MANITOBA-MINNESOTA TRANSMISSION PROJECT
BOTANICAL AND VEGETATION ENVIRONMENTAL MONITORING

ANNUAL TECHNICAL REPORT – Year III

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SUMMARY

Botanical and vegetation resources were assessed in Year III post-construction environmental monitoring. Surveys were completed for golden-winged warbler habitat, with botanical summaries presented, and for select invasive plant species sites to determine species presence and distribution. The accuracy of effect predictions and the effectiveness of mitigation are discussed for golden-winged warbler habitat. The environmental monitoring schedule for wetlands and traditional use plant species were completed in 2021 (two years post-construction), while the schedule for invasive plant species and species of conservation concern was completed in 2020 (one-year post-construction).

Thirteen sites were re-visited to monitor golden-winged warbler habitat that intersects the final preferred route RoW. There is once again a general increase in cover and richness in the lower vegetation canopies between this year and last year's post-construction growth, with ongoing vegetation regeneration. In 2022, the cover and richness measures in the understory are comparable to or above their baseline values (2019), and no significant differences were found between understory cover ($p=0.057$) or richness ($p=0.223$) from 2019 and 2022 surveys. After three seasons of re-growth since clearing, notable differences in the understory cover and structure in GWW sites include an increase of herbaceous forb cover (27.8% in 2022, from 19.7 in 2019), and an increase in tree seedling cover (11.2% in 2022, from 3.5 in 2019). While the mid-canopy woody layer continues to regenerate post-construction, the current cover, species richness and diversity measures are still significantly lower ($p<0.05$) than baseline measures. In the mid-canopy, tall shrubs continue to show a reduced cover (1.9% in 2022, from 11.3% in 2019), however, the cover of tree saplings remains comparable between surveys conducted in the current year and during pre-construction surveys. On the RoW, tree canopy cover in the tallest stratum is generally absent from GWW sites. Three community types were identified, distinguished by species composition, abundance and emerging structure.

Twenty-eight noxious, invasive or non-invasive SNA species were recorded along the RoW throughout vegetation monitoring this season. Species were recorded in surveys for golden-winged warbler habitat and from additional select sites visited to assess the presence of noxious plants previously recorded. Of these species, 11 are listed in the Manitoba Noxious Weed Act as noxious weeds harmful to livestock or agricultural crops. Three notable noxious species were recorded including Tier 1 spotted knapweed, and Tier 2 species hoary alyssum and oxeye daisy. At least 10 species are considered invasive (not listed noxious) due to their tendency to outcompete native species, and dominate habitats once introduced. In general, the abundance and distribution of Tier 1 and 2 noxious species

recorded at select invasive monitoring sites was reduced this season, compared to previous monitoring results.

During sampling this season, five species of conservation concern were recorded in plots and as incidentals from sampling, throughout the RoW. Among these, one species was ranked Imperilled (S2S3), while the remaining four species are ranked Vulnerable (S3 to S3S5). One species at risk was observed during project monitoring. Riddell's goldenrod is listed as Threatened under the Manitoba's *Endangered Species and Ecosystems Act* and Special Concern by the federal *Species at Risk Act* and the Committee on the Status of Endangered Wildlife in Canada.

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1.0 INTRODUCTION

On April 4 2019, the Minister of Sustainable Development granted an Environment Act Licence (Class 3 No. 3288) to Manitoba Hydro for the construction, operation, and decommissioning of the Manitoba-Minnesota Transmission Project. On June 13 2019, a Certificate of Public Convenience and Necessity was obtained from the National Energy Board (EC-059). Clearing and construction for the Project began in the fall of 2019 and was completed during the spring of 2020. In the summer of 2022, botanical and vegetation resources were assessed in Year III of environmental monitoring for the Manitoba-Minnesota Transmission Project.

The Manitoba-Minnesota Transmission Project is a new high voltage alternating current (AC) transmission project required to deliver contracted quantities of power to and from the United States. It will improve reliability through an increase in capacity during drought and emergency situations, and increase Manitoba Hydro's involvement in the electricity markets in the United States (Manitoba Hydro 2015). The Manitoba-Minnesota Transmission Project involved construction of a 500-kilovolt AC transmission line in southeastern Manitoba and upgrades to associated converter stations at Dorsey, Riel and Glenboro. The transmission line starts at the Dorsey Converter Station (located near Rosser, northwest of Winnipeg) and travels south around Winnipeg and passes near the Riel Station, east of the city (Southern Loop corridor). The line continues south to the Manitoba–Minnesota border and connects to the Great Northern Transmission Line (Map 1-1, Appendix II).

The Manitoba-Minnesota Transmission Project occurs over four ecoregions including (from west to east) the Aspen Parkland, Lake Manitoba Plain, Interlake Plain, and Lake of the Woods. The Glenboro South Station is the only project component located in the Aspen Parkland Ecoregion. The Project traverses developed land, agricultural land, and native vegetation including deciduous forest, coniferous forest, mixedwoods, shrubland, grassland, and wetlands. All four ecoregions are heavily influenced by agricultural activities.

This assessment involved environmental monitoring along the final preferred route right-of-way (RoW). Potential environmental effects as a result of the Project are listed in Appendix III, which were identified in the Manitoba-Minnesota Transmission Project Environmental Impact Statement (Assessment of Potential Environmental Effects on Vegetation and Wetlands, Chapter 10; Manitoba Hydro 2015). Project commitments for environmental monitoring of botanical and vegetation resources are identified in Appendix IV. The specific objectives remaining for this study, based on the Environmental Monitoring Plan (Manitoba Hydro 2019a), and review of the Report on Public Hearing (Manitoba Clean

Environment Commission 2017), Environment Act Licence, and National Energy Board Certificate, were as follows:

- Conduct environmental monitoring of golden-winged warbler habitat; and
- Conduct environmental monitoring for invasive and noxious plant species.

The following hypotheses were developed for environmental monitoring of botanical and vegetation resources for the MMTP project:

Hypothesis 1: *There are observed differences in species composition within sites being monitored over successive years along the transmission line right-of-way.*

Hypothesis 2: *Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way.*

2.0 BACKGROUND

The following section discusses the environmental monitoring background for golden-winged warbler habitat and invasive plant species.

2.1 Golden-winged Warbler Habitat

The Golden-winged warbler (*Vermivora chrysoptera*) is a species of conservation concern listed as Threatened by *The Endangered Species and Ecosystems Act* (ESEA) in Manitoba, the federal *Species at Risk Act* (SARA), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). In Manitoba, the golden-winged warbler is ranked as uncommon throughout its range or in the province, with breeding status (S2S3B), by the Manitoba Conservation Data Centre (MBCDC). Golden-winged warbler nesting and foraging habitat requirements include a patchy mixture of shrubs, saplings, herbaceous openings, scattered canopy trees and mature deciduous forest, e.g., a combination of early successional habitat alongside a mature forest edge. Trees are used primarily for song posts and foraging, and transitional edges of forests are often used for nest placement. The golden-winged warbler is well adapted to the dynamic habitat created by periodic disturbances, which in highly human-modified environments can include utility right-of-way maintenance (Environment and Climate Change Canada 2016). Golden-winged warblers were identified as a species requiring careful consideration due to their Threatened designation, and the identification of critical habitat along a portion of the Project area. As outlined in the environmental assessment, Manitoba Hydro carried out detailed studies on the breeding locations, habitat preferences, and species biology in preparing the Construction Environmental Protection Plan and Environmental Monitoring Plan. Thirteen sites were surveyed for golden-winged warbler habitat along the final preferred route during pre-construction surveys (Szwaluk Environmental Consulting and Newman 2019).

