MANITOBA-MINNESOTA TRANSMISSION PROJECT

Biophysical Technical Data Reports

Manitoba-Minnesota Transmission Project Technical Data Report – Noise

FINAL REPORT

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Sign-off Sheet

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Abbreviations

AN	audible noise
dBA	decibel – A-weighted
EIS	environmental impact statement
kV	kilovolt
LAA	local assessment area
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
m	metre(s)
MMTP	Manitoba-Minnesota Transmission Project (the Project)
PDA	Project development area
PTH	Provincial Trunk Highway
RAA	regional assessment area
RM	rural municipality
ROW	right-of-way
RVTC	Riel-Vivian Transmission Corridor
SLTC	Southern Loop Transmission Corridor
TDR	technical data report
VC	valued component

Glossary

Audible noise	Any sound in the acoustic domain (music, speech, etc.).
Decibel (A-weighted)	Decibel (A-weighted) – dBA – relative loudness (sound pressure level) perceived by the human ear.
Physical disturbance	Temporary change in environmental conditions that causes a pronounced change in an ecosystem.

1.0 INTRODUCTION

Manitoba Hydro is proposing construction of the Manitoba-Minnesota Transmission Project (MMTP; the Project) which includes construction of a 500 kV AC transmission line in southeastern Manitoba. The proposed Project would originate at the Dorsey Converter Station northwest of Winnipeg, then travel south around Winnipeg within planned utility corridors including the Southern Loop Transmission Corridor (SLTC) and the Riel to Vivian Transmission Corridor (RVTC) to just east of Provincial Trunk Highway (PTH) 12. The line then continues southward across the rural municipalities of Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn and Piney to the Manitoba-Minnesota border crossing located south of the community of Piney. The Project also includes the construction of terminal equipment at the Dorsey Converter Station, and electrical upgrades within the Dorsey and Riel converter stations, and modifications at the Glenboro South Station requiring re-alignment of transmission lines entering the station.

This Technical Data Report (TDR) for Noise was developed to support the overall Environmental Impact Statement (EIS). It is intended to assess the potential effects of noise generated by the Project on the Acoustic Environment. For this assessment, noise is considered a pathway to an effect on a Valued Component (VC), rather than a VC itself.

1.1 BACKGROUND

1.1.1 Project Overview

The Project is described in three general regions: the upgrade work to the three stations, the additional transmission line constructed in the existing planned transmission utility corridors extending from Dorsey Converter Station to just east of PTH 12, and the new transmission line extending south from the Anola area to the border by Piney, Manitoba.

1.1.2 Spatial Boundaries

The following spatial boundaries were used to collect and analyze data for the Project.

1.1.2.1 Project Development Area (PDA)

The Project Development Area (PDA) is the area of physical disturbance from Project activities, within areas of construction activity for the Project, namely the Transmission Line ROW (80-100 m) and the three converter station improvement sites.

1.1.2.2 Local Assessment Area (LAA)

The LAA for the transmission line and stations consists of a 1 km buffer extending from edges of the PDA (**Map Series 1-100 in Appendix A**). The LAA represents the area where direct and indirect effects from noise are likely to be most pronounced or identifiable. The corridor was defined based on the anticipated extent to which noise levels associated with the Project can be heard by the human ear. When determining noise levels, an equivalent sound level (L_{eq}) is the method often used to describe sound levels that vary over time, resulting in a single decibel value, which takes into account the total sound energy over the time period of interest.

This assessment focuses on noise predicted to be generated within the LAA by the Project.

1.1.2.3 Regional Assessment Area (RAA)

The RAA includes the PDA and the boundaries of all rural municipalities (RMs) traversed by the PDA. From north to south RMs considered include: Rosser, Headingley, Macdonald, Ritchot, Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn, Piney and South Cypress (for the Glenboro South Station component only). The RAA is the area in which cumulative effects are assessed and it is anticipated other projects or activities occurring within the same RMs may have the potential to act cumulatively with the Project.

1.2 PURPOSE

Activities associated with the Project can increase ambient noise near the PDA. The largest source of noise during construction is the combined operation of machinery (i.e., bulldozers, transportation vehicles, clearing equipment, and cranes), and periodic explosive discharges by implosive sleeves during conductor stringing. Typically the largest source of noise along the transmission line during operation is associated with corona discharges that result in audible noise typically heard as a hissing or crackling sound. Corona discharges are produced at points along the transmission line conductors and are more common during foul-weather events (Exponent, 2015). Other sources of noise will be produced during maintenance activities that will be conducted using equipment including quads, snowmobiles, and possible infrequent use of helicopters. Operational sources of noise associated with stations will typically include humming sounds from transformer and reactor components that will be added to the existing stations (Exponent 2015).

Assessment of Project-generated noise was conducted for construction phases associated with transmission line construction and station improvements. The assessment also considered movement of personnel, materials and equipment in support of Project construction and normal operations and maintenance activities.

The purpose of this TDR is to:

- Characterize the likely baseline noise environment in the area of the Project.
- Describe and estimate noise that will be generated from construction vehicle and machinery use during construction and operation phases of the Project.
- In the context of the assessment's overall approach, the acoustic environment effects are then considered for their effect on VCs, which include:
  - Wildlife and Wildlife Habitat
  - Traditional Land and Resource Use
  - Land and Resource Use
  - Community Health and Well-Being
  - Human Health Risk

2.0 REVIEW OF EXISTING LITERATURE SOURCES AND BASELINE DATA GAPS

2.1 EXISTING LITERATURE SOURCES

The information described in this TDR comes from a collection of sources in the literature that are relevant to the Project area. The following sources were reviewed for applicable noise information related to the Project:

- Manitoba Hydro, 2012. Keeyask Generation Project Environmental Impact Statement.
- Manitoba Hydro, 2011. Bipole III Environment Impact Statement.
- Exponent, 2015. Manitoba-Minnesota Transmission Project Electrical Field, Magnetic Field, Audible Noise, and Radio Noise Calculations.
- Bonneville Power Administration, 2012. I-5 Corridor Reinforcement – Draft EIS.
- Stantec, June 2015. Manitoba-Minnesota Transmission Project Traffic Impact Study.
- MMTP construction, operations and maintenance equipment and Project activity lists provided by Manitoba Hydro. This data was used to understand the construction equipment deployment numbers for phases of the Project.
- SENES Consultants Limited, 2005. Noise Assessment Study Selkirk Generating Station. Prepared for Manitoba Hydro.

2.2 DATA GAPS AND LIMITATIONS

The following data gaps and limitations were noted with regard to the available information on noise:

- Literature values were identified and applied in the absence of Project-specific baseline and construction noise monitoring data. Based on the understanding that due to the anticipated construction intensity, the temporary and mobile nature of construction phases, the numbers of equipment deployed in phases of Project construction and the availability of existing baseline data, robust characterization of expected noise outputs, project-specific baseline monitoring was not required in support of this TDR.
- The Project activities during operation of the transmission line and stations related to noise are the transmission of power through the lines, transformers, and reactors, and the ongoing maintenance of the infrastructure. Data from Manitoba Hydro noise monitoring activities related to construction of similar transmission lines and stations were not available.

2.3 ASSUMPTIONS

Upon completion of the construction for the Project, operation and maintenance will take place within an environment that will remain categorized as primarily rural, and agricultural-activity based.

The construction phase of the Project will generate noise associated with the operation of vehicles and machinery required to conduct construction and clearing within the PDA ROW and station footprints. The operation and maintenance phase of the Project will involve a much smaller allocation of crews and vehicles than are anticipated for construction. Operations and maintenance of the MMTP transmission line will generate noise resulting from normal operations including transmission line hum or Audible Noise (AN), noise generated by station operation, and noise resulting from periodic inspection and maintenance within the transmission line ROW.

Additional assumptions include:

- Construction and operations noise was estimated by identifying construction vehicle deployments as specified by Manitoba Hydro in their provided summary listing titled: "500 kv Manitoba-Minnesota Transmission Project – Construction Equipment."
- There are two types of project-related trips associated with construction of transmission lines and stations: workforce traffic and material delivery traffic. These are described in greater detail in Section 6 of the Traffic Impact Study, Stantec 2015.
- It is assumed the majority of workers will be commuting from Winnipeg. Many workers' homes or temporary accommodations will be located at a distance to construction sites that allows for daily commuting for the duration of the Project.
- Construction of the Project will occur on a 10-hour workday basis, and is assumed to occur 7 days per week for a total Project duration from August 2017 to March 2020.

Data relied upon for construction vehicle noise propagation in this noise assessment was based upon the conservative assumption to disregard the effects of sound attenuation by natural features, manmade structures, and does not account for varying topographies. As a result, it is expected that noise levels reported at varying distances from noise sources within this document would likely be lower when the natural sound attenuation of these natural features is accounted for in the propagation of noise from noise generating sources.

3.0 METHODS

3.1 DATA COLLECTION METHODS

Noise levels (with the exception of implosive charges) were estimated based on the general size and deployment of the construction and/or maintenance equipment complement used during the Project activities with the application of literature-based noise emission values. A general equipment complement was provided by Manitoba Hydro with breakdown by activity. No Project-specific baseline noise data collection was undertaken and this information is generally not collected by Manitoba Hydro as the construction equipment required for the transmission line would be temporary at a given location and of a smaller magnitude than other non-monitored construction projects such as highway maintenance or construction work. Noise levels during operation were limited primarily to audible noise values predicted by Exponent.

Inferences about the existing environment were guided by an understanding of the study area land uses, including urban, rural and natural zones, intermixed with recreational, industrial and agricultural lands transected by a network of roads and highways.

3.2 ANALYTICAL METHODS

The analysis of anticipated noise generated by the Project phases was based on literature values for noise as defined for similar scale construction activity and similar deployments of equipment for construction and operations activities. Once the values were obtained, the assessment of the potential effects of noise on the acoustic environment was then conducted qualitatively.

Overall noise levels decrease with distance under normal fair weather conditions as the pressure wave disperses from its source. Noise generated by conventional typical construction equipment was monitored and modeled by a power utility in the United States. The study demonstrated how these levels dissipate with increasing distances from a construction site. Based on data from this study, noise loads from the combined conventional construction equipment are estimated to be 89 dBA L_{eq} at 15 m. Noise levels from a combined conventional construction equipment team at increasing distances are also listed in Table 3-1 (Bonneville Power Administration 2012).

Table 3-1: Combined Construction Equipment Noise Levels by Distance from Construction Site

Distance from Construction Site (metres)	Hourly L_{eq} (dBA)
15	89
30	83 (similar to truck at 50 feet)
60	77
120	71
240	65
480	59 (similar to indoor conversation)

Assumptions: Combined equipment used was one each – grader, bulldozer, heavy truck, backhoe, pneumatic tools, concrete pump, and a crane. This complement of construction equipment is considered a reasonable surrogate for construction equipment intensities for Project construction. Reference noise level of 89 dBA (Leq). Distance for the reference noise level: 15 m. Noise attenuation rate: 6 dBA/doubling of distance. This calculation is considered conservative as it does not include the sound attenuating effects, of local shielding, atmospheric attenuation or varying topographies.

Source: Bonneville Power Administration, 2012. I-5 Corridor Reinforcement – Draft EIS. Accessed on April 17, 2015 from http://www.bpa.gov/Projects/Projects/I-5/Pages/Draft-EIS.aspx

4.0 EXISTING ENVIRONMENT: NOISE

4.1 EXISTING AMBIENT NOISE

Existing ambient noise levels are expected to be typical of urban and rural settlement areas. Throughout the Project area, noise levels can vary widely however these noise levels remain typical for a rural and urban mixed-use environment. Ambient noise levels may be intermittently high in urban areas such as near Winnipeg and Steinbach, particularly near industrial and commercial operations and main arterial traffic routes, but are expected to be consistently low or moderate elsewhere. The existing environment noise levels will fluctuate during different seasons of the year, as affected by seasonal uses for agriculture and recreation and combined with other factors such as rail and air traffic, and wind. Existing sources of noise in the Project LAA are primarily intermittent man-made noise such as highway traffic, all-terrain vehicles, airplanes, snowmobiles, agricultural operations and related large vehicle movements, other construction activities, and light industrial manufacturing facilities. For example, a tractor under load is reported to create sound intensities of approximately 100 dBA (Tetr*ES* 2005). The sound level on the shoulder of a major highway is between 80 and 90 dBA (Health Canada 2005). A noise assessment study conducted for the Selkirk Generating Station showed that areas in the vicinity of Selkirk had measured background noise levels between 44.5 and 40.4 dBA for daytime, and between 40.4 and 39.9 dBA for nighttime (SENES 2005); these values can be interpreted as representative noise levels associated with typical urban-rural mixed settings.

