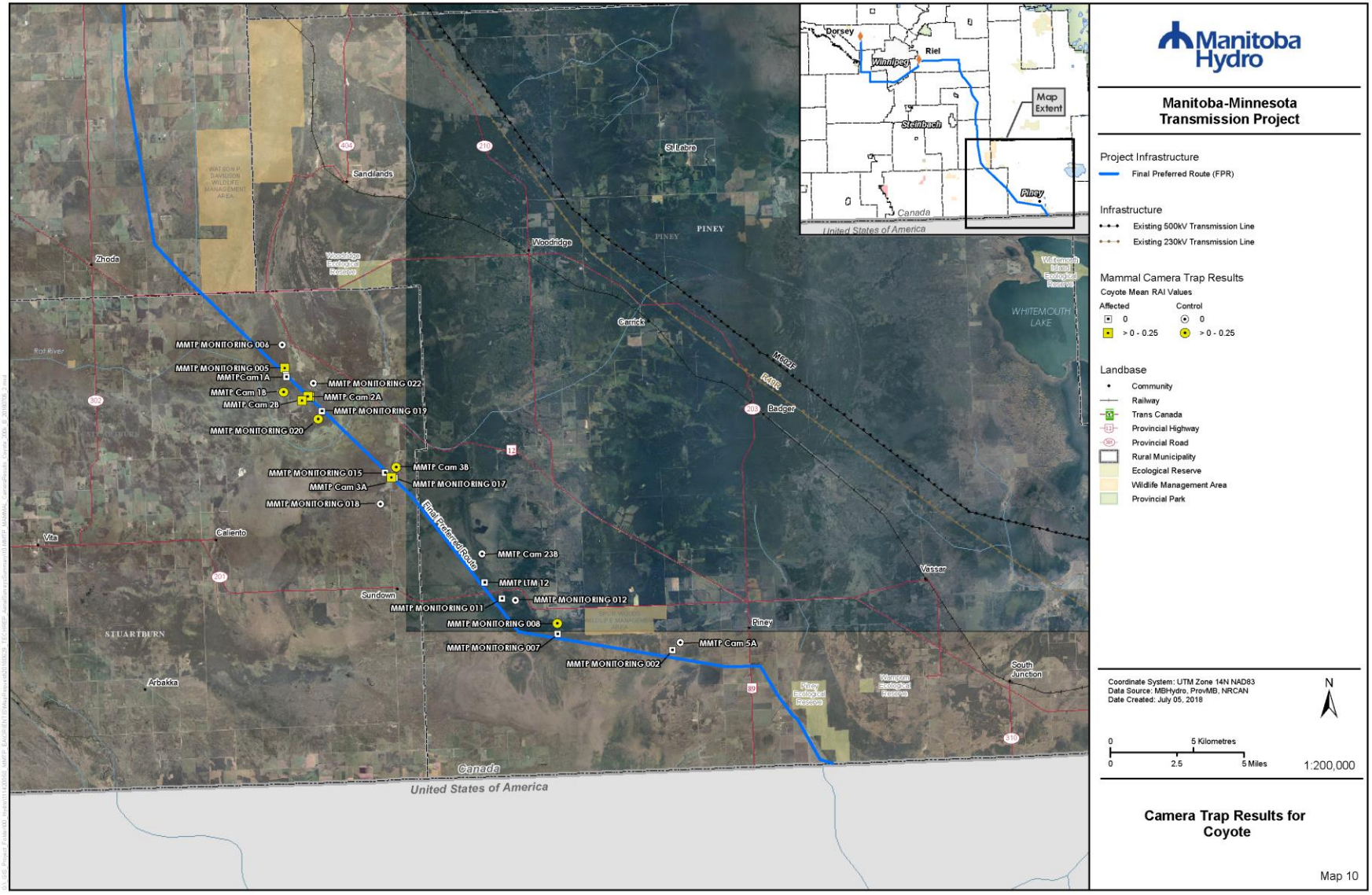

Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Aerial Mammal Survey Area
2016 - 2018
Aerial Mammal Survey Observations 2018
Individual(s) Observed
Deer
1 - 3
4 - 7
>/= 8
Coyote
1
Wolf
1
Tracks Observed
Moose
1
Wolf
1
3
Landbase
Community
Railway
Provincial Highway
Trans Canada
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 04, 2018
N
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Aerial Mammal Survey Observations 2018
Map 5
Dorsey
Riel
Winnipeg
Steinbach
Survey Area
Piney
Canada
United States of America
St Labre
Sandilands
Woodridge
Zhoda
Garrick
Badger
Vita
Caliento
Sundown
Vassar
Piney
Arbakka
South Junction
STUARTBURN
WHITEMOUTH LAKE
Final Preferred Route
Canada
United States of America


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Mammal Camera Trap Results
White-tailed Deer Mean RAI Values (Summer)
Affected
Control
> 0 - 0.25
0.26 - 0.50
0.51 - 0.75
> 0.75
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
N
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Camera Trap Results for White-tailed Deer During the Summer
Map 6
Map Extent
Dorsey
Riel
Winnipeg
Steinbach
Piney
Canada
United States of America
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam 1A
MMTP Cam 1B
MMTP Cam 2B
MMTP Cam 2A
MMTP MONITORING 022
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3A
MMTP Cam 3B
MMTP MONITORING 017
MMTP MONITORING 018
Final Preferred Route
MMTP Cam 23B
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
Arbakka
South Junction
STUARTBURN
PINEY
WHITEMOUTH LAKE
Canada
United States of America


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Mammal Camera Trap Results
White-tailed Deer Mean RAI Values (Winter)
Affected
0
> 0 - 0.25
0.51 - 0.75
Control
> 0 - 0.25
0.26 - 0.50
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
N
0 5 Kilometres
0 2.5 5 Miles
1:200,000
Camera Trap Results for White-tailed Deer During the Winter
Map 7
Dorsey
Riel
Winnipeg
Steinbach
Map Extent
Piney
Canada
United States of America