Clearing of the RoW is the primary project activity that may result in a change in habitat for the golden-winged warbler. In recognition of this, Manitoba Hydro has developed a Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat during Construction and Operation of the Manitoba-Minnesota Transmission Project (Environment Canada IR EC/MH-003). To validate EIS predictions, verify implementation of mitigation measures, and to allow for adaptive management, post-construction monitoring will identify changes to golden-winged warbler habitat. Monitoring activities for golden-winged warbler habitat are identified in Table 2-1.

Mitigation measures identified in the Construction Environmental Protection Plan

- Refer to Clearing Management Plan for detailed clearing prescriptions.

- Retain shrubs and herbaceous vegetation <4m tall to the extent possible.
- Typically, 5-10 perch trees must be retained per span where feasible.

Table 2-1. Monitoring activities for golden-winged warbler habitat.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Desktop and field surveys	Habitat location	Identif-ied in PDA, LAA, RAA	1 field season	Once	2014	Habitat composition; auditory or visual detection
Pre-construction	Analyze imagery to confirm location and record baseline vegetation information	Vegetation cover	PDA	Pre-construct-ion	Once	Summer	Species composition and abundance
Construction	Ground surveys to identify vegetation changes not discernible from habitat mapping	Vegetation cover	PDA	During construct-ion	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify vegetation changes not discernible from habitat mapping	Vegetation cover	PDA	2yrs	Annual	Summer	Species composition and abundance

2.2 Invasive Plant Species

As outlined in Chapter 10 of the EIS, the prevalence of non-native and invasive plant species (including noxious species) may increase as a result of the Project. Non-native species are plants that grow outside of their normal range while invasive species are plants that out-compete native species when introduced outside of their natural setting. Noxious species have the ability to spread rapidly and are designated by regulation, *The Noxious Weeds Act* (Manitoba Government 2022).

Construction equipment and vehicles can introduce non-native and invasive plants. During the field assessments in 2014, 10 noxious species were observed in the PDA (Manitoba Hydro 2015). About half of the species were encountered in areas of disturbance (i.e., cleared areas, gravel pits, roads, ATV trail edges) or near agricultural fields (cultivated and pasture). During pre-construction surveys for ATK, WET (2017) and GWW (2019), there were seven noxious species (all Tier 3) recorded, with an additional nine invasive or non-native species in these components. In Year II of monitoring there are 16 noxious species recorded, with an additional 24 invasive or non-native species recorded in ATK, GWW and WET surveys.

Non-native and invasive species can be problematic by displacing or outcompeting native species through several mechanisms. Non-native and invasive species can grow vigorously under a wide range of climatic and soil conditions, they are often early colonizers after disturbance, and plants persist even with removal of vegetative portions. Seed production is generally abundant and can occur under conditions otherwise adverse for native plants. The seeds of many invasive and non-native plants are easily disseminated and can be long lived in the seed bank.

To validate EIS predictions, verify implementation of mitigation measures, and to allow for adaptive management, post-construction monitoring will identify changes in species composition and abundance. Monitoring activities for invasive plant species are identified in Table 2-2.

Mitigation measures identified in the Construction Environmental Protection Plan

- Implement Biosecurity cleaning measures as per the Biosecurity Management Plan (for Tier 1 Noxious Weeds).
- Confine vehicle traffic to established trails to the extent possible.
- In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan for mitigation.

Table 2-2. Monitoring activities for invasive plant species.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Desktop and field surveys	Species names and locations	Sites surveyed in PDA, LAA	1 field season	Once	2014	Species composition and abundance
Pre-construction	Ground surveys to record non-native and invasive species	Species occurrence	PDA	Pre-construction	Once	Summer	Species composition and abundance
Construction	Ground surveys to identify and measure occurrence of invasive species on ROW and monitor protection measures	Species occurrence	PDA	During construction	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify and measure occurrence of invasive species on ROW	Species occurrence	PDA	1yr	Annual	Summer	Species composition and abundance

3.0 METHODS

The methods used to assess the botanical and vegetation resources can be divided into three general groups, those used for: i) project review and site selection; ii) environmental monitoring; and iii) data preparation and analyses. The following sections summarize the specific techniques used in each of these three groups.

3.1 Project Review and Sample Site Selection

Biophysical information collected and prepared for the Manitoba-Minnesota Transmission Project with relevance to pre-construction surveys and subsequent environmental monitoring was reviewed prior to fieldwork. Applicable documents included the Environmental Impact Statement (Manitoba Hydro 2015), Environmental Monitoring Plan (Manitoba Hydro 2019a), Construction Environmental Protection Plan (Manitoba Hydro 2019b) and Mapbook (Manitoba Hydro 2020), Botanical and Vegetation Pre-construction Surveys (Szwaluk Environmental Consulting and Newman 2017 and 2019), the Invasive Plant Pre-construction Survey (Szwaluk Environmental Consulting 2018), and the Botanical and Vegetation Environmental Monitoring Technical Reports (Szwaluk Environmental Consulting and Newman 2020 and 2021). Pre-construction and environmental monitoring requirements for vegetation are specified in the Environmental Monitoring Plan (Manitoba Hydro 2019a). Regulatory documents were also reviewed to determine environmental monitoring requirements for vegetation (see Appendix IV).

To select preliminary pre-construction and environmental monitoring sites for the Project, the Environmental Protection Information Management System (EPIMS) Map Viewer was used to view project footprint imagery (pre-clearing digital ortho-rectified imagery). EPIMS Map Viewer imagery provides information on land use, environmentally sensitive sites, and the Manitoba land cover classification. Eighteen cover classes are identified, with broad vegetation classes including coniferous, deciduous and mixedwood forest, wetland and grassland.

Suitable sites were selected based on vegetation type, accessibility, disturbance (i.e., sites where invasive and non-native species may establish and proliferate), and landowner permission. In 2022, previously surveyed sites (2017 through 2021) were reviewed to determine their location along the final preferred route (FPR) RoW. Field maps (1:10,000) were provided by Manitoba Hydro prior to fieldwork (Construction Environmental Protection Mapbook; Manitoba Hydro 2020).

Valued components of the biophysical environment (i.e., vegetation) were identified to sample and monitor for the Manitoba-Minnesota Transmission Project. Environmental indicators were identified based on regulatory, environmental and cultural importance,

identified through the environmental assessment process and preparation of the monitoring plan. Remaining indicators for monitoring included golden-winged warbler habitat and invasive plant species.

3.2 Environmental Monitoring

Post-construction environmental monitoring began in 2020 after clearing and construction activities were completed. This season (2022) represents Year III of post-construction monitoring. Pre-construction surveys for the project were conducted in 2017, 2018 and 2019.