4.2 NOISE ENVIRONMENT REGULATORY FRAMEWORK

The Regulatory Framework for Noise in Manitoba consists of regulations intended for management of worker exposure to noise levels in occupational environments, and local municipal bylaws established for noise nuisance management in the acoustic environment. The Province of Manitoba establishes noise control guidelines for land use planning, and also authorizes municipalities to create and implement municipal plans and noise-control by-laws. Guidance is also provided through Manitoba's published *Guidelines for Sound Pollution* for daytime and nighttime acceptable and desirable noise levels in residential areas (Table 4-1).

For workplace environments, workplace exposure is regulated under the Province's Workplace Safety and Health Regulation (M.R. 217/2006). Requirements under the Regulation are as follows:

a. Continuous noise generated at a new workplace must not exceed 85 dBA, or at a level which is reasonably practicable with the use of sound control measures.

b. If noise levels generated within the workplace are expected to exceed 80 dBA, an employer must conduct a noise exposure assessment at the workplace in accordance with methods described in the Regulation.

For regulation of ambient daytime and nighttime noise levels, Manitoba Conservation and Water Stewardship does not enforce specific noise limits but instead will review nuisance noise in the event five (5) complaints have been reported by residents, and may provide requirements for proponents to seek methods to reduce noise (Eshetu Beshada 2015). In Manitoba, both the City of Winnipeg and the City of Brandon do not include specific thresholds for noise in their Noise Bylaws; however, they do contain clauses that limit the operation of certain noise-generating equipment (lawnmowers, grinders, etc.) during certain hours of the day.

The day-night average sound level (L_{dn}) is defined as the average noise level over a 24-hour period. For construction phases less than one year in duration, Health Canada has set the guideline of a L_{dn} of 62 dBA; for construction phases greater than one year in duration. This guideline is based on a previous study conducted by Health Canada that determined the level at which people start to find construction equipment highly annoying. The guideline indicates that a construction project should not result in a 6.5% increase in highly annoyed people compared to the baseline condition. This is also the guideline suggested for operational phases. Health Canada guidance including the percent highly annoyed calculation relies on ISO 1996-1:2003 (Canadian Standards Association 2005).

Manitoba has published *Guidelines for Sound Pollution*, which defines the sound level limit to assess noise in the outdoor environment for daytime and nighttime.

Table 4-1: Environmental Sound Level Objectives for Continuous or Intermittent Sounds

Location	Leq (1) (DAY) 7:00 A.M. TO 10:00 P.M.	Leq (1) (NIGHT) 10:00 P.M. TO 7:00 A.M.
RESIDENTIAL AREA		
(a) Maximum Desirable	55	45
(b) Maximum Acceptable a. Summer or year round operations	60	50
b. Predominant discrete tone(s) or appreciable impulsive/impact character	55	45
c. Winter operations only or temporary operations	65	55
COMMERCIAL AREA		
Maximum Desirable	55	45
Maximum Acceptable	70	60
INDUSTRIAL AREA		
Maximum Desirable	70	70
Maximum Acceptable	70	70

5.0 RESULTS

5.1 CONSTRUCTION

Construction of the transmission line, stations, and access roads will generate temporary and intermittent noise in the vicinity of the ROW. Noise generated by construction activities would be sporadic and transitory (as construction progresses linearly along ROW) during construction phases. Noise levels will rise and fall according to the construction schedule and associated construction phase activities. Transmission line construction will produce noise levels originating within and adjacent to the ROW while noise generated by the planned upgrades to the existing stations will be generated primarily at each station site and over a period restricted to the construction phase of the Project.

Based upon results derived from similar developments (Bonneville Power Administration 2012) and similar construction intensity efforts, combined construction equipment for any of the activities below is estimated to generate 89 dBA of noise at a clear distance of 15 m from construction equipment within the PDA. Sound pressure levels will decrease with distance as intensity decreases. Further attenuation is expected as the sound waves travel through and over natural and man-made barriers (*i.e.*, trees, shelterbelts, outcrops, buildings). Construction will be carried out using conventional construction equipment, as listed in the sub-sections below. The estimation of noise generated by construction of the Project focuses on noise generated by the following activities:

- Construction of access roads
- Transporting materials to sites, equipment at sites, operation of support vehicles, and miscellaneous activities
- Site clearing
- Foundation construction
- Assembling and erecting towers
- Tower stringing

Typical noise levels associated with the operation of the equipment used in the construction of MMTP are summarized in Table 5-1.

Table 5-1: Typical Noise Emission Rates for Construction Equipment

Type of Equipment	Leq dBA at 15 metres*
Implosive Sleeve**	110
Road Grader	85
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Crane	85
Combined Equipment	89***

*Decibels (A-weighted)

***Does not factor sound point discharge of implosive sleeves.

Sources:

**Specification Sheet: CapX2020, 2012. Implosive devices used for transmission line construction. Accessed on April 22, 2015 from capx2020.com/factsheets/implosive_devices_fact_sheet.pdf. January 5, 2012.

***Thalheimer, E. 1996. Construction noise control program and mitigation strategy for the Central Artery/Tunnel Project. ASA/INCE Noise Control Conference. Seattle, WA.

5.1.1 Access Roads – Construction

Access to worksites will generally be via existing public access roads or trails whenever possible. Minor deviations from the ROW may be necessary in severe terrain conditions. The majority of noise generated during access construction will be created by internal combustion gasoline and diesel engines for the duration of project construction, and on the basis of a construction intensity indicated by Manitoba Hydro of 7 days per week for 10 hours per day.

Manitoba Hydro provided construction equipment allocations for this construction activity as follows:

- Four (4) 850G John Deere bulldozers (185 horsepower)
- Two (2) 120 Caterpillar motor graders (125 horsepower)
- Two (2) tractors with drags (210 horsepower).

5.1.2 Transporting Materials, Equipment, Support Vehicles and Miscellaneous Activities

There is a requirement for vehicles, heavy equipment, and miscellaneous equipment to perform various support functions for the Project throughout the construction phase. The operation of these equipment units will generate intermittent, transitory noise.

Supporting equipment and vehicles allocated by Manitoba Hydro to this activity are expected to include:

- Five (5) semi-trucks with flatbeds (475 horsepower)
- Three (3) mechanic's trucks (350 horsepower)
- Fifty (50) contractor ½ ton crew cab trucks (300 horsepower)
- Ten (10) Manitoba Hydro ½ ton crew cab trucks (300 horsepower)
- Three (3) ¾ ton fuel trucks (350 horsepower)
- One (1) 5 ton fuel truck (400 horsepower)
- Ten (10) generators/light stands (50 horsepower).

5.1.3 Tree Clearing

Clearing and disposal of trees on the ROW will be undertaken using heavy equipment in advance of construction activities. The clearing activities will generate intermittent, transitory noise over an anticipated 64-day period.

Equipment allocated by Manitoba Hydro to complete clearing of the ROW will include:

- Four (4) Tigercat drum cutters (500 horsepower)
- Four (4) mulchers (250 horsepower)
- Two (2) John Deere feller bunchers (286 horsepower)
- One (1) grapple skidder (225 horsepower)
- Two (2) hydro axe (135 horsepower).

5.1.4 Foundation Construction

Equipment used for construction of foundations required for the towers. Equipment allocated by Manitoba Hydro to complete cast-in-place foundation construction includes:

- Three (3) auger drills (400 horsepower)
- Three (3) concrete trucks (315 horsepower)
- Eight (8) Caterpillar 320 excavators (138 horsepower)
- Two (2) Caterpillar 200 excavators equipped with plate compactors (115 horsepower).

This foundation construction is expected to generate intermittent, transitory noise over an 89-day period, however, with an average tower span of 400 m and an estimated two (2) days for each installation, levels would be reduced and nearly indiscernible in less than four (4) to six (6) days at any given receptor.

5.1.5 Assembly and Erecting Towers

Assembly and erection of guyed-suspension and lattice self-supporting towers will require the use of noise generating equipment over an estimated 216-day period during project construction. It is assumed that each tower will require up to two days to erect within the construction period. Equipment allocated by Manitoba Hydro to assemble and erect towers includes:

- Two (2) Caterpillar 972 loaders (287 horsepower)
- Four (4) Terex 3063B boom trucks (210 horsepower)
- Two (2) 100 ton cranes (262 horsepower)

5.1.6 Tower Stringing

Stringing overhead conductors on towers involves the installation of conducting cable on the erected transmission towers and is carried out using various noise-generating equipment over an estimated 106-day period.

Implosive sleeves will be used to splice reels of conductors in order to create a continuous conductor along the transmission line during construction. Each implosion will generate 110 dBA at intervals along the PDA and will be perceived as a blast sound. Each conductor spool carries approximately 3200 m of wire, so the implosive sleeves would be used approximately every five (5) to six (6) towers (assuming approximately 400 m spans).

Equipment allocated by Manitoba Hydro to string conductors will include:

- Six (6) Terex 3063B boom trucks (210 horsepower)
- Two (2) drum pullers (100 horsepower)
- Two (2) drum tensioners (100 horsepower)
- Two (2) Caterpillar D8s for sagging (328 horsepower)
- Two (2) 100 ton cranes (262 horsepower)
- Two (2) 9 ton radial arm diggers (250 horsepower)
- Two (2) Caterpillar 320 excavators (138 horsepower)

Results from similar construction efforts conducted elsewhere have indicated that at a distance of 480 m from the MMTP construction areas within the PDA, noise is expected to reduce to 59 dBA (not including implosions by tower stringing activities) (Bonneville Power Administration 2012).

5.2 OPERATIONS AND MAINTENANCE

Operations and maintenance of the MMTP transmission line and station upgrades will generate noise emissions in the form of Audible Noise (AN).

The estimated noise generated by operations and maintenance of MMTP focuses on the following activities:

- Transmission line operation corona discharge (data provided by Exponent 2015).
- Noise generated by equipment additions to stations (data provided by Exponent 2015).
- Annual maintenance/inspection patrols (surrogate data used from Bonneville Power Administration 2012).
- Vegetation control (surrogate data used from Bonneville Power Administration 2012).

5.2.1 Operations

5.2.1.1 Transmission Lines

Noise associated with normal operations will be low level, and highly localized and is limited to Audible Noise (AN) typically produced during fair and foul weather conditions by corona discharges at transmission line conductors during operations, and can be heard as a hissing or crackling sound that may be audible from a position located directly below the transmission line.

During medium-fair weather conditions, maximum audible noise associated with operation of MMTP transmission lines anywhere along the edge-of-ROW is expected to be approximately 23 dBA (Exponent 2015), resulting in an inaudible increase above the ambient noise level typically experienced in quiet rural locations of 30-40 dBA. At 30 m beyond the edge-of-ROW, audible noise resulting from transmission line operation is expected to be a maximum 21 dBA (Exponent 2015), which is below the typical ambient noise generated at quiet rural locations.

During periodic foul weather conditions that may cause corona discharges, maximum audible noise at the edge-of-ROW is expected to be 48 dBA, dissipating to 45 dBA at a location 30 m from the edge-of-ROW (Exponent 2015).

5.2.1.2 Stations

The stations will undergo upgrades to their existing infrastructure that will be required to support the MMTP's electricity distribution. Noise associated with operation of stations will be generated by equipment that will be added to the existing sites. Audible noise levels estimated at nearby residences by equipment additions are shown on Table 5-2 (Exponent 2015).