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam 1A
MMTP Cam 1B
MMTP Cam 2B
MMTP Cam 2A
MMTP MONITORING 022
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3A
MMTP Cam 3B
MMTP MONITORING 017
MMTP MONITORING 018
MMTP Cam 23B
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Final Preferred Route
Sandilands
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
Piney
Arbakka
South Junction
STUARTBURN
WHITEMOUTH LAKE
Canada
United States of America


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Mammal Camera Trap Results
Black Bear Mean RAI Values (Winter)
Affected
Control
0
> 0 - 0.25
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
N
0
5 Kilometres
2.5
5 Miles
1:200,000
Camera Trap Results for Black Bear
Map 8
Map Extent
Dorsey
Riel
Winnipeg
Steinbach
Piney
Canada
United States of America
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam 1A
MMTP Cam 1B
MMTP Cam 2B
MMTP MONITORING 022
MMTP Cam 2A
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3B
MMTP Cam 3A
MMTP MONITORING 017
MMTP MONITORING 018
Final Preferred Route
MMTP Cam 23B
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
Arbakka
South Junction
STUARTBURN
PINEY
WHITEMOUTH LAKE
Canada
United States of America


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Mammal Camera Trap Results
Gray Wolf Mean RAI Values
Affected
Control
0
> 0 - 0.25
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Map Extent
Dorsey
Riel
Winnipeg
Steinbach
Piney
Canada
United States of America
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
Piney
Arbakka
South Junction
STUARTBURN
WHITEMOUTH LAKE
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam1A
MMTP Cam 1B
MMTP Cam 2B
MMTP MONITORING 022
MMTP Cam 2A
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3A
MMTP Cam 3B
MMTP MONITORING 017
MMTP MONITORING 018
MMTP Cam 238
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Final Preferred Route
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Camera Trap Results for Gray Wolf
Map 9