Environmental monitoring involved native vegetation surveys (quantitative) in selected habitats along the FPR. In 2022, environmental monitoring included sites for golden-winged warbler habitat (GWW) and select sites for invasive plant species. The monitoring schedule for wetlands and traditional use plant species were completed in 2021 (two years post-construction), while monitoring for invasive plant species and species of conservation concern was completed in 2020 (one-year post-construction). No further targeted monitoring for these components occurred in 2022 with the exception of select sites on the FPR to re-assess invasive plant species presence and distribution.

3.2.1 Native Vegetation Survey

Sites previously selected for native vegetation surveys were used for continued monitoring of golden-winged warbler habitat. The native vegetation survey consisted of establishing sample plots on sites with relatively homogenous vegetation. Vegetation was sampled for composition, abundance and structure.

Sampling of selected sites followed methods outlined by Redburn and Strong (2008) and involved the establishment of five 1 m^2 quadrats nested within 2.5 m^2 quadrats to sample herbs and low shrubs (≤1 m) and tall shrubs and saplings (>1 - 2.5 m), respectively. Quadrats were spaced at 5 m increments along a 30 m transect, starting at the 5 m mark. The composition of vegetation cover >2.5 m tall was estimated using a 20 m by 30 m plot centered on each transect. Plant cover was estimated to the nearest 1% for species <15% cover and nearest 5% for those with higher cover. Other incidentally observed species were recorded. Ground cover estimates (percent) were recorded and included inanimate cover of exposed soil, litter, rock, water and wood. Site condition measurements included percent slope and aspect. Plot locations were marked at the beginning of each transect with GPS coordinates, and staked with a 30 cm section of conduit pipe driven into the ground with a pin flag inserted.

3.2.2 Invasive Plant Monitoring

Surveys for invasive plant species occurred at 22 select locations along the FPR to monitor species presence and distribution. Weed density distribution (Appendix V) followed Adams et al. (2009). At each location, the site was traversed by foot and scanned for the targeted invasive species. Environmental monitoring for invasive plant species was completed in 2020, one-year post-construction.

3.2.3 Conservation Status Ranking

Plants species of conservation concern were recorded when encountered during monitoring of GWW sites. Species of conservation concern encompass plants tracked by the Manitoba Conservation Data Centre (MBCDC), and include those listed provincially under Manitoba's *Endangered Species and Ecosystems Act* (ESEA), or federally under the *Species at Risk Act* (SARA) or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Species are ranked provincially by the MBCDC according to a standardized procedure used by Conservation Data Centres and Natural Heritage Programs in North America on a five-point scale from Critically Imperilled to Secure. Listed below are definitions for interpreting conservation status ranks at the subnational or provincial (S) level. Ranks may also be intermediary between levels.

CRITICALLY IMPERILLED (S1): At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

IMPERILLED (S2): At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

VULNERABLE (S3): At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

APPARENTLY SECURE (S4): At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

SECURE (S5): At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

Under ESEA, SARA and COSEWIC, species are designated into the following categories: Endangered, Threatened, Extirpated, and Special Concern (see Appendix I).

Environmental monitoring for species of conservation concern was completed in 2020, one-year post-construction.

3.3 Data Preparation and Analyses

All vascular plants were recorded and voucher specimens were collected for those unidentifiable in the field, where the population size permits. Specimens were collected following guidelines of the Alberta Native Plant Council (2006). Identification of vascular plants followed Flora of North America (1993+), and other flora as needed. Plant nomenclature followed the Manitoba Conservation Data Centre (Manitoba Government 2022a).

Upon completion of field sampling, the data was digitized and verified for accuracy. For each plot with quantitative sampling, mean values for vegetation percent cover were calculated in plots for tree and tall shrub strata, herb and low shrub understory, the non-vascular stratum, as well as inanimate ground cover.

Total species cover (summed % plant cover) and species richness (actual number of species present) were determined for each plot. Species diversity was calculated using the Shannon diversity index, which combines species richness with relative abundance. Equitability was calculated to determine the evenness of species in their distribution within the site.

The Shannon diversity index (1) and equitability (2) are calculated as shown below. The diversity index values fall generally between 1.5 (i.e., low diversity) and 3.5 (Kent and Coker 1996, p97). The equitability (or evenness) value, with an upper limit of 1, is a measure of whether species abundance in a community is evenly distributed.

$$(1) \qquad \text{Diversity } H' = -\sum_{i=1}^{s} p_i \ln p_i$$

where s = the number of species

p_i = the proportion of individuals or the abundance of the *i*th species expressed as a proportion of total cover

ln = log base$_n$

(2) $$\text{Equitability J} = \frac{H'}{H'_{max}} = \frac{\sum_{i=1}^{s} p_i \ln p_i}{\ln s}$$

where s = the number of species

p_i = the proportion of individuals of the *i*th species or the abundance of the *i*th species expressed as a proportion of total cover

ln = log base$_n$

Although recent research suggests that H' is becoming an expected standard for assessing biological diversity, Strong (2016) suggests that this measure be accompanied by independent analyses of richness and evenness to ensure proper representation of abundance data in ecology.

Wilcoxon tests were used to determine if significant ($P \leq 0.05$) differences occurred between paired sets of samples.

Sites were described by classifying community types based on plant species composition and abundance using hierarchical cluster analysis. Ward's method was used as the clustering algorithm, with squared Euclidean distance as the dissimilarity measure. Where vegetation community types are listed, naming was based on their structure and species dominance by stratum. Species separated by a slash (/) indicates a change in stratum, while co-dominant species are separated by a dash (-) indicating similar abundance within the stratum. Stand cover followed categories identified in The Canadian Vegetation Classification System (Strong et al. 1990) and included closed (>60%), open (>25-60%), and sparse (≤25%).

Statistical analyses were performed using the R Statistical Package (R Core Team 2019). Cluster analyses followed (Maechler et al. 2019) in the R Statistical Package. Diversity and evenness measures were calculated in Excel.

4.0 RESULTS

The following section discusses the results for the environmental indicators monitored, including golden-winged warbler habitat (GWW) and invasive plant species (INV) at select sites. Although monitoring for and species of conservation concern (SCC) was completed in 2020, species presence was recorded project wide where observed.

The botanical summary for sites sampled by quantitative survey includes total species cover, species richness, species diversity index, and species evenness. The complete flora is provided in Appendix VIII, with at least 144 plant species across 39 families, recorded in 2022. Throughout results, plants are referred to by English name, with scientific name included on first mention, trees are referred to by common name. The accuracy of effect predictions and the effectiveness of mitigation for sites are discussed.

4.1 Golden-winged Warbler Habitat

Thirteen sites were sampled for golden-winged warbler (*Vermivora chrysoptera*) habitat (GWW) from August 6 to 8, along the FPR RoW (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_FA605). The FPR intersects areas of critical golden-winged warbler habitat, according to the EIS (Chapter 9; Manitoba Hydro 2015).