Table 5-2: Audible Noise Perceived at Nearby Residences of Equipment to be Added to the Dorsey and Riel Converter Stations and the Glenboro South Station for MMTP

Station	Equipment	Dimensions of Each (length x width x height)	AN Levels Estimated at Nearest Residence	Manitoba Guideline for L_{eq} - Daytime	Manitoba Guideline for L_{eq} - Nightime
Dorsey	4 x 500-kV Reactors	5.8 x 10 x 8 m	52 dBA	55 dBA	45 dBA
Riel	3 x Autophase Transformers	8.3 x 8.3 x 7.6 m	44 dBA	55 dBA	45 dBA
Glenboro South	2 x Phase Shifting Transformers	16 x 9 x 10 m	55 dBA	55 dBA	45 dBA

5.2.2 Maintenance

Based upon results derived from similar developments and similar construction intensity efforts, the combined construction equipment for combined maintenance activities is estimated to generate 89 dBA of noise recorded at distances 15 m from sites within the PDA. Sound waves will dissipate with distance and will attenuate though natural and man-made barriers (*i.e.*, trees, shelterbelts, outcrops, buildings). At 480 m from the MMTP PDA, noise is expected to reduce to 59 dBA or less depending on the presence of various barriers and attenuating conditions (Bonneville Power Administration 2012).

Manitoba Hydro indicates it will perform annual patrols of the MMTP associated infrastructure and ROW by ground crews, with potential use of a helicopter. Equipment allocated by Manitoba Hydro to perform annual inspections is expected to include:

- Eight (8) ½ ton crew cab trucks (300 horsepower)
- Quads
- Snowmobiles
- Trooper (two-tracked machine)
- Helicopter patrol over a half-day, once per year

Manitoba Hydro will perform annual vegetation control within the MMTP ROW by applying herbicide (every 3-7 years) and brushing (every 7-10 years) using ground crews within a temporary interval spanning a duration ranging between several days and up to three weeks. Equipment allocated by Manitoba Hydro to perform annual vegetation maintenance is expected to include:

- Ground application of herbicide within the ROW (quads).
- Brushing (850G John Deere bulldozers [185 horsepower], brusher, chainsaws).

6.0 SUMMARY

The potential effects of Project activities on the acoustic environment are expected to be minimal, primarily distributed along linear infrastructure corridors including highways and transmission line ROWs. Noise associated with each of the construction, operation and maintenance phases will be intermittent and temporary, and is expected to be contained mostly within the PDA.

The maximum noise level generated by equipment (not including implosive splicing) during both the construction and maintenance phases is anticipated to be 89 dBA at a 15 m distance from noise sources; noise which travels beyond the PDA during construction and maintenance activities will dissipate substantially with mitigation by natural and manmade attenuation features, and is anticipated to generate approximately 59 dBA or less at a distance of 480 m from noise sources within the PDA (similar to an indoor conversation; Exponent 2015). Implosions will sporadically generate 110 dBA (at 15 m) during the construction phase, will likely occur approximately 2-3 km apart and will likely be perceived by nearby receptors. Once in operation, the transmission line is expected to generate a maximum noise level of 23 dBA under fair-weather conditions, which is expected to be negligible when compared to typical ambient background noise associated with quiet rural locations (30-40 dBA). Foul-weather conditions are also expected to mask any noise generated by increases in transmission line operational noise, resulting in a negligible effect.

Urban areas and rural settlements located within the LAA will likely, on occasion, perceive noise generated by construction activities; however, this noise will be minimal and short term in duration.

This estimation is a conservative assessment based on literature values and an assumption of zero noise attenuation by surrounding land use, vegetation, and structures. Consequently, when comparing noise expected to be generated by added equipment at the Dorsey and Glenboro Station sites to Manitoba *Guidelines for Sound Pollution*, operational noise is predicted to exceed the nighttime guidelines when perceived at the nearest residences. These predictions are based on simplified modeling, and it is expected that natural and man-made noise attenuation features can contribute to mitigating perceived noise at the nearby residences. In the event noise complaints are received it is recommended that site based monitoring of operational noise be undertaken to confirm noise exposure levels (Exponent 2015).

7.0 REFERENCES

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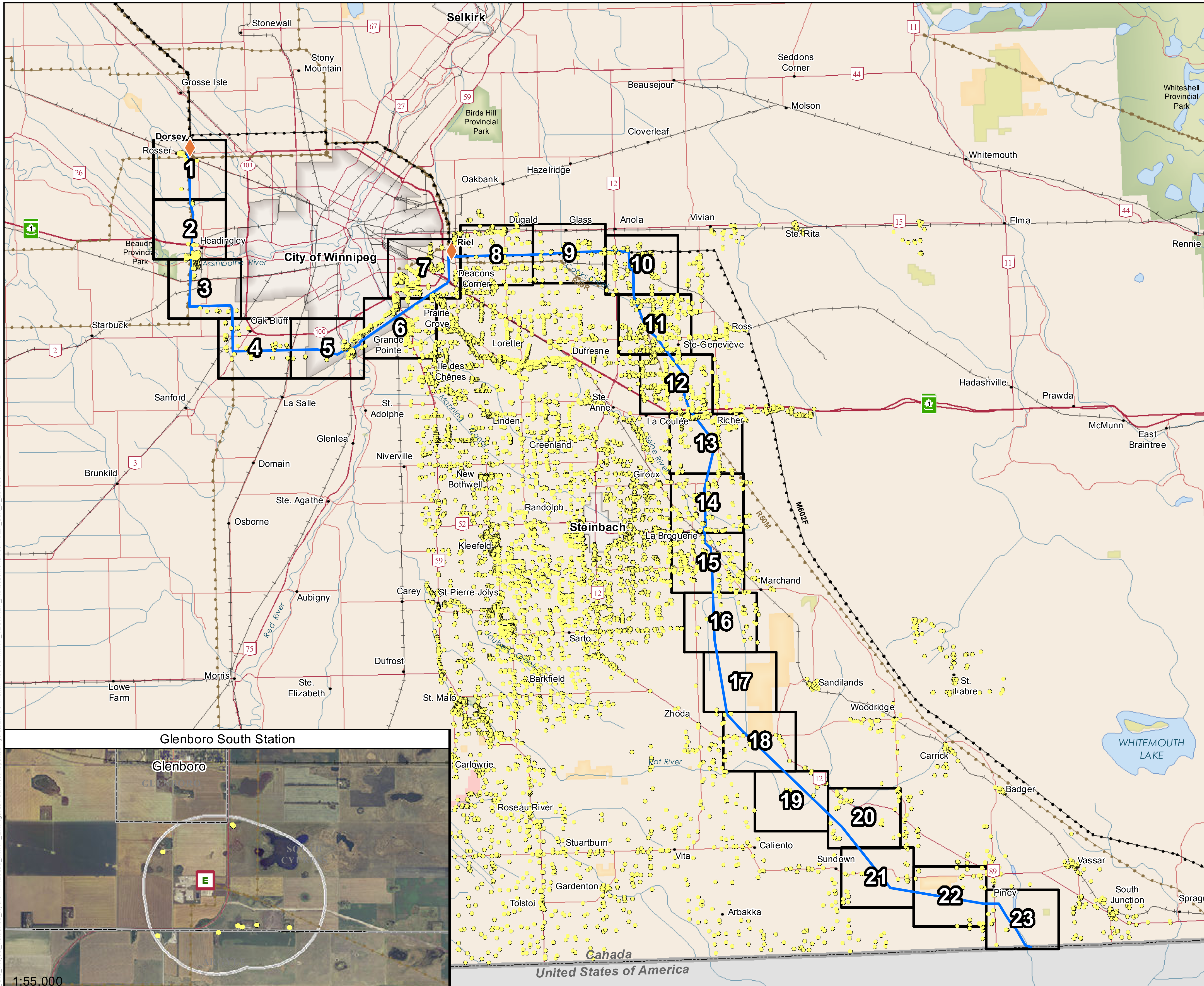
APPENDIX A:
MAP SERIES 1-100 – PROJECT DEVELOPMENT AREA, LOCAL ASSESSMENT AREA AND RECEPTORS



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station (Existing)
- Final Preferred Route (FPR)

Infrastructure

- Electrical Stations
- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

Map Tile Index - 1:30,000

- Map Series Tile

Receptor[1]

- Occupied House

Assessment Area

- Air Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 19, 2015

N

0 5 10 Kilometres
0 5 10 Miles

1:500,000

Index of Map Series Receptor Locations

Map Series 1-100

G:_GIS_Project_Folder\00_Hydro\111420050_MMTP_EA\Figures\TechnicalReports\PhysicalEnvironment\1-100-00-MMTP_TECHREP_AirAssessmentArea\INDEX_30K_B_20150819.mxd

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Final Preferred Route (FPR)
- Station Expansion
- Converter Station Footprint

Infrastructure
- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line

Receptor[1]
- Occupied House

Assessment Area
- Project Development Area (PDA)
- Local Assessment Area

Landbase
- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-01

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

Infrastructure

- Existing 230kV Transmission Line

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

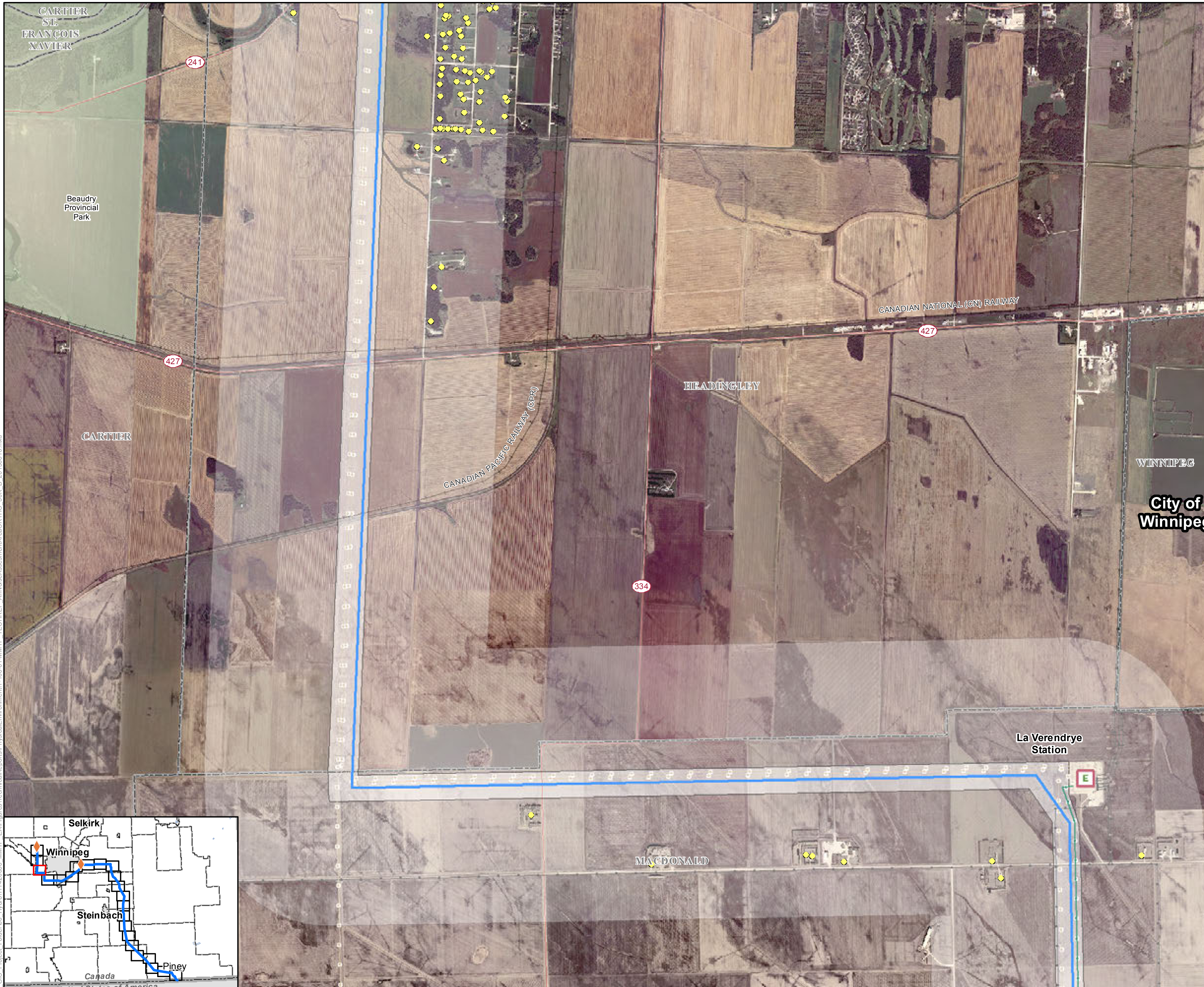
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-02