Manitoba Hydro
Manitoba-Minnesota Transmission Project
Project Infrastructure
Final Preferred Route (FPR)
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Mammal Camera Trap Results
Coyote Mean RAI Values
Affected
Control
0
> 0 - 0.25
Landbase
Community
Railway
Trans Canada
Provincial Highway
Provincial Road
Rural Municipality
Ecological Reserve
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 05, 2018
N
0
5 Kilometres
0
2.5
5 Miles
1:200,000
Camera Trap Results for Coyote
Map 10
Map Extent
Dorsey
Riel
Winnipeg
Steinbach
Piney
Canada
United States of America
MMTP MONITORING 006
MMTP MONITORING 005
MMTP Cam 1A
MMTP Cam 1B
MMTP Cam 2B
MMTP MONITORING 022
MMTP Cam 2A
MMTP MONITORING 019
MMTP MONITORING 020
MMTP MONITORING 015
MMTP Cam 3A
MMTP Cam 3B
MMTP MONITORING 017
MMTP MONITORING 018
MMTP Cam 23B
MMTP LTM 12
MMTP MONITORING 012
MMTP MONITORING 011
MMTP MONITORING 008
MMTP MONITORING 007
MMTP Cam 5A
MMTP MONITORING 002
Final Preferred Route
Sandilands
St Labre
Woodridge
Zhoda
Garrick
Badger
Vita
Gallento
Sundown
Vassar
Piney
Arbakka
South Junction
STUARTBURN
WHITEMOUTH LAKE

APPENDIX

Table 1. Summary of the pre-construction monitoring mammal camera trap study results.

Camera ID	Treatment	Season	Year	No. of Operation Days	White-tailed Deer			Black Bear			Gray Wolf			Coyote		
					No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI
MMTP_LTM_12	Affected	winter	2015-16	157	13	10	0.06	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_LTM_12	Affected	summer	2017	153	7	7	0.05	2	2	0.01	0	0	0.00	0	0	0.00
MMTP_LTM_12	Affected	summer	2018	49	4	4	0.08	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_LTM_12	Affected	winter	2017-18	180	3	3	0.02	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_002	Affected	summer	2017	159	40	33	0.21	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_002	Affected	summer	2018	49	5	3	0.06	7	6	0.12	0	0	0.00	0	0	0.00
MMTP_MONITORING_002	Affected	winter	2017-18	180	12	12	0.07	4	4	0.02	0	0	0.00	0	0	0.00
MMTP_MONITORING_005	Affected	summer	2017	158	2	2	0.01	6	5	0.03	0	0	0.00	1	1	0.01
MMTP_MONITORING_005	Affected	summer	2018	44	0	0	0.00	2	2	0.05	0	0	0.00	0	0	0.00
MMTP_MONITORING_005	Affected	winter	2017-18	180	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_006	Control	summer	2017	158	11	11	0.07	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_006	Control	summer	2018	44	2	1	0.02	3	2	0.05	0	0	0.00	0	0	0.00
MMTP_MONITORING_006	Control	winter	2017-18	180	17	12	0.07	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_007	Affected	summer	2017	159	1	1	0.01	6	6	0.04	0	0	0.00	0	0	0.00
MMTP_MONITORING_007	Affected	summer	2018	37	0	0	0.00	2	2	0.05	0	0	0.00	0	0	0.00
MMTP_MONITORING_007	Affected	winter	2017-18	180	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_008	Control	summer	2017	159	78	64	0.40	4	4	0.03	1	1	0.01	0	0	0.00
MMTP_MONITORING_008	Control	summer	2018	37	13	4	0.11	0	0	0.00	1	1	0.03	0	0	0.00
MMTP_MONITORING_008	Control	winter	2017-18	180	148	73	0.41	0	0	0.00	11	7	0.04	1	1	0.01
MMTP_MONITORING_011	Affected	summer	2017	158	3	3	0.02	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_011	Affected	summer	2018	49	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_011	Affected	winter	2017-18	180	3	3	0.02	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_012	Control	summer	2017	159	19	18	0.11	2	2	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_012	Control	summer	2018	44	1	1	0.02	1	1	0.02	0	0	0.00	0	0	0.00
MMTP_MONITORING_012	Control	winter	2017-	180	4	4	0.02	0	0	0.00	0	0	0.00	0	0	0.00