4.1.1 Data Analysis of Golden-winged Warbler Habitat

Diversity measures from GWW monitoring are presented in detail for the current year, and means are compared between pre-construction (2019) and three subsequent monitoring years (2020 to 2022). Vegetation descriptions are provided for the lowest canopy (the understory, <1m) and the mid canopy (>1 to 2.5m, where present), Table 4-1a. The lowest canopy includes herbaceous forbs and grasses, low shrubs, and the seedlings (<1m) of tall shrubs and trees. The mid-canopy includes tall shrubs, and tree saplings and the occasional low shrub that has exceeded 1m in height. Cover may exceed 100% as individual species cover may overlap within a layer. During monitoring in 2022, the total mean species cover in sites ranges from 26.6 to 109% in the low canopy layer. Sites can be floristically diverse, with an average species richness of 34.4 species recorded in plots, (14 to 54 species). The mean diversity (2.68) and evenness (0.77) are relatively high for all sites. Some very sparse to sparse cover of tall shrubs is present at all sites but one, with an average of 8.6% cover, ranging from nil to 23%. Overall, there is once again a general increase in cover and richness in the lower vegetation canopies between this year and last year's post-construction growth, with ongoing vegetation regeneration. On the RoW, tree canopy cover is generally absent from GWW sites. Four sites had very sparse growth reaching the tree canopy (>2.5 m in height); with cover either at 6% dominated by white spruce, with willow (GWW-19), 1-2% canopy cover by willows (GWW-016; -024), or trembling aspen (GWW-

018), data not shown. The tree canopy cover measured in 2022 is similar to the previous year's cover, with the new addition of trembling aspen.

Table 4-1a. Golden-winged warbler habitat sites: vegetation measures for species cover, species richness, diversity and evenness in the low- and mid-canopies, 2022.

2022 Sites	Understory (herbs, low shrubs, seedlings)				Mid-canopy (tall shrubs, saplings)			
	Cover	Species	Div.	Even.	Cover	Species	Div.	Even.
GWW-001	100.0	47	3.19	0.83	6.2	2	0.18	0.26
GWW-004	87.6	36	2.85	0.80	17.6	3	0.35	0.32
GWW-006	46.8	19	1.88	0.64	2.2	2	0.17	0.25
GWW-008	72.2	31	2.78	0.81	11.2	3	0.37	0.34
GWW-009	82.6	43	2.96	0.79	23.2	3	0.42	0.39
GWW-010	83.6	54	3.35	0.84	5.0	4	0.20	0.14
GWW-013	98.0	51	2.98	0.76	0.0	-	-	-
GWW-015	26.6	14	1.86	0.71	0.6	1	0.09	-
GWW-016	101.8	29	2.61	0.78	8.4	3	0.26	0.24
GWW-018	81.8	43	3.16	0.84	14.4	5	0.51	0.32
GWW-019	104.8	21	2.00	0.66	7.2	3	0.25	0.23
GWW-022	109.0	26	2.53	0.78	6.2	2	0.18	0.25
GWW-024	60.8	33	2.71	0.78	9.8	2	0.33	0.48
Mean 2022	81.2	34.4	2.68	0.77	8.6	2.8	0.28	0.29

After this third season of monitoring in GWW sites, the cover and richness measures in the understory are comparable to or above their baseline values (2019), and no significant differences were found between understory cover ($p=0.057$) or richness ($p=0.223$) from 2019 and 2022 surveys. However, the understory diversity ($p=0.003$) and evenness ($p=0.002$) measured in 2022 has increased over baseline measures. While the mid-canopy woody layer continues to regenerate post-construction, the current cover, species richness and diversity measures are still significantly lower ($p=0.006$, $p=0.002$ and $p=0.002$, respectively) than baseline measures, Table 4-1b.

A more in-depth comparison of the vegetation structure measured pre-construction and throughout monitoring is useful to track, as the golden-winged warbler has specific structural habitat requirements. Vegetation cover and species counts for all plant growth forms measured during pre-construction surveys and in Year III are shown in Table 4-1c below. Growth forms include, in the understory, grasses, herbaceous forbs, low shrubs, tall shrub seedlings, and tree seedlings; in the mid-story, tall shrubs and tree saplings; and in the tree canopy, tall shrubs (>2.5m) and trees.

Table 4-1b. Mean vegetation measures from three vegetation canopies in golden-winged warbler habitat sites during pre-construction (2019) and throughout monitoring (2020, 2021, 2022) surveys.

Vegetation Canopies	Pre-constr.	Monitoring		
	2019	2022	2021	2020
Understory (herbs, low shrubs, seedlings)				
Understory Cover (%)	67.2	81.2	62.9	47.2
Species Richness	31.6	34.5	34.2	32.1
Diversity	1.94	2.68	2.77	2.79
Evenness	0.56	0.77	0.79	0.81
Mid-canopy (tall shrubs, saplings)				
Tall Shrub Cover (%)	17.7	8.6	6.0	1.8
Species Richness	5.6	2.8	2.6	2.1
Diversity	0.47	0.28	0.25	0.64
Evenness	0.29	0.29	0.29	0.73
Tree canopy (>2.5m tall shrubs, trees)				
Tree Cover (%)	22.4	0.8	0.8	0.4
Species Richness	2.7	1.3	1.3	1.0
Diversity	0.37	0.03	0.12	-
Evenness	0.36	-	-	-
Number of Surveys	13	13	13	13

Table 4-1c. Vegetation structure regrowth in golden-winged warbler sites on the RoW, by plant growth form in three canopies. Mean % cover is shown from pre-construction (2019) and throughout monitoring surveys, (2020-2022).

Canopy, plant form	Pre-constr.	Monitoring		
	2019	2022	2021	2020
Understory				
Grasses	24.3	25.1	17.3	12.8
Herbs	19.7	27.8	19.9	15.9
Low shrubs	6.1	5.1	3.8	4.9
Tall shrub seedlings	13.6	11.9	11.6	7.1
Tree seedlings	3.5	11.2	10.3	6.5
Total cover, understory:	*67.2*	*81.2*	*62.9*	*47.2*
Mid Canopy				
Tall shrubs	11.3	1.9	1.2	0.9
Tree saplings	6.4	6.7	4.8	0.9
Total cover, mid-canopy:	*17.7*	*8.6*	*6.0*	*1.8*
Tree Canopy				
Tall shrubs	1.9	0.3	0.3	0.0
Trees	20.5	0.5	0.5	0.4
Total cover, tree canopy:	*22.4*	*0.8*	*0.8*	*0.4*

After three seasons of re-growth since clearing, notable differences in the understory cover and structure in GWW sites include an increase of herbaceous forb cover (27.8% in 2022, from 19.7 in 2019), and an increase in tree seedling cover (11.2% in 2022, from 3.5 in 2019).

In the mid-canopy, tall shrubs are still in the process of early regeneration and continue to show a reduced cover (1.9% in 2022, from 11.3% in 2019), however, the cover of tree saplings remains comparable between surveys conducted in the current year and during pre-construction surveys. In terms of species richness this year, the mid-canopy species count has rebounded to a total of 13 species (2.5 per site) among GWW sites. During pre-construction surveys, a total of 18 species (5.6 per site) were recorded in the mid-canopy (data not shown).