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Electrical Station

Existing 230kV Transmission Line

St. Vital Transmission Complex (Proposed)

Existing 115-230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-03

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Existing 230kV Transmission Line

St. Vital Transmission Complex (Proposed)

Existing 115-230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-04

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

St. Vital Transmission Complex (Proposed)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

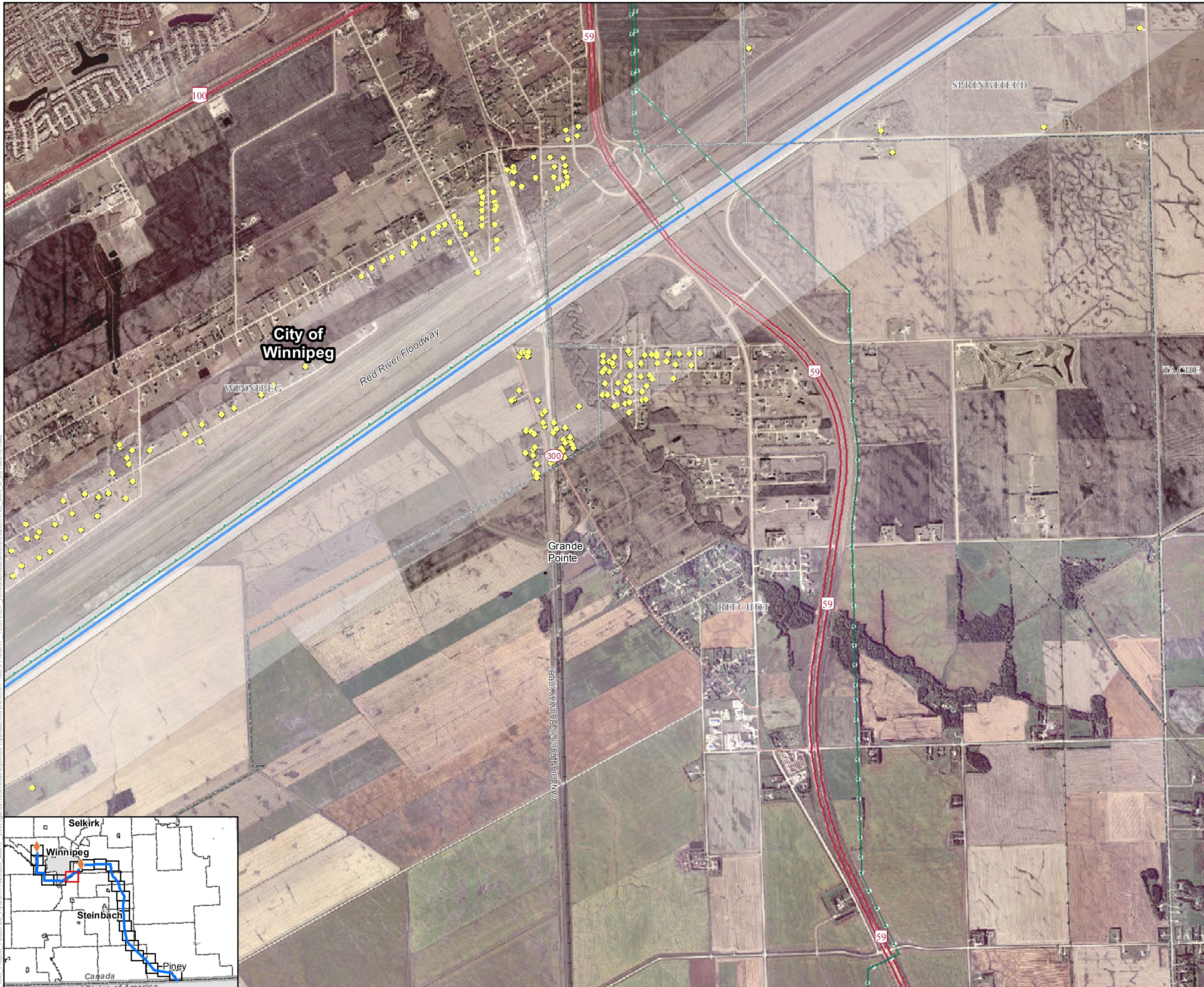
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-05



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

Infrastructure

- St. Vital Transmission Complex (Proposed)
- Existing 115-230kV Transmission Line

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

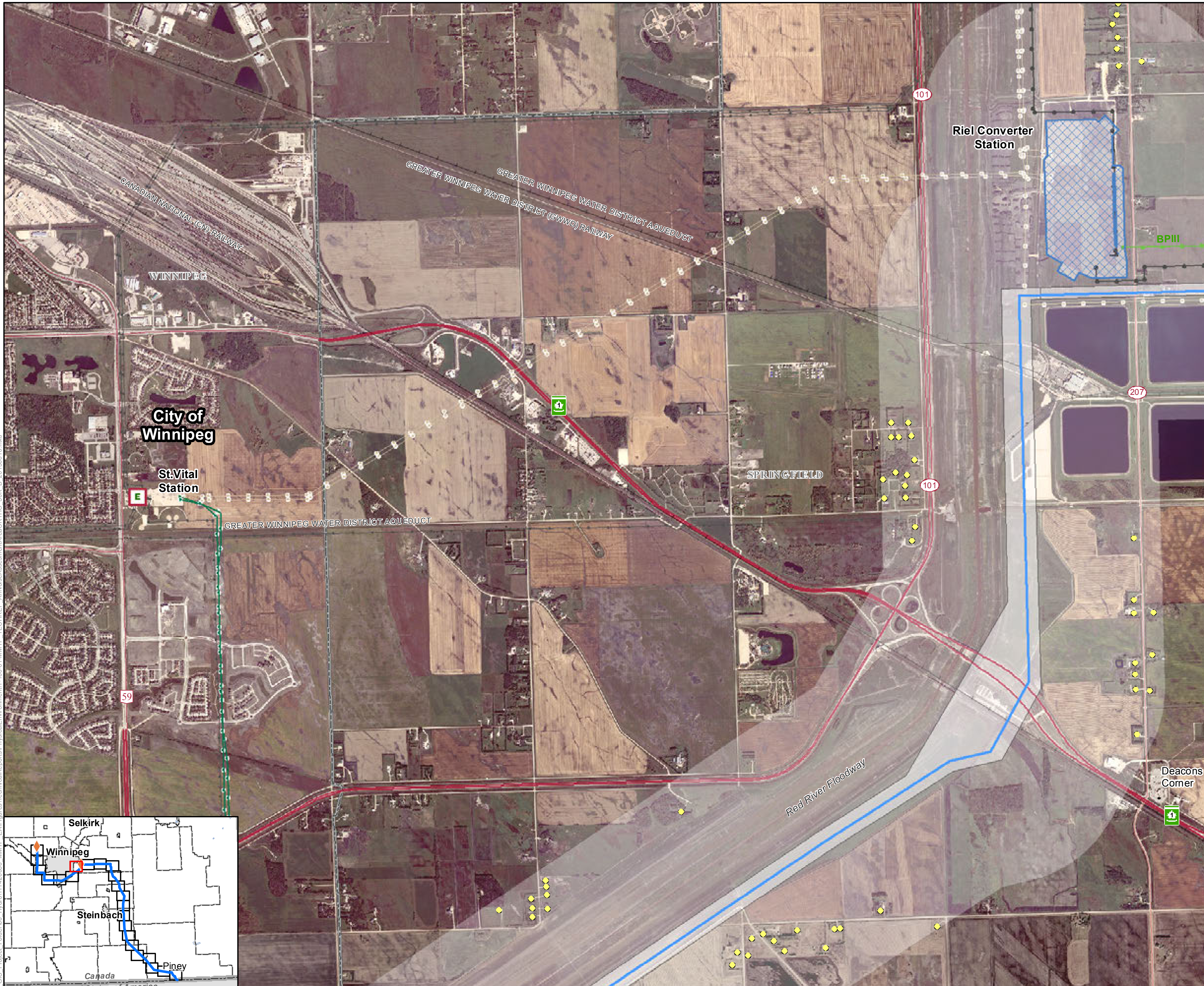
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-06



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Final Preferred Route (FPR)
- Converter Station Footprint

Infrastructure
- Electrical Station
- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line
- Bipole III Transmission Line (Approved)
- St. Vital Transmission Complex (Proposed)
- Existing 115-230kV Transmission Line

Receptor[1]
- Occupied House

Assessment Area
- Project Development Area (PDA)
- Local Assessment Area

Landbase
- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

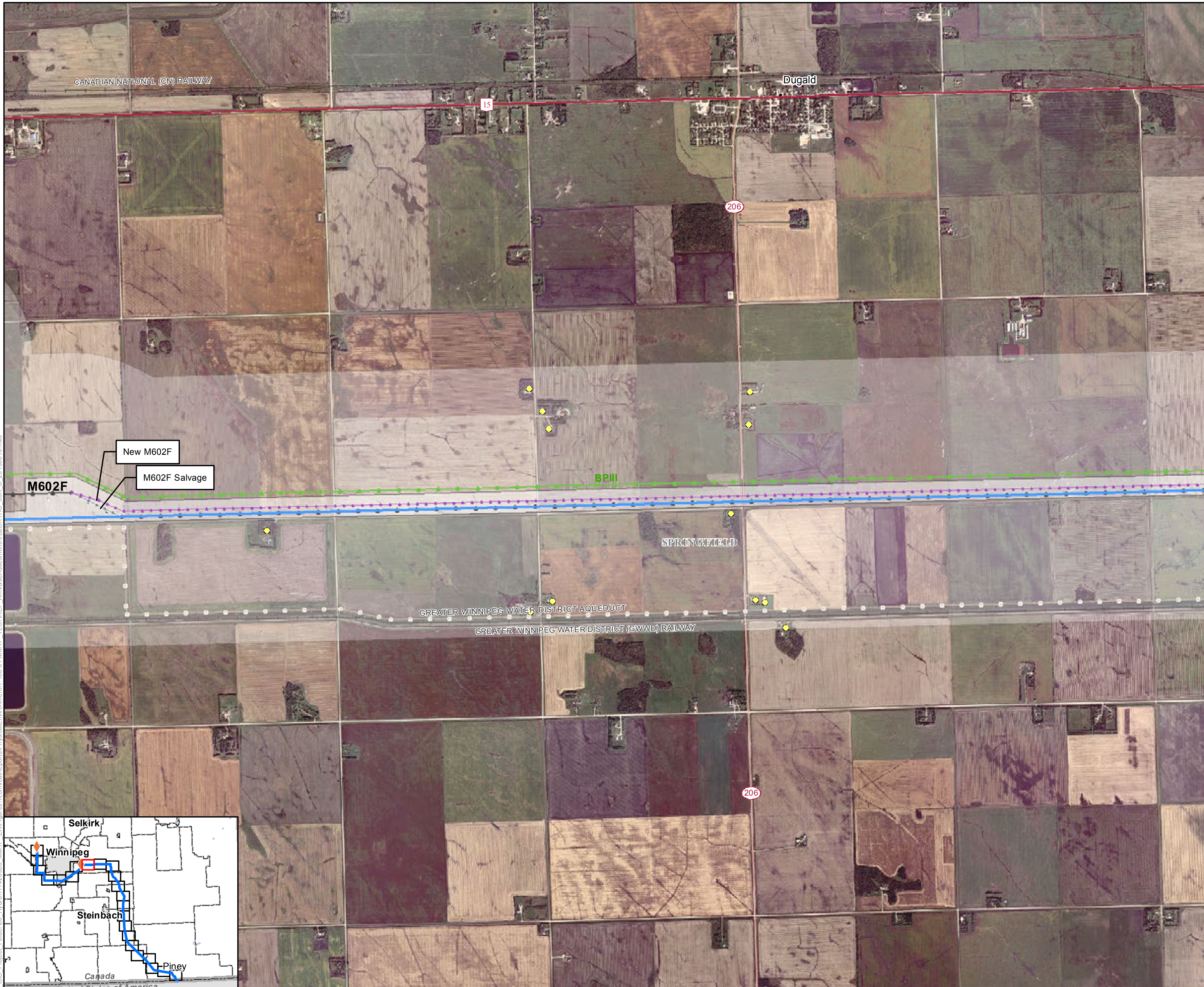
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-07