Camera ID	Treatment	Season	Year	No. of Operation Days	White-tailed Deer			Black Bear			Gray Wolf			Coyote		
					No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI
			18													
MMTP_MONITORING_015	Affected	summer	2017	159	39	34	0.21	15	8	0.05	0	0	0.00	0	0	0.00
MMTP_MONITORING_015	Affected	summer	2018	364	9	9	0.02	11	8	0.02	0	0	0.00	0	0	0.00
MMTP_MONITORING_015	Affected	winter	2017-18	180	152	96	0.53	1	1	0.01	13	7	0.04	0	0	0.00
MMTP_MONITORING_017	Affected	summer	2017	159	135	104	0.65	5	5	0.03	0	0	0.00	0	0	0.00
MMTP_MONITORING_017	Affected	summer	2018	37	23	20	0.54	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_017	Affected	winter	2017-18	180	30	20	0.11	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_018	Control	summer	2017	159	269	185	1.16	1	1	0.01	0	0	0.00	0	0	0.00
MMTP_MONITORING_018	Control	summer	2018	37	35	25	0.68	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_018	Control	winter	2017-18	180	106	64	0.36	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_019	Affected	summer	2017	158	14	11	0.07	10	9	0.06	0	0	0.00	0	0	0.00
MMTP_MONITORING_019	Affected	summer	2018	44	0	0	0.00	12	11	0.25	0	0	0.00	0	0	0.00
MMTP_MONITORING_019	Affected	winter	2017-18	180	3	3	0.02	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_020	Control	summer	2017	158	154	111	0.70	6	6	0.04	1	1	0.01	1	1	0.01
MMTP_MONITORING_020	Control	summer	2018	44	19	17	0.39	13	11	0.25	0	0	0.00	0	0	0.00
MMTP_MONITORING_020	Control	winter	2017-18	180	22	17	0.09	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_022	Control	summer	2017	158	44	35	0.22	3	3	0.02	0	0	0.00	0	0	0.00
MMTP_MONITORING_022	Control	summer	2018	44	3	3	0.07	0	0	0.00	0	0	0.00	0	0	0.00
MMTP_MONITORING_022	Control	winter	2017-18	180	19	18	0.10	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam1A	Affected	summer	2017	158	12	10	0.06	2	2	0.01	0	0	0.00	0	0	0.00
MMTPCam1A	Affected	summer	2018	44	25	16	0.36	1	1	0.02	0	0	0.00	0	0	0.00
MMTPCam1A	Affected	winter	2017-18	180	14	9	0.05	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam1A	Affected	summer	2014	164	23	22	0.13	24	21	0.13	0	0	0.00	0	0	0.00
MMTPCam1B	Control	summer	2014	158	125	100	0.63	5	5	0.03	0	0	0.00	1	1	0.01
MMTPCam1B	Control	winter	2014	4	1	1	0.25	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam1B	Control	summer	2016	183	85	67	0.37	5	5	0.03	0	0	0.00	0	0	0.00
MMTPCam1B	Control	summer	2017	158	149	109	0.69	9	7	0.04	0	0	0.00	1	1	0.01
MMTPCam1B	Control	summer	2018	44	30	26	0.59	1	1	0.02	0	0	0.00	0	0	0.00
MMTPCam1B	Control	winter	2015-16	158	8	7	0.04	0	0	0.00	2	1	0.01	0	0	0.00
MMTPCam1B	Control	winter	2017-	180	22	15	0.08	0	0	0.00	0	0	0.00	2	2	0.01