The tree canopy is included to show the ongoing regeneration and development within this stratum, although few sites (four of 13) had any growth in this tallest stratum. It will take some years for woody regeneration to reach these heights, where management of RoW vegetation permits. Here, absence or the sparse cover of trees (0.5% in 2022, 24% in 2019) and tall shrubs (0.3% in 2022, from 1.9% in 2019) represents woody growth that was left uncleared from the RoW during construction, as well as any early development of regenerating tall shrubs or trees reaching this upper canopy (>2.5 m) this season. When the total species counts are considered, overall diversity in the tree stratum has not yet returned to pre-construction levels. During monitoring years to date, three species were recorded in the tree canopy in 2022, five species in 2021, and one in 2020. In 2019, a total of 12 tree and tall shrub species were recorded in the tree canopy (data not shown).

4.1.1.1 Cluster Analysis and Community Typing

Community type groups for the 13 sites of golden-winged warbler habitat are described through hierarchical cluster analyses of the understory vegetation stratum. All GWW community types share some commonalities, the sites are all deciduous communities of trembling aspen, with balsam poplar or bur oak. Trees >2.5m are generally absent with exception of two sites (GWW-019, 5% white spruce; GWW-018, 1% trembling aspen), and the sparse tall shrub canopy is still in early stages of regeneration. Deciduous tree seedlings and saplings are found in nearly all sites, predominantly trembling aspen. On the ground, litter is high, bare soil is absent, and woody debris is variable throughout sites. The following three community types (Table 4-1d) are determined based on still-emerging vegetation structure, and the species assemblages and cover in the understory. Notably, for the first time since clearing of the RoW, the understory data from monitoring sites this year provides the same clustering groups that were first seen with the understory data from 2019 surveys.

Table 4-1d. Community types of thirteen golden-winged warbler habitat sites on the RoW, 2022.

Community Type	Surveys	Species, total	Species, mean
Herb Rich–Tall Shrub seedlings/ Sparse Tall Shrubs	5	99	46.4
Balsam Poplar–Trembling Aspen Seedlings–Kentucky Bluegrass/ Sparse saplings Balsam Poplar–Trembling Aspen	4	62	24.8
Trembling Aspen seedlings–Red-osier Dogwood seedlings–Prickly Rose–Marsh Reed Grass/ Trembling Aspen saplings	4	71	29.3

Herb Rich– Tall Shrub seedlings Beaked Hazelnut– Saskatoon/ Sparse Tall Shrubs Beaked Hazelnut– Chokecherry

This group is made up of five sites (GWW-001, -002, -006, -007, -010), and distinguished by a richly diverse and well-developed understory with high overall vegetation cover (90%), consisting of herbaceous forbs (39%), woody growth (30%) and grasses (22%). Cover of woody growth includes a diversity of tall shrub seedlings (17%) that include beaked hazelnut (*Corylus cornuta*), Saskatoon (*Amelanchier alnifolia*), alder-leaved buckthorn (*Endotropis alnifolia*) and chokecherry (*Prunus virginiana*), and trembling aspen seedlings (7.5%). A diverse mix of herbaceous forbs are present, e.g., Canada anemone (*Anemone canadensis*), hoary puccoon (*Lithospermum canescens*), snakeroot (*Sanicula marilandica*), Lindley's aster (*Symphyotrichum ciliolatum*), veiny meadow-rue (*Thalictrum venulosum*), and western poison-ivy (*Toxicodendron rydbergii*) are among those most frequent. Grasses and occasional sedges are a moderate component, accounting for 22% cover of the understory. While diverse grasses are present, the dominant species are Kentucky bluegrass (*Poa pratensis*), marsh reed grass (*Calamagrostis canadensis*) and creeping bentgrass (*Agrostis stolonifera*). A sparse mid-canopy cover (9%) is made up primarily of regenerating trembling aspen saplings, with occasional and sparse, but diverse, tall shrubs. On the ground, woody debris is extremely variable in this group (0- 68% cover) and is highest on average (18%) due to a single site. Moss cover is generally absent.

Balsam Poplar–Trembling Aspen seedlings–Kentucky Bluegrass/ Sparse saplings Balsam Poplar–Trembling Aspen

Four sites fall into this group (GWW-008, -015, -019, -024), although one (GWW-19) joins as an outlier. All four sites in this group are characterized by the presence of balsam poplar and trembling aspen, with a minimal cover of woody debris on the ground. This group is summarized first using data from three sites, while GWW-19 is summarized separately. Within three sites, the understory cover is moderately well-developed (60%), consisting of an even mix of grasses (17%) and herbaceous forbs (16%), and low woody growth of tree seedlings (10%), tall shrub seedlings and low shrubs (5%, each). Grasses are predominantly non-native Kentucky bluegrass, smooth brome (*Bromus inermis*) and

Timothy (*Phleum pratense*). Woody growth in the understory is made up of shrubby cinquefoil (*Dasiphora fruticosa*) or Bebb's willow (*Salix bebbiana*), and seedlings of trembling aspen and balsam poplar. The mid-canopy is very sparse (7%), made up of primarily saplings of trembling aspen, with balsam poplar. On the ground, woody debris is low (<6%) in all sites. Moss cover is relatively high (7%), present in three sites, (absent in the outlying site).

While also clustered within this group, the uniquely high cover of selected species sets site GWW-019 apart. This site was originally dominated by balsam poplar and is the only site with conifers present, where all other GWW sites' original canopy was dominated by trembling aspen. The overall understory cover in this site is extremely high (112%), due to overlapping cover. Throughout monitoring seasons, the grass component in GWW-019 has steadily increased in the understory, currently at 59% cover, made up of creeping bentgrass and Kentucky bluegrass. In pre-construction surveys, GWW-019 also presented as a very grassy site (90% cover). Herb cover is relatively high (27%), but dominated by certain disturbance tolerant or invasive species, such as Canada goldenrod (*Solidago canadensis*), Canada thistle (*Cirsium arvense*) and tufted vetch (*Vicia cracca*). Tree seedling cover from the understory is also relatively high (13%) and consists of balsam poplar. The mid-canopy is sparse (7%), made up of balsam poplar saplings and willows (*Salix interior* and *S. bebbiana*).

Trembling Aspen seedlings–Red-osier Dogwood seedlings–Prickly Rose–Marsh Reed Grass/Trembling Aspen saplings

This group is made up of four sites (GWW-003, -005, -009, -012), distinguished by a well-developed understory, with a high (85%) vegetation cover overall. The understory consists of a mix of grasses (27%), herbaceous forbs (23%) and tree seedlings (17%), as well as tall shrub seedlings (10%) and low shrubs (8%). Woody species in the understory consist primarily of trembling aspen seedlings, with red-osier dogwood (*Cornus sericea*) and prickly rose (*Rosa acicularis*), with occasional seedlings of willows. Frequent herbaceous forbs include Canada goldenrod, and heart-leaved Alexander (*Zizia aptera*). Most frequent graminoids are marsh reed grass, Kentucky bluegrass, creeping bentgrass and hay sedge (*Carex foenea*). Though sparse, this group has the most well-developed mid-canopy cover (10%), made up primarily of trembling aspen saplings, with occasional and very sparse Bebb's willow. The ground cover of woody debris is low (>5%) in three sites and high (38%) in one site. Moss cover is generally absent.