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)
- M602F Modification (Salvage)
- M602F Modification (New)

Infrastructure

- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line
- Bipole III Transmission Line (Approved)
- Existing 115-230kV Transmission Line

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

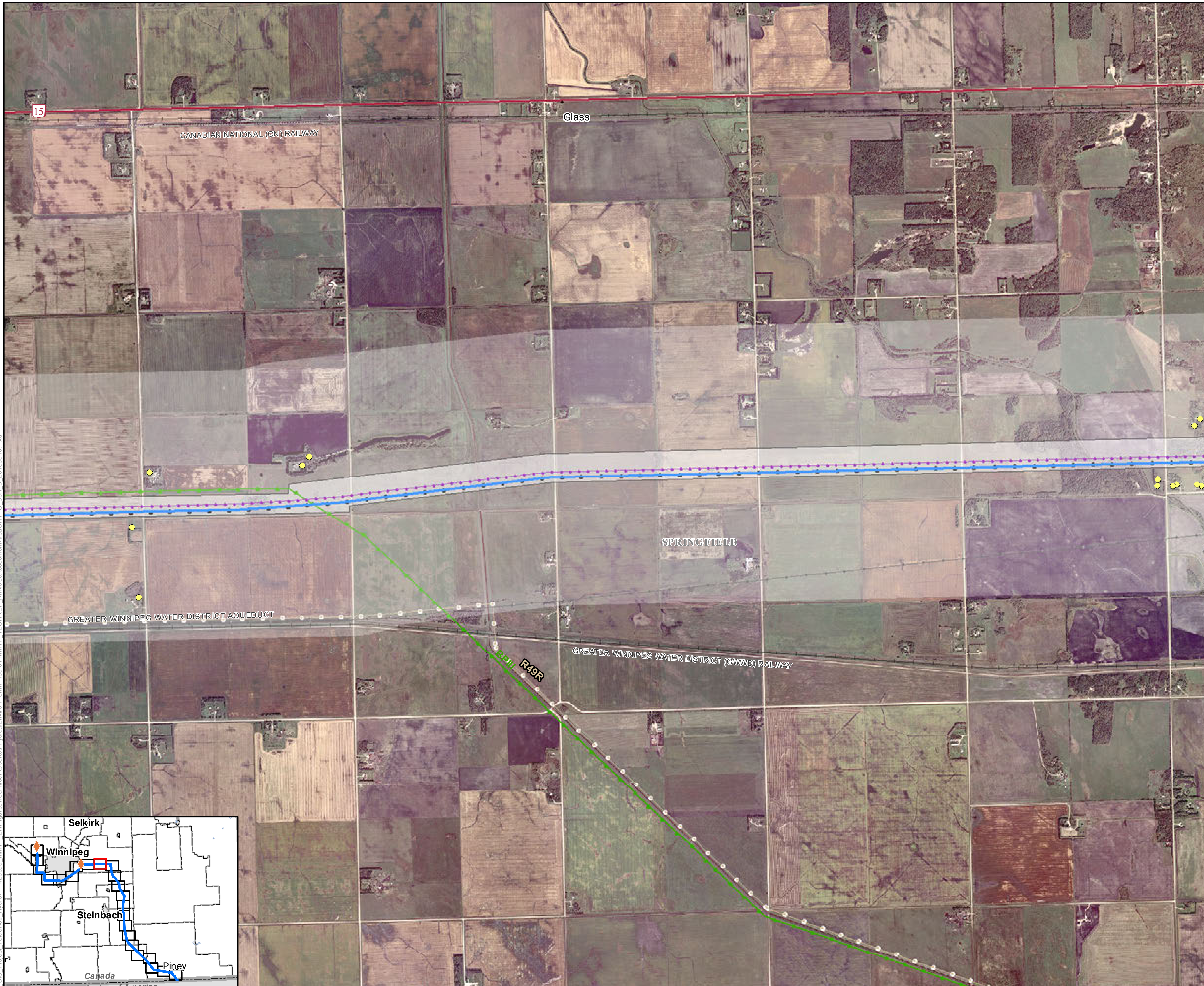
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-08



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)
- M602F Modification (New)

Infrastructure

- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line
- Bipole III Transmission Line (Approved)
- Existing 115-230kV Transmission Line

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

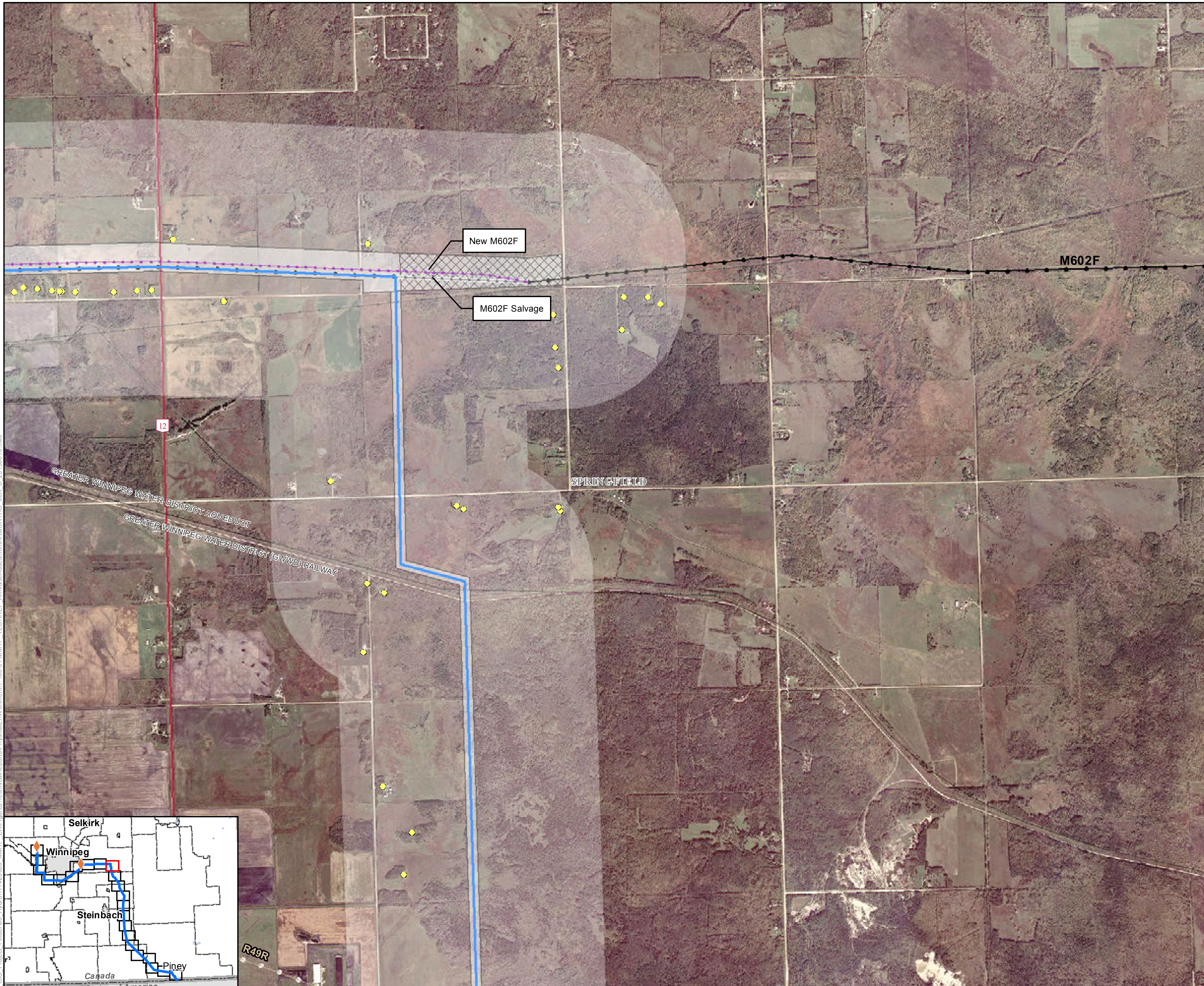
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-09



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)
- M602F Modification (Salvage)
- M602F Modification (New)
- M602F Extension and Salvage

Infrastructure

- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line
- Existing 115-230kV Transmission Line

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

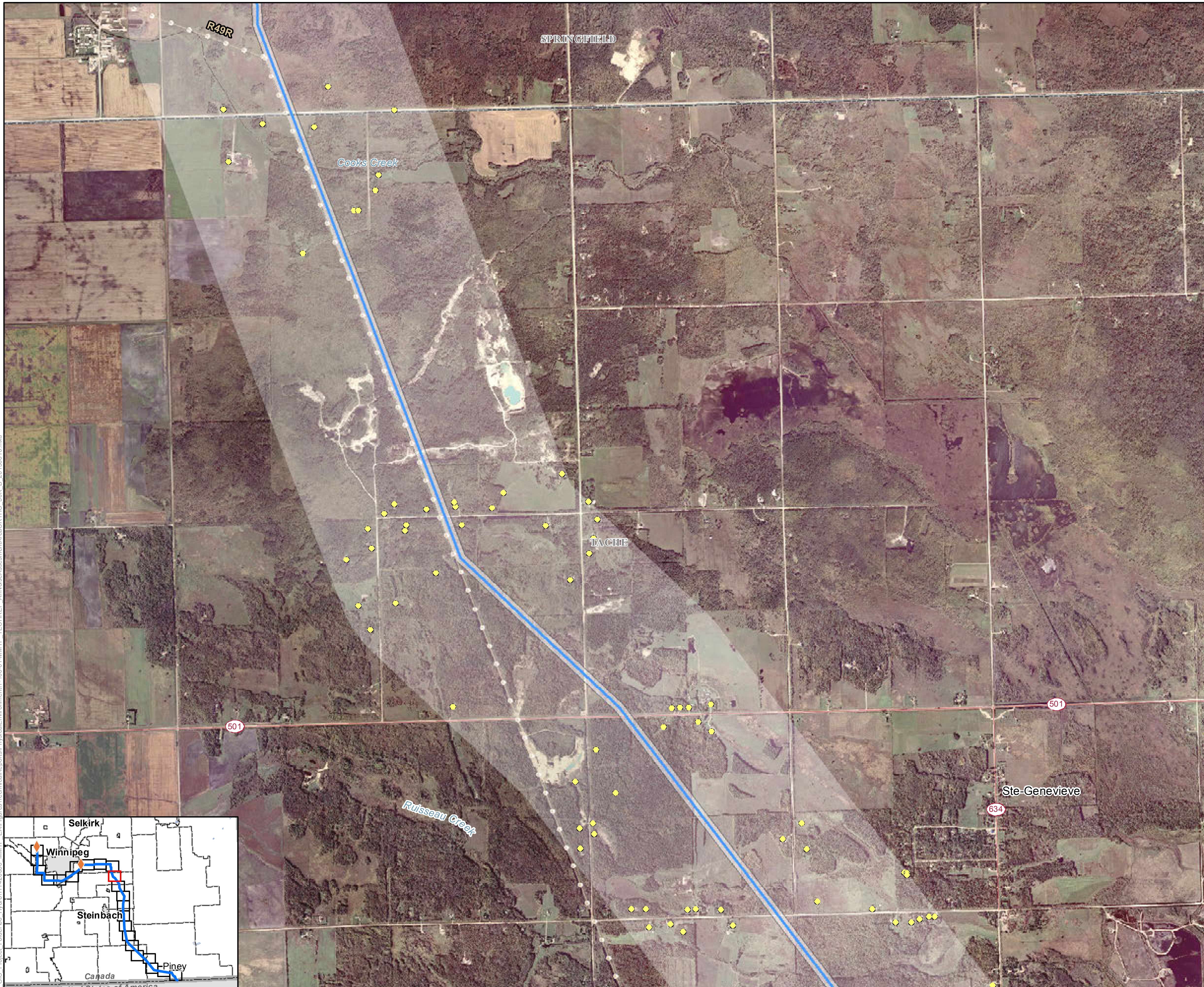
0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-10