Camera ID	Treatment	Season	Year	No. of Operation Days	White-tailed Deer			Black Bear			Gray Wolf			Coyote		
					No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI
			18													
MMTPCam23B	Control	summer	2017	159	22	20	0.13	6	5	0.03	0	0	0.00	0	0	0.00
MMTPCam23B	Control	summer	2018	37	4	4	0.11	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam23B	Control	winter	2017-18	180	3	3	0.02	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam23B	Control	summer	2014	68	37	33	0.49	1	1	0.01	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	summer	2017	158	28	23	0.15	7	5	0.03	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	summer	2018	44	0	0	0.00	4	2	0.05	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	winter	2017-18	180	7	7	0.04	0	0	0.00	2	2	0.01	0	0	0.00
MMTPCam2A	Affected	summer	2014	158	50	34	0.22	44	34	0.22	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	winter	2014	4	4	2	0.50	1	1	0.25	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	summer	2016	76	5	5	0.07	37	26	0.34	0	0	0.00	0	0	0.00
MMTPCam2A	Affected	winter	2015-16	158	16	14	0.09	10	5	0.03	0	0	0.00	1	1	0.01
MMTPCam2A	Affected	winter	2016-17	2	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam2B	Affected	summer	2014	158	109	76	0.48	26	22	0.14	0	0	0.00	0	0	0.00
MMTPCam2B	Affected	winter	2014	4	5	4	1.00	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam2B	Affected	summer	2016	183	80	70	0.38	26	19	0.10	0	0	0.00	0	0	0.00
MMTPCam2B	Affected	winter	2015-16	158	40	27	0.17	0	0	0.00	0	0	0.00	1	1	0.01
MMTPCam2B	Affected	winter	2016-17	2	1	1	0.50	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam3A	Affected	summer	2014	158	248	156	0.99	4	4	0.03	0	0	0.00	1	1	0.01
MMTPCam3A	Affected	winter	2014	4	3	3	0.75	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam3A	Affected	summer	2016	183	141	103	0.56	3	3	0.02	0	0	0.00	0	0	0.00
MMTPCam3A	Affected	winter	2015-16	158	73	32	0.20	0	0	0.00	0	0	0.00	1	1	0.01
MMTPCam3A	Affected	winter	2016-17	2	5	2	1.00	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam3B	Control	summer	2014	158	207	104	0.66	8	8	0.05	0	0	0.00	0	0	0.00
MMTPCam3B	Control	winter	2014	3	7	3	1.00	0	0	0.00	0	0	0.00	2	1	0.33
MMTPCam3B	Control	summer	2016	183	73	54	0.30	1	1	0.01	0	0	0.00	0	0	0.00
MMTPCam3B	Control	summer	2017	153	98	74	0.48	3	3	0.02	0	0	0.00	0	0	0.00
MMTPCam3B	Control	summer	2018	37	26	22	0.59	3	3	0.08	0	0	0.00	0	0	0.00
MMTPCam3B	Control	winter	2015-16	157	192	117	0.75	1	1	0.01	3	2	0.01	2	2	0.01

Camera ID	Treatment	Season	Year	No. of Operation Days	White-tailed Deer			Black Bear			Gray Wolf			Coyote		
					No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI	No. of Individuals	No. of Events	RAI
MMTPCam3B	Control	winter	2016-17	133	47	28	0.21	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam3B	Control	winter	2017-18	180	13	8	0.04	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam5A	Control	winter	2014	5	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
MMTPCam5A	Control	summer	2014	158	62	49	0.31	2	2	0.01	0	0	0.00	0	0	0.00
MMTPCam5A	Control	summer	2017	159	34	24	0.15	1	1	0.01	0	0	0.00	0	0	0.00
MMTPCam5A	Control	summer	2018	49	2	2	0.04	6	5	0.10	0	0	0.00	0	0	0.00
MMTPCam5A	Control	winter	2017-18	180	43	33	0.18	3	2	0.01	2	1	0.01	0	0	0.00