4.1.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas previously cleared (2019/2020), the effect predictions on golden-winged warbler habitat (Appendix III) included the following:

- Change in vegetation landscape intactness
- Change in native vegetation cover class abundance, distribution and structure
- Change in habitat availability

The predicted change in landscape intactness was accurate for transmission RoW clearing. Vegetation has been selectively cleared in 2019/2020 to accommodate the transmission line and enhance suitability for GWW. Removal and long-term loss of forest cover from RoW clearing is an effect of transmission line development (Manitoba Hydro et al. 2003). Other studies have identified that fragmentation is frequently an inevitable consequence of large-scale corridor projects (Joro Consultants 2011).

The Habitat Management Plan (Environment Canada IR EC/MH-003) provides information on RoW clearing activities for critical golden-winged warbler habitat. Mitigation measures identified in the Construction Environmental Protection Plan (Manitoba Hydro 2020) were previously assessed at each golden-winged warbler site sampled, see Table 4-1e. Clearing and construction activities were carried out over the fall and winter months of 2019 and 2020. Mitigation at GWW sites included whether shrubs and herbaceous vegetation <4 m tall were retained to the extent possible; and whether five to ten perch trees were retained per span where feasible. Perch sites are small groups of three to five trees within 10 m of the cleared edge of the RoW. As identified in 2020, perch trees on the RoW were often absent, however the linear RoW boundaries occasionally supported small clumps of trees or individual stems remaining just inside the RoW edges, which may also provide perch opportunities for GWW. Golden-winged warbler sites were primarily open hardwood canopies (pre-construction), dominated by trembling aspen, with occasional balsam poplar and/or bur oak. Clearing prescriptions for GWW sites were available for reference in the Clearing Management Plan prior to construction.

Table 4-1e. Mitigation measures assessed at sites monitored for golden-winged warbler habitat on the RoW.

Mitigation Measure
Refer to Clearing Management Plan for detailed clearing prescriptions.
Retain shrubs and herbaceous vegetation <4m tall to the extent possible.
Typically, 5-10 perch trees must be retained per span where feasible.

This was a wet year for vegetation sampling compared to dry conditions in 2021. In Year III monitoring, regenerating vegetation in several sites was well-developed in Management Zone 2 of the Habitat Management Plan (Manitoba Hydro 2016; Environment Canada IR EC/MH-003). Zone 2 boundaries include 12 to 50 m on either side of the centreline of the RoW between tower footprints, where management involved selective removal of woody vegetation. The tree canopy in the RoW of the GWW sites previously was a mixture of

deciduous species. The tree stratum remains very sparse in species cover (as a result of previous clearing), although increased tall shrub cover (1-2.5 m tall) was visible in the RoW from the previous years' sampling (Photograph 4-1a). This season, mean total tall shrub cover has increased to 8.6%, from 6% in 2021 and 1.8% in 2020. The tall shrub stratum commonly supported species such as aspen, Saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), willows (*Salix* spp.), balsam poplar, red-osier dogwood (*Cornus sericea*) and beaked hazelnut (*Corylus cornuta*). Pre-construction values averaged 17.7% in this stratum (2019). A well-developed low shrub and herb stratum (<1 m) occurred in the RoW. Mulched wood ground cover has become obscured with a rich diversity of forbs and grasses. Berry plants and fruiting shrubs were frequently recorded on the RoW. This season, mean total species cover in sites has risen to 90.6% from 69.7% in 2021, as a result of species regeneration and changing structure. Photograph 4-1b shows vegetation regeneration at site GWW-016, with a rich understory of shrubs, forbs and graminoids.

In two GWW sampling sites (GWW-006 and -015), broadleaf herbicide control occurred along an adjacent transmission line RoW, with over spraying extending extensively into areas of the MMTP RoW. Although some young saplings (e.g., trembling aspen) and other vegetation appeared to remain with living stems (in parts of the sprayed RoW), the leaves on these young regenerating shrubs and plants appeared stressed and discolored with leaves partly browning or blackening. In other areas where spraying occurred, the vegetation was more heavily damaged or destroyed in monitoring plots (Photograph 4-1c). At monitoring plot GWW-006, regenerating shrubs were also visibly trampled this season (Photograph 4-1d). According to the Habitat Management Plan (Manitoba Hydro 2016; Environment Canada IR EC/MH-003), higher quality GWW habitat was previously observed at GWW-006 compared to other sites, prior to herbicide application. Site GWW-006 supported the presence of graminoids, forbs, and a low and tall shrub layer, with patches of remaining shrub vegetation, adjacent to deciduous forest.

This season, bare ground was still noticeable in the vicinity of some GWW sites. Larger areas of soil disturbance observed along the RoW (e.g., 10 x 10 m of bare ground) were broadcast seeded with a prescribed native seed mix to prevent colonization by non-native, invasive or noxious weeds (e.g., GWW-006, -019). See Rehabilitation Monitoring and Vegetation Management, Section 4.4.

An old-growth oak tree (>100 years) remains unaffected at an environmentally sensitive site (HERT-201) on the RoW, approximately 12 m from the centerline, near monitoring plot GWW-008 (Photograph 4-1e). Slow growing old growth trees could remain in their habitat, where they do not interfere with vegetation clearance requirements for safe operation of the transmission line.

Photograph 4-1a. Dense aspen regeneration, 1 to 2.5 m in height, GWW-009.

Photograph 4-1b. Vegetation regeneration at site GWW-016.

Photograph 4-1c. Broadleaf herbicide control extending into the MMTP RoW at GWW-015.

Photograph 4-1d. Broadleaf herbicide control at GWW-006 and trampling of tall shrub vegetation.

Photograph 4-1e. Old-growth bur oak remaining on the RoW in GWW habitat.

4.2 Invasive Plant Species

Noxious, invasive, and non-native (ranked SNA) species observations were recorded in and incidental to all quantitative surveys (i.e., GWW) and at select invasive plant species sites in 2022, (Field Activity ID MMTP_CON-FA605) (Map 4-1, Appendix II).

This year, 28 noxious, invasive or non-invasive SNA species were recorded along the RoW throughout vegetation monitoring (GWW sites and select invasive sites). Two monitoring components, the quantitative invasive sampling and roadside invasive surveys, were completed in 2020.

Of the 28 species recorded, 11 species are listed in the Manitoba Noxious Weed Act as noxious weeds harmful to livestock or agricultural crops. Noxious weeds may include species that are invasive, non-invasive, or native species. For example, milkweeds (*Asclepias* spp.) and water hemlocks (*Cicuta* spp.) are native species that may be harmful to livestock if ingested. Tier 1 and 2 designations provide the most severe listing for noxious species; one Tier 1 species was observed in 2022, spotted knapweed (*Centaurea stoebe*). Two Tier 2 noxious species recorded were hoary alyssum (*Berteroa incana*) and oxeye daisy (*Leucanthemum vulgare*). The remaining eight noxious species are listed as Tier 3.

While not considered noxious, at least 10 species are invasive (ranked SNA or S5) due to their tendency to outcompete native species, and dominate habitats once introduced (Canadian Food Inspection Agency 2008; Invasive Species Council of Manitoba 2022). An

additional seven are non-native species (ranked SNA), but considered neither noxious nor invasive. The establishment and persistence of non-native species in an environment may still lead to the exclusion of native plants.

Together, the noxious, invasive and non-invasive SNA species recorded along the RoW in 2022 include eight families, most prominently represented are Asteraceae and Fabaceae (eight species each) followed by Poaceae (seven species). All noxious weed, invasive and non-native (non-invasive) species from GWW and select monitoring sites are listed in Table 4-2a.

Table 4-2a. Noxious, invasive and non-invasive non-native (SNA) species recorded, from components monitored in 2022.

Species	Rank	Noxious Weed	Invasive Status	Family
Agrostis stolonifera[1, 2]	SNA			Poaceae
Ambrosia artemisiifolia	S5	Tier 3		Asteraceae
Asclepias sp.[2]	-	Tier 3		Asclepiadaceae
Berteroa incana	SNA	Tier 2	CFIA	Brassicaceae
Bromus inermis[1, 2]	SNA		CFIA	Poaceae
Centaurea stoebe	SNA	Tier 1	ISCM	Asteraceae
Cicuta maculata[2]	S4S5	Tier 3		Apiaceae
Cirsium arvense[1, 2]	SNA	Tier 3	CFIA, ISCM	Asteraceae
Cirsium vulgare[2]	SNA	Tier 3		Asteraceae
Echinochloa crus-galli	SNA			Poaceae
Elymus repens[1, 2]	SNA		CFIA	Poaceae
Hordeum jubatum[2]	S5	Tier 3		Poaceae
Leucanthemum vulgare	SNA	Tier 2	CFIA, ISCM	Asteraceae
Lotus corniculatus	SNA		CFIA	Fabaceae
Medicago lupulina[2]	SNA			Fabaceae
Medicago sativa	SNA		CFIA	Fabaceae
Melilotus albus[1, 2]	SNA		CFIA	Fabaceae
Phalaris arundinacea[2]	S5		CFIA	Poaceae
Phleum pratense[1, 2]	SNA			Poaceae
Plantago major[2]	SNA		CFIA	Plantaginaceae
Ranunculus acris[2]	SNA		CFIA, ISCM	Ranunculaceae
Sonchus arvensis[1, 2]	SNA	Tier 3	CFIA, ISCM	Asteraceae
Taraxacum officinale[1, 2]	SNA	Tier 3	CFIA	Asteraceae
Tragopogon dubius[2]	SNA			Asteraceae
Trifolium hybridum[1, 2]	SNA			Fabaceae
Trifolium pratense	SNA		CFIA	Fabaceae
Trifolium repens	SNA			Fabaceae
Vicia cracca[2]	SNA		ISCM	Fabaceae

Note: [1] Species also recorded during pre-construction GWW surveys (2019).
[2] Species recorded in 2022 GWW surveys.

Prior to monitoring, during the pre-construction surveys, nine non-native species (SNA) were recorded in total from GWW surveys (noted in Table 4-2a), including three Tier 3 noxious weeds: Canada thistle (*Cirsium arvense*); field sow-thistle (*Sonchus arvensis*); and common dandelion (*Taraxacum officinale*). All but two non-native species are considered invasive (Canadian Food Inspection Agency 2008; Invasive Species Council of Manitoba 2022). In 2022, 19 species in GWW surveys were ranked non-native, invasive, or noxious species (Tier 3).

Twenty-one select sites (INV) were visited along the RoW and at access points, to assess the presence of noxious Tier 1 and 2 plants, previously recorded in Rural Municipalities of Piney and Stuartburn. Three noxious species were observed, including spotted knapweed (*Centaurea stoebe*, Tier 1), hoary alyssum (*Berteroa incana*, Tier 2) and oxeye daisy (*Leucanthemum vulgare*, Tier 2), Table 4-2b. Distribution at sites was coded into classes following Adams et al. (2009).

Spotted knapweed was newly recorded at INV-812-R (Photograph 4-2a) this season as a single patch, with hoary alyssum sporadically occurring at the site. In 2020, spotted knapweed was observed nearby (<1 km) at INV-377-R but not at this location in 2022. Hoary alyssum was observed roadside at three other locations this season (INV-203-R; -716-R; -813-R). Oxeye daisy was more frequently observed, recorded at 12 sites. At site INV-721-R, oxeye daisy was recorded in multiple (six) locations along a ditch ranging in distribution from a few plants to a single patch, although it was previously recorded here as a few patches with several sporadically occurring plants. While oxeye daisy was newly recorded at some sites (e.g., INV-210-R; 510-R), it was not re-recorded at others (e.g., INV-379-R; -385-R; -386-R). At one site where surveying was prevented by a gate on private land (INV-716-R), both oxeye daisy and hoary alyssum were visible along a trail from the access approach, (see Photograph 4-2b).

Although the number of discrete observations of Tier 1 and 2 noxious plants is similar at these specific sites between monitoring in 2020 (18 observations) and 2022 (17 observations), the abundance of noxious plants (by distribution code) from observations in 2022 is generally reduced, compared to 2020. Higher distribution codes (including multiple patches plus greater sporadic occurrence) were far more frequent in 2020 (13 observtions) than in 2022 (five observations).

This season, scentless false mayweed (*Tripleurospermum inodorum*, Tier 2) was not observed along the RoW ditch at INV-19-R. Tower site 323 was also visited to assess a previous infestation of white cockle (*Silene latifolia*, Tier 3), see Section 4.4.

Table 4-2b. Noxious plant species (Tier 1 and 2) recorded with distribution code, at select sites visited in 2022 and previous monitoring (2020).

Species	Noxious Weed	Distribution Code (2022)	Distribution Code (2020)	Site
Centaurea stoebe	Tier 1	Not present	1	377-R
Centaurea stoebe	Tier 1	3	Not present	812-R
Berteroa incana	Tier 2	5	5	203-R
Berteroa incana	Tier 2	5	Not present	716-R
Berteroa incana	Tier 2	6	4	812-R
Berteroa incana	Tier 2	2	2	813-R
Leucanthemum vulgare	Tier 2	Not present	3	210-R[1]
Leucanthemum vulgare	Tier 2	3	Not present	210-R[1]
Leucanthemum vulgare	Tier 2	1	Not present	210-R[1]
Leucanthemum vulgare	Tier 2	Not present	8	379-R
Leucanthemum vulgare	Tier 2	Not present	2	385-R
Leucanthemum vulgare	Tier 2	Not present	4	386-R
Leucanthemum vulgare	Tier 2	2	Not present	387-R
Leucanthemum vulgare	Tier 2	4	Not present	510-R
Leucanthemum vulgare	Tier 2	6	4	716-R
Leucanthemum vulgare	Tier 2	2	8	721-R[1]
Leucanthemum vulgare	Tier 2	3	8	721-R[1]
Leucanthemum vulgare	Tier 2	2	8	721-R[1]
Leucanthemum vulgare	Tier 2	3	8	721-R[1]
Leucanthemum vulgare	Tier 2	1	8	721-R[1]
Leucanthemum vulgare	Tier 2	Not present	3	721-R[1]
Leucanthemum vulgare	Tier 2	1	8	721-R[1]
Leucanthemum vulgare	Tier 2	2	8	814-R
Tripleurospermum inodorum	Tier 2	Not present	5	19-R

Note: [1] Multiple plant locations within monitoring site.

Photograph 4-2a. Spotted knapweed newly recorded at site 812-R (Tier 1).

Photograph 4-2b. Oxeye daisy and hoary alyssum visible during surveys along an access approach and trail at site INV-716-R.

4.3 Species of Conservation Concern

Observations of species of conservation concern (SCC) were recorded project wide for components monitored in 2022, including in and incidental to all vegetation monitoring surveys (i.e., GWW; Map 4-1, Appendix II) (Field Activity ID MMTP_CON_FA605). Post-construction environmental monitoring for species of conservation concern at rare plant sites was completed in 2020.

Five species of conservation concern were recorded throughout the RoW, in and incidental to four monitoring plots (GWW) in 2022. Among the species of conservation concern, one species was ranked Imperilled (S2S3), the remaining four species are ranked Vulnerable (S3 to S3S5), Table 4-3. Species of conservation concern were observed from open grass sites and previously deciduous forested sites.

Table 4-3. Species of conservation concern recorded in 2022.

Species	Common Name	Rank	Family
Imperilled species (S2S3)			
Solidago riddellii	Riddell's Goldenrod	S2S3	Asteraceae
Vulnerable species (S3 to S3S5)			
Amphicarpaea bracteata	Hog-peanut	S3S5	Fabaceae
Agalinis tenuifolia	Narrow-leaved Agalinis	S3	Scrophulariaceae
Lonicera involucrata	Black Twinberry	S3S4	Caprifoliaceae
Scirpus pallidus	Pale Bulrush	S3S4	Cyperaceae

One species at risk was observed during project monitoring, listed under the Manitoba's *Endangered Species and Ecosystems Act* (ESEA) and the federal *Species at Risk Act* (SARA). Riddell's goldenrod (*Solidago riddellii,* S2S3) is listed as Threatened by ESEA and Special Concern by SARA. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) also lists this species as Special Concern. Riddell's goldenrod was incidentally observed during sampling in 2021 and observed again in 2022 at GWW-000. Riddell's goldenrod was located on the RoW, in a ditch with approximately 30 plants recorded (Photograph 4-3).

Photograph 4-3. Riddell's goldenrod observed near sampling plot GWW-018.

4.4 Rehabilitation Monitoring and Vegetation Management

This season, 22 additional sites (21 select INV sites plus one tower site) were visited to investigate the presence of invasive plant species along the RoW. The most threatening noxious weeds observed this season included Tier 1 spotted knapweed (*Centaurea stoebe*), and Tier 2 hoary alyssum (*Berteroa incana*) and oxeye daisy (*Leucanthemum vulgare*). Spotted knapweed was newly recorded at site INV-812-R, and subsequently removed. Spotted knapweed was not observed at site INV-377-R this year. The distribution of Tier 1 and 2 noxious plant species was reduced this season from previous monitoring in 2020 and 2021. Photographs 4-4a and 4-4b show hoary alyssum and oxeye daisy observed at sites in 2022. Where observed and manageable, Tier 1 and 2 noxious plants were pulled, bagged and removed from sites.

In 2021, white cockle (*Silene latifolia*, Tier 3 noxious weed) was observed at Tower 323 with a few gaps in a near continuous distribution throughout the RoW, approximately 150 m in length (Appendix V, Adams et al., 2009). The plants were knocked down with weed eaters to reduce further seed spreading from maturing plants, and follow-up management was recommended due to the size of the infestation. In 2022, white cockle was absent from the RoW at Tower 323. A native seed mix was previously broadcasted on the bare ground. Photograph 4-4c and 4-4d shows the site in 2021 and 2022, respectively.

Photograph 4-4a. Hoary alyssum observed at site INV-812-R.

Photograph 4-4b. Oxeye daisy observed at site INV-721-R.

Photograph 4-4c. Infestation of white cockle at Tower site 323 in 2021.

Photograph 4-4d. White cockle not observed in 2022 along RoW at Tower site 323, with establishment of grass mix previously seeded.

Re-seeding efforts occurred at two sites along the RoW, as bare ground was still apparent during this seasons sampling. Near GWW-006, patches of bare soil occurred off the road allowance leading into the RoW. An area approximately 5 x 15 m was broadcast seeded with a native seed mix (Photograph 4-4e). Near site GWW-019, an area 10 x 10 m of bare ground was still pervasive, as were sporadic non-native and noxious Tier 3 plants. Species observed here included creeping bentgrass (*Agrostis stolonifera*, SNA), tufted hairgrass (*Deschampsia cespitosa*, S4S5), reed canarygrass (*Phalaris arundinacea*, S5), barnyard grass (*Echinochloa crus-galli*, SNA), slender wildrye (*Elymus trachycaulus*, S5), foxtail barley (*Hordeum jubatum*, S5) and American sloughgrass (*Beckmannia syzigachne*, S5). The area was re-seeded in the RoW at the end of an access trail. The content of the native seed mix applied this season was 95:5 grass: forb, and specifically 30% Canada wildrye, 20% side oats grama, 20% slender wheatgrass, 15% tufted hairgrass, 10% Junegrass, and 5% American vetch. The native seed reclamation mix was prepared by BrettYoung.

Photograph 4-4e. Bare soil re-seeded near GWW-006. Also, damaged vegetation (brown color) from herbicide application in background.

4.5 Hypothesis Testing

Two hypotheses were proposed for environmental monitoring of botanical and vegetation resources for the Project, with the intent to focus on the relationship between vegetation growth and clearing and construction activities.

Hypothesis 1 "*There are observed differences in species composition within sites being monitored over successive years along the transmission line right-of-way*" proved to be true in Year III post-construction monitoring. Since clearing, and during all successive monitoring years, the mean species richness at golden-winged warbler habitat sites (GWW) has been relatively consistent within each of three vegetation strata (e.g., the low-, mid-, and tree canopies). However, numbers of species recorded in the understory in 2022 (34.5 species), is slightly higher than in 2019 (31.6). The woody canopies take longer to regenerate and on average, there are fewer species recorded in the mid-canopy in 2022 (2.8 species), than in 2019 (5.6). Among sites with vegetation growth in the tree canopy, mean species richness has been consistent throughout monitoring, but is still currently lower (1.3 species) than pre-construction (2.7 species). While this difference in mean richness appears modest (where present, the tree canopy is generally sparse), the total diversity recorded throughout all sites' tree canopies is more marked. Pre-construction, 12 tree and tall shrub (>2.5m in height) species were recorded in the tree canopy. During the monitoring years, three species were recorded in the current year, five in 2021, and one in 2020.

Hypothesis 2 "*Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way*" is true in Year III post-construction monitoring. Although the monitoring schedule for invasive plant species from pre-construction through one-year post-construction was completed in 2020, a total of 28 non-native species were recorded this season from existing monitoring sites (GWW and select INV sites), including one Tier 1, two Tier 2 and eight Tier 3 species. Pre-construction GWW