G:_GIS_Project_Folder\00_Hydro\111420050_MMTP_EA\Figures\TechnicalReports\PhysicalEnvironment\1-100-01-MMTP_TECHREP_AirNoiseAssesmentAreaORTHO_30K_B_20150616.mxd



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Existing 230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

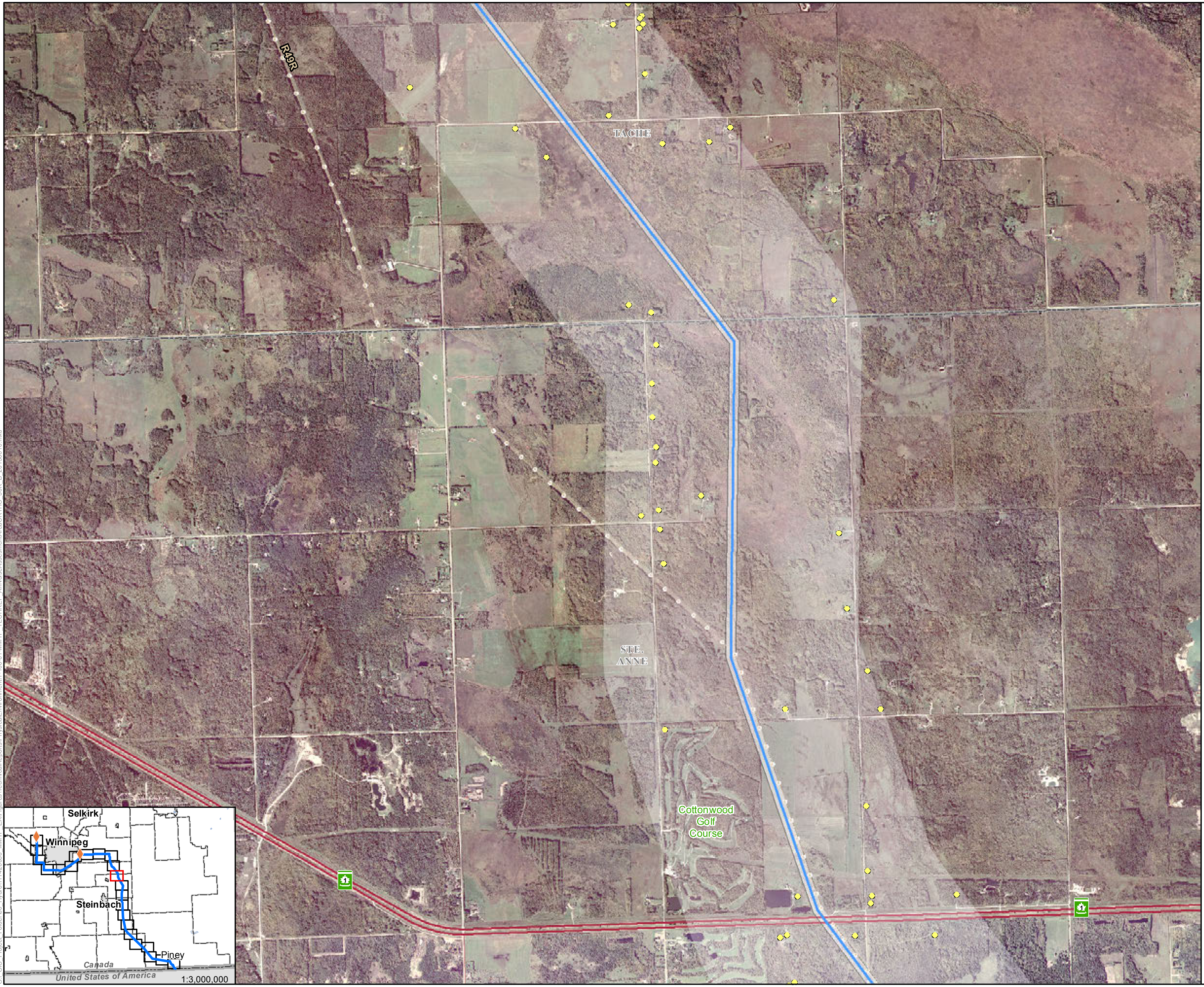
0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-11



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Existing 230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

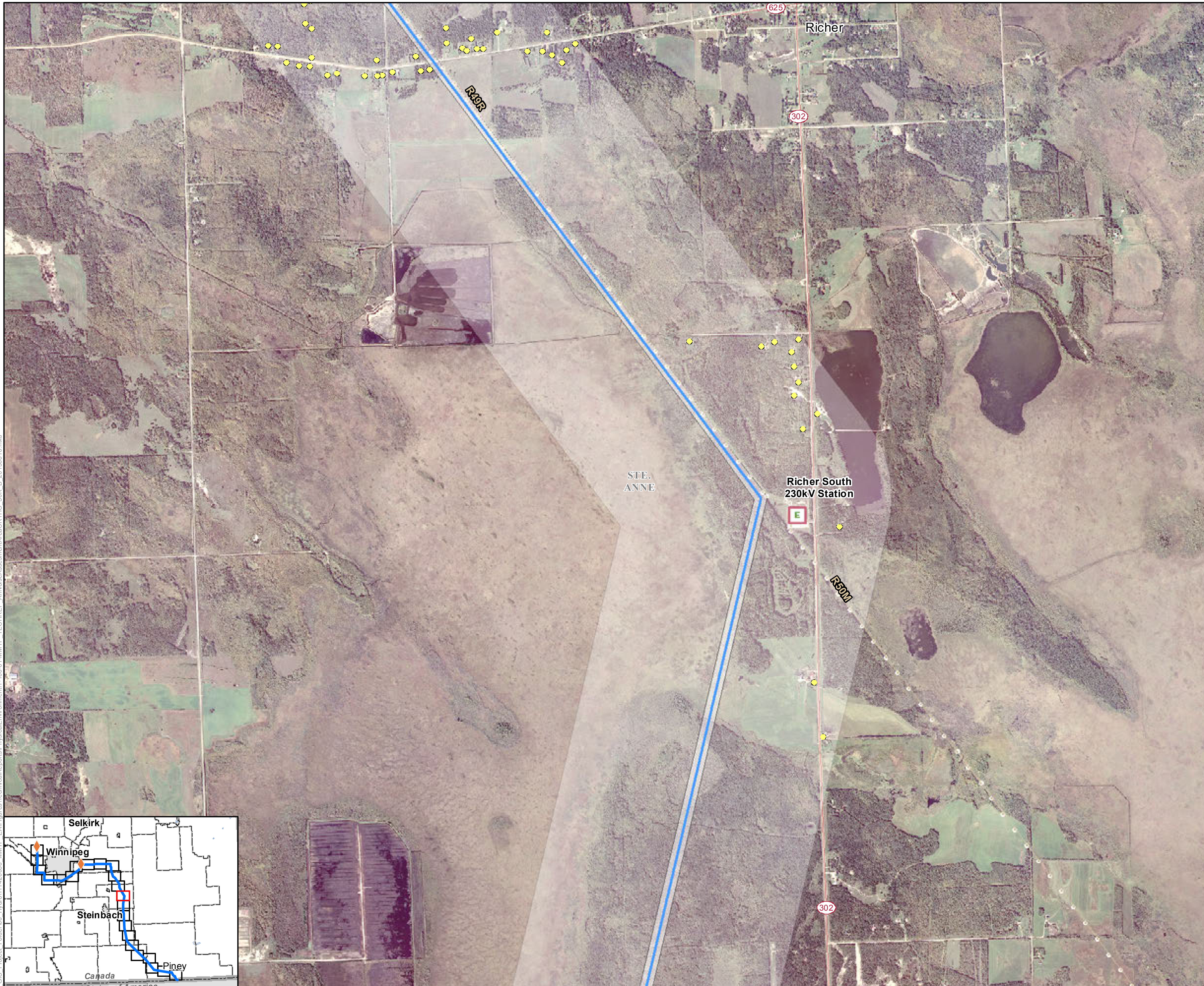
0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-12



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Electrical Station

Existing 230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

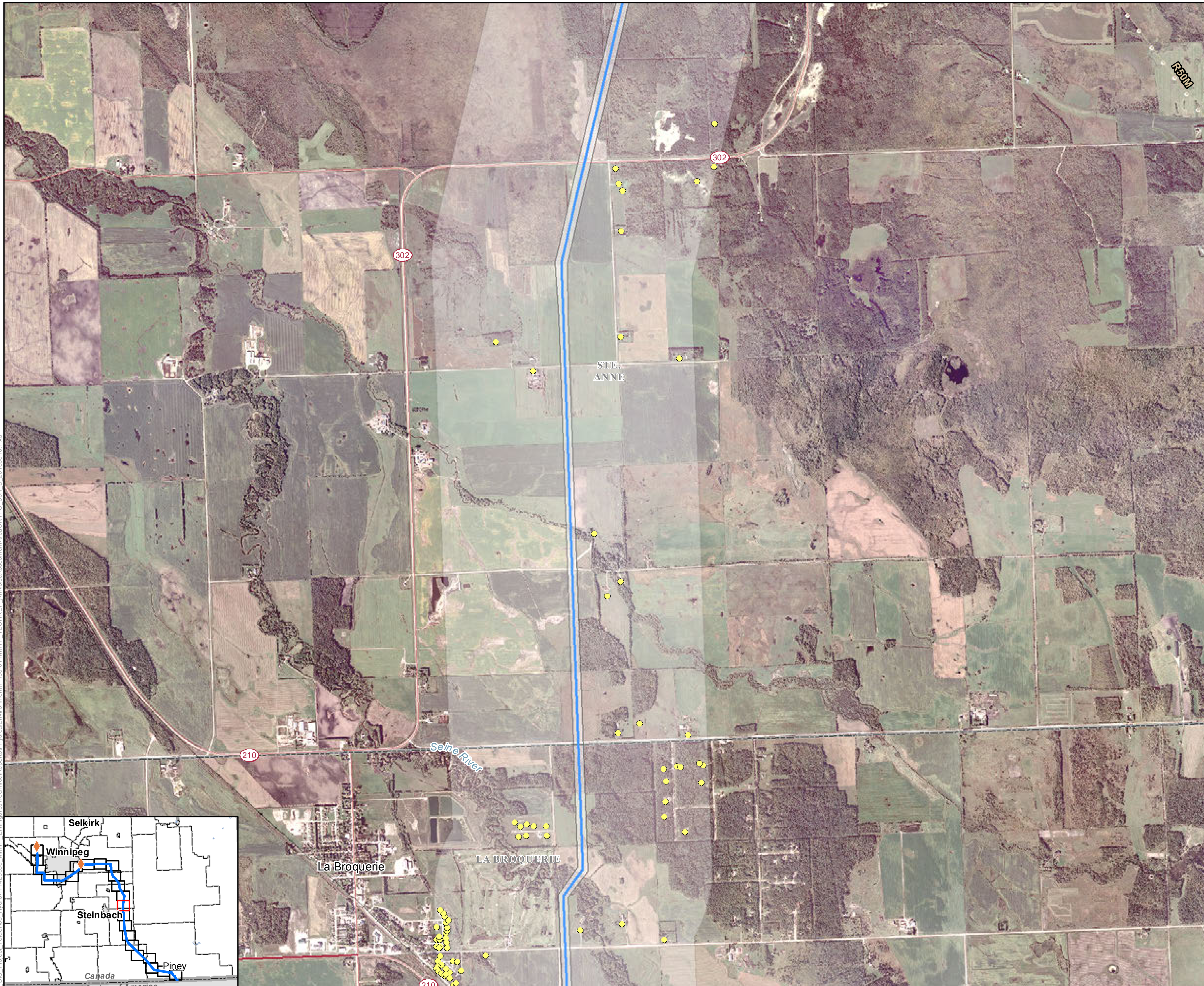
0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-13



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Infrastructure

Existing 230kV Transmission Line

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

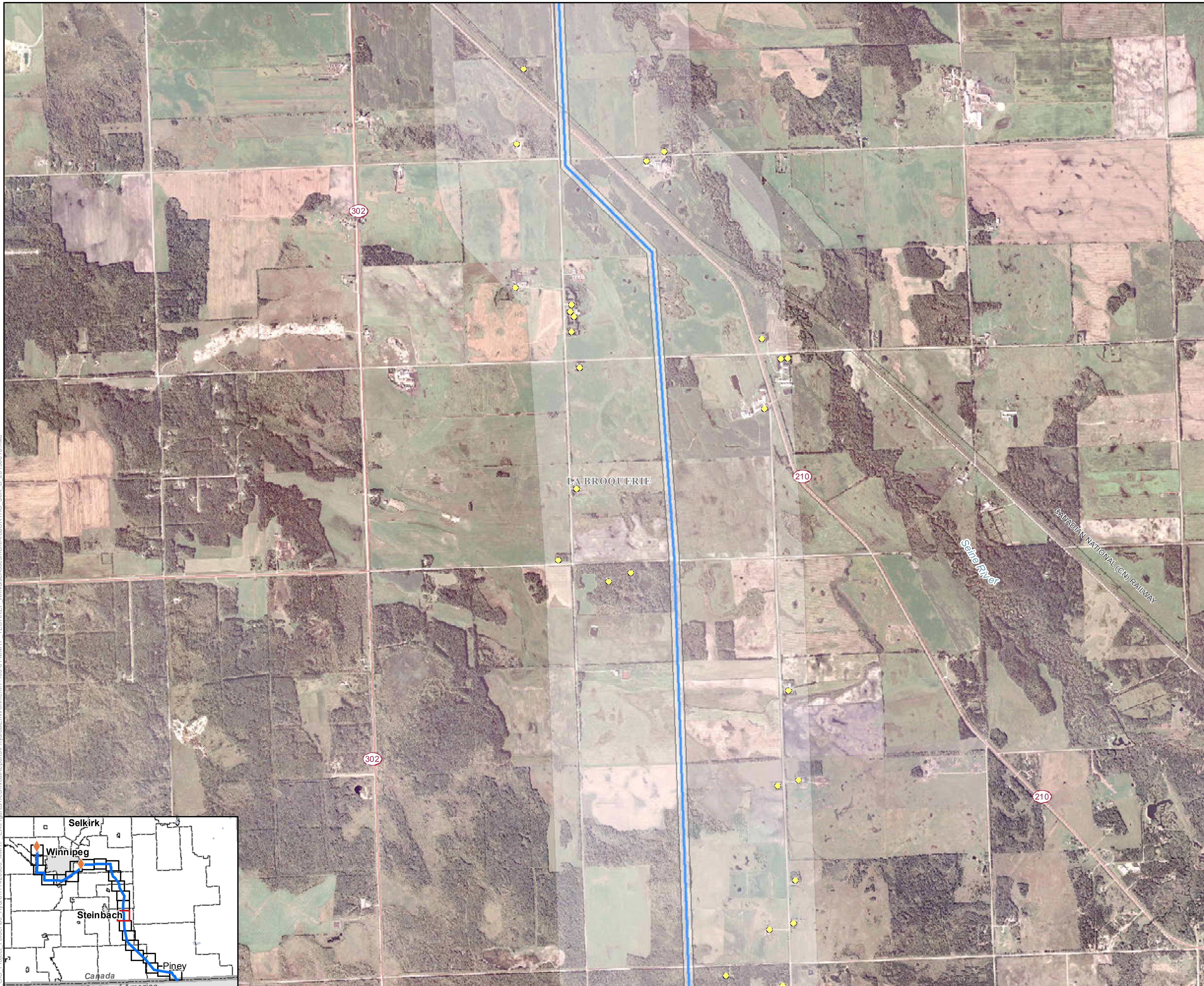
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-14



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
Final Preferred Route (FPR)

Receptor[1]
Occupied House

Assessment Area
Project Development Area (PDA)
Local Assessment Area

Landbase
Community
Trans Canada Highway
Provincial Highway
Provincial Road
City / Town
First Nation Lands
Rural Municipality
Ecological Reserve
Crown Land
Wildlife Management Area
Provincial Park
Watercourse
Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

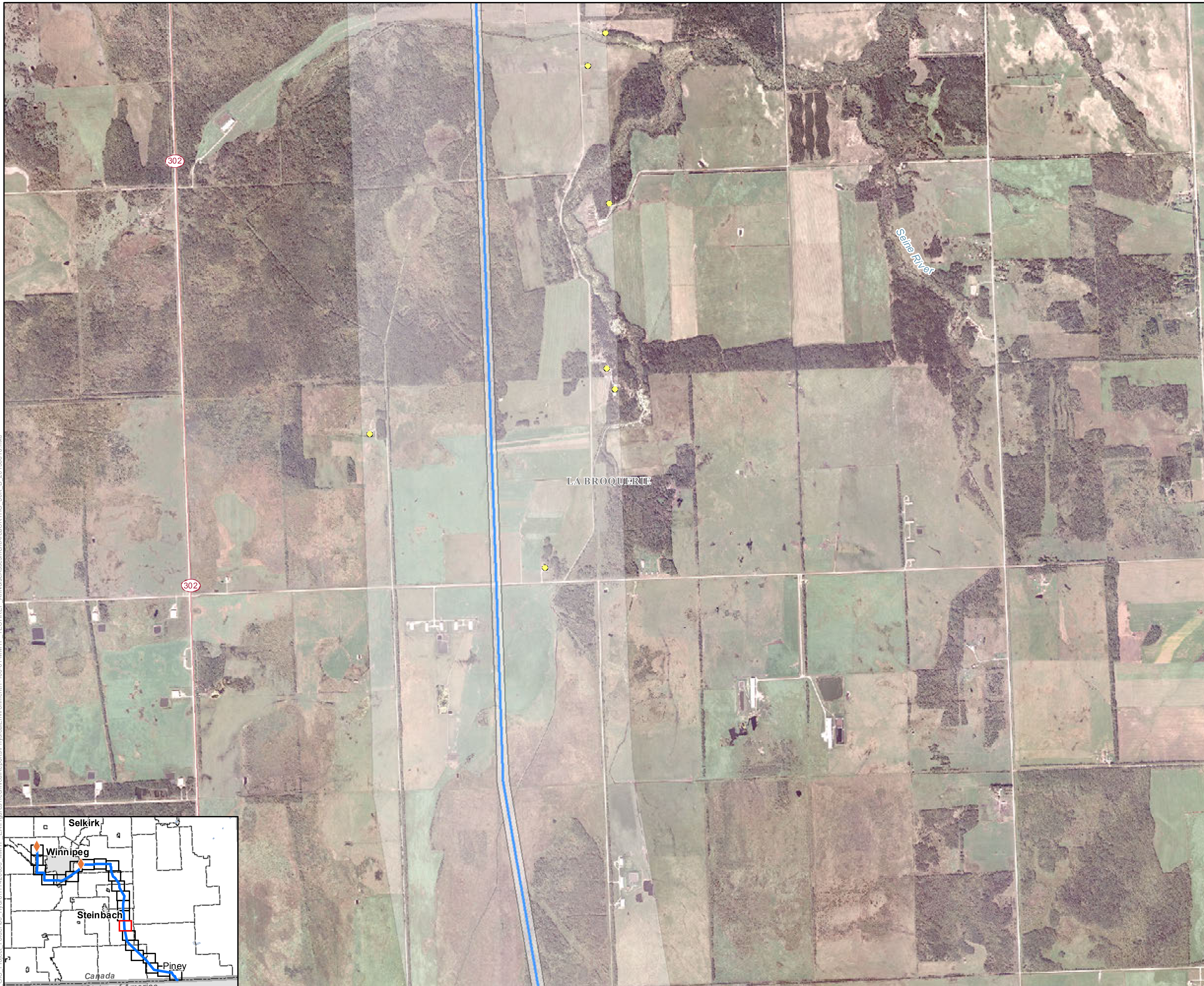
0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-15

G:_GIS_Project_Folder\00_Hydro\11142050_MMTP_EA\Figures\TechnicalReports\PhysicalEnvironment\1-100-01-MMTP_TECHREP_AirNoiseAssessmentAreaORTHO_30K_B_20150616.mxd



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community
Trans Canada Highway
Provincial Highway
Provincial Road
City / Town
First Nation Lands
Rural Municipality
Ecological Reserve
Crown Land
Wildlife Management Area
Provincial Park
Watercourse
Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

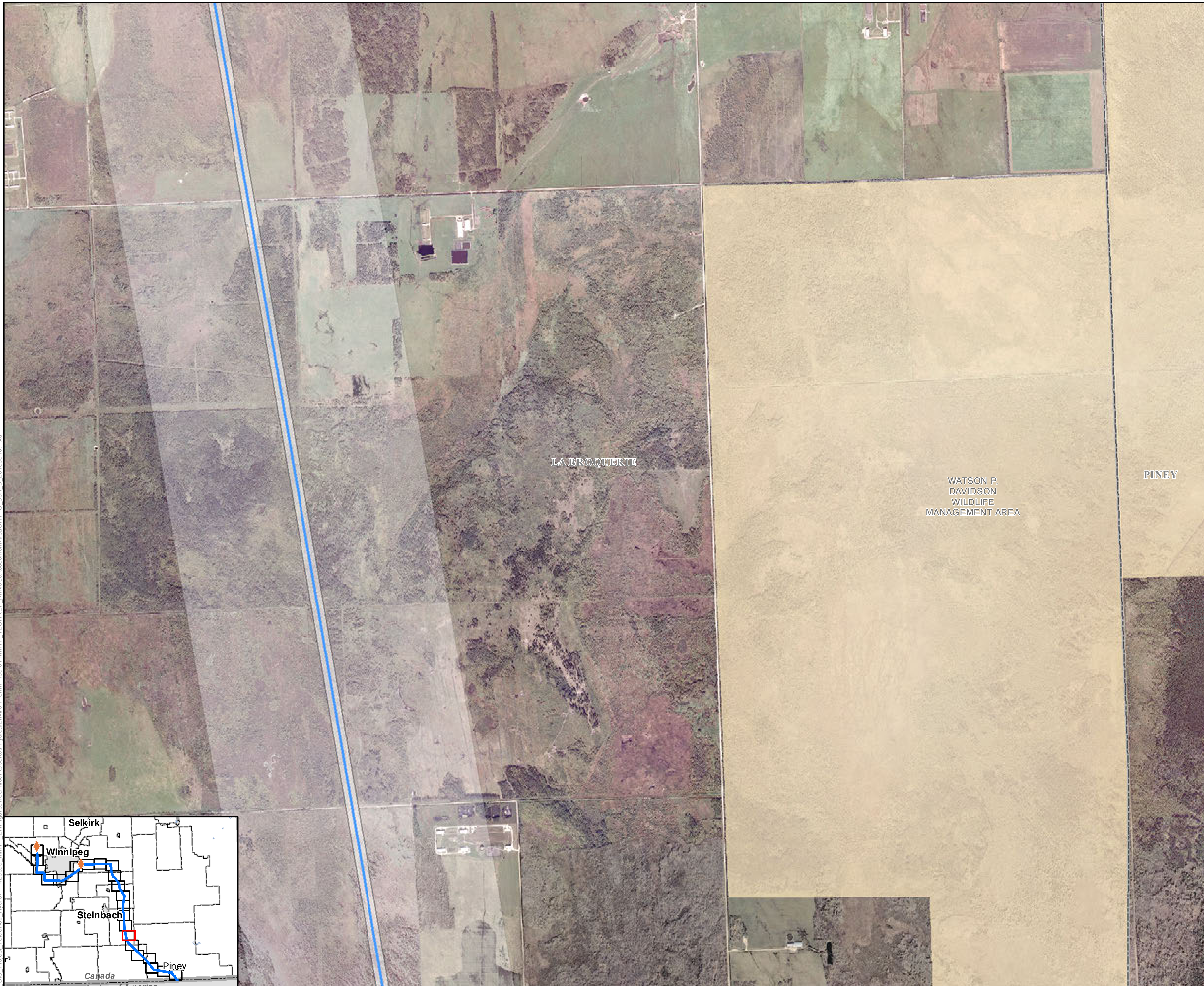
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-16



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

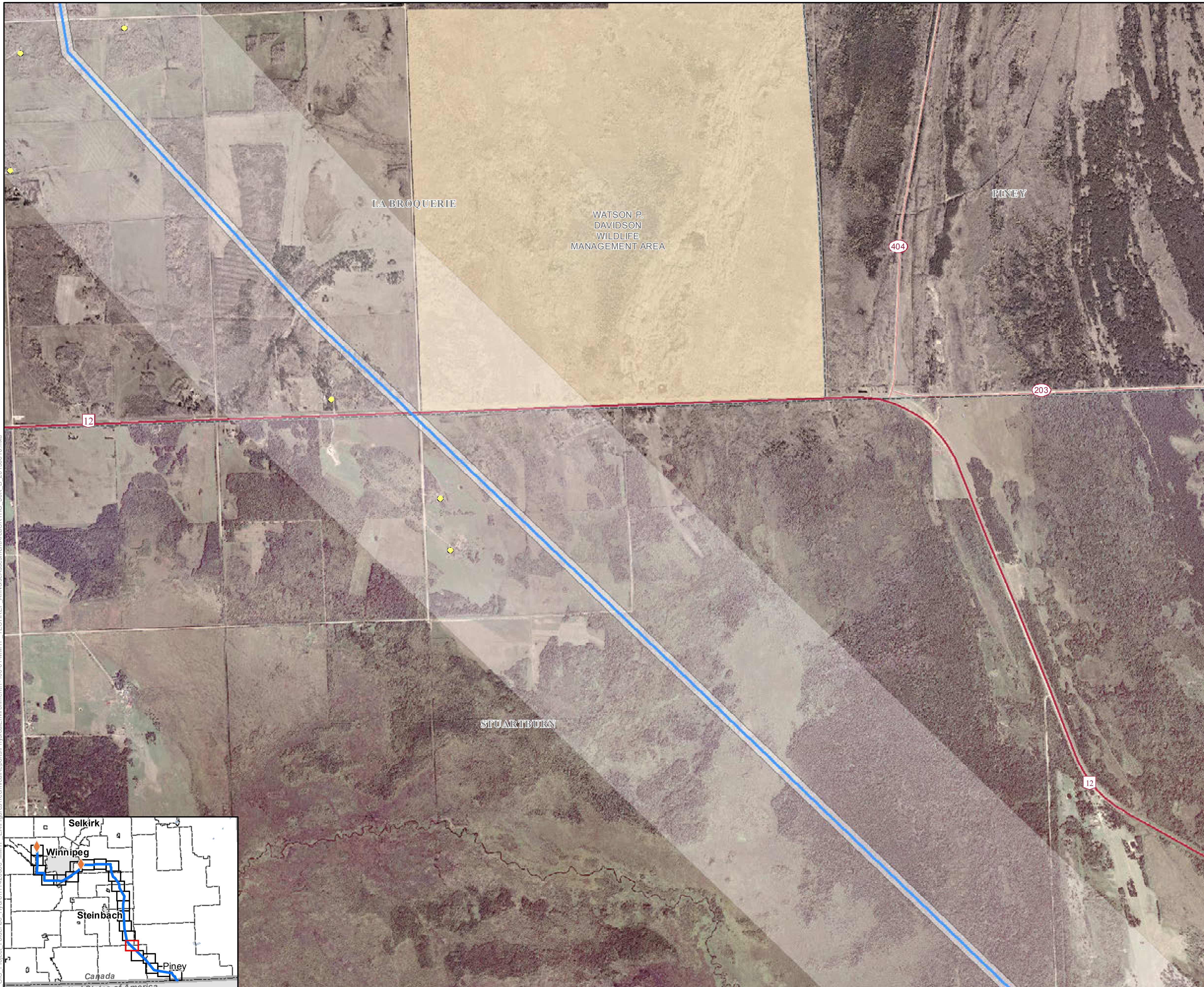
0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-17



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

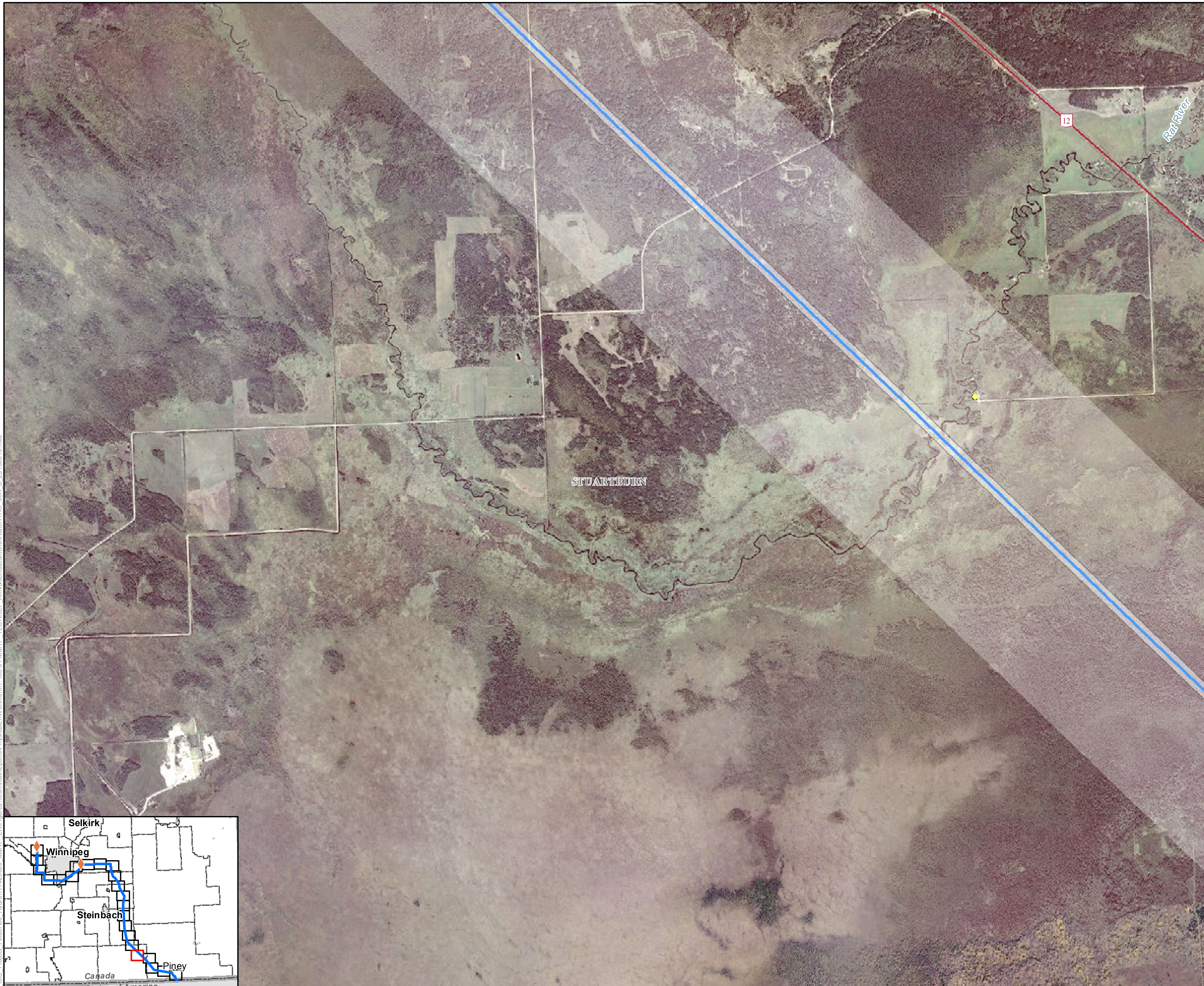
N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-18



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-19

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-20

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- Provincial Road
- City / Town
- First Nation Lands
- Rural Municipality
- Ecological Reserve
- Crown Land
- Wildlife Management Area
- Provincial Park
- Watercourse
- Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-21

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

Final Preferred Route (FPR)

Receptor[1]

Occupied House

Assessment Area

Project Development Area (PDA)

Local Assessment Area

Landbase

Community

Trans Canada Highway

Provincial Highway

Provincial Road

City / Town

First Nation Lands

Rural Municipality

Ecological Reserve

Crown Land

Wildlife Management Area

Provincial Park

Watercourse

Waterbody

Source:
1. Occupied House, 2013-15, Manitoba Hydro and Stantec (Data acquired through air photo interpretation and windshield survey)

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 11, 2015

N

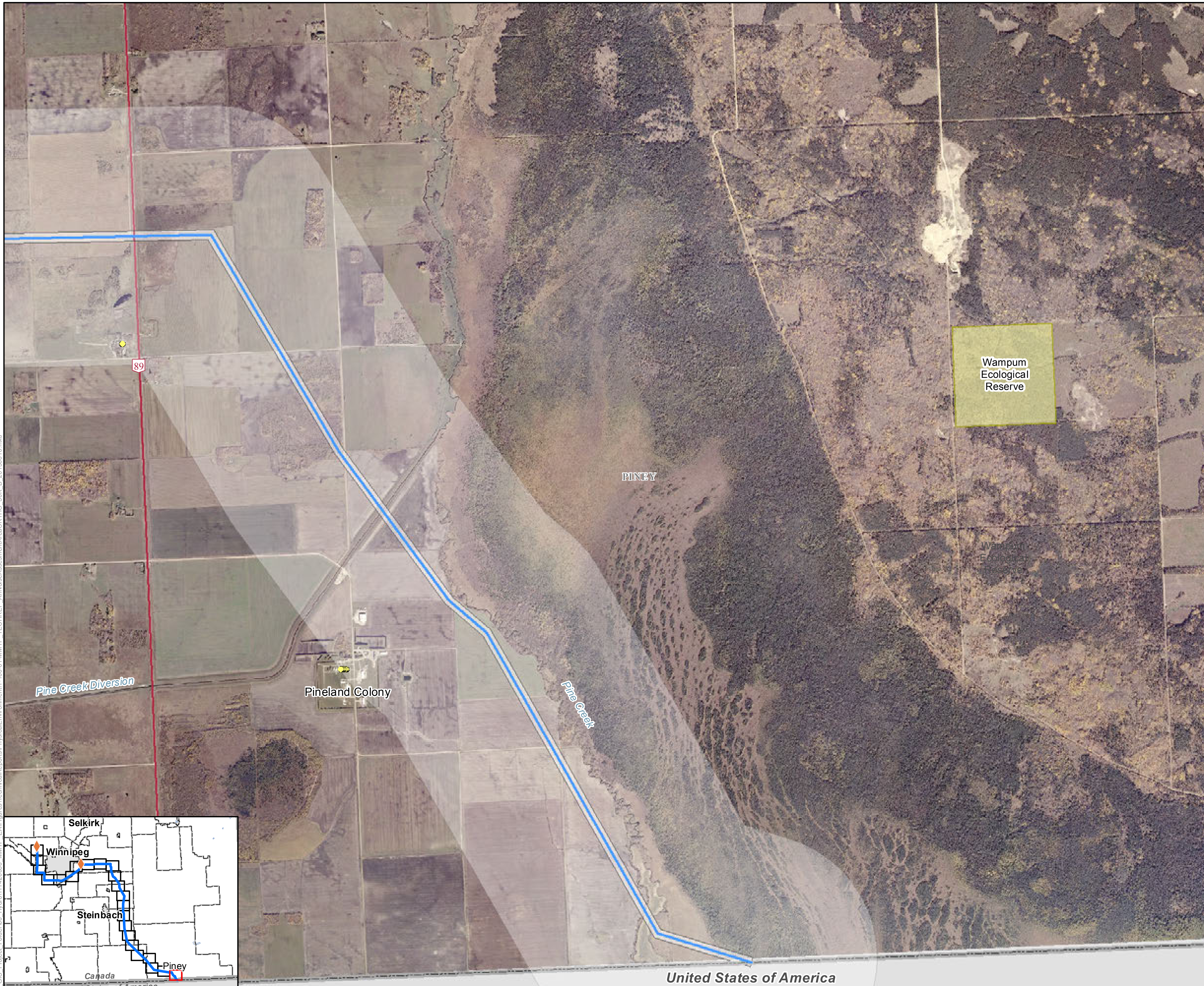
0 0.5 1 Kilometres

0 0.25 0.5 Miles

1:30,000

Receptor Locations

Map 1-100-22



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

Receptor[1]

- Occupied House

Assessment Area

- Project Development Area (PDA)
- Local Assessment Area

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
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Receptor Locations

Map 1-100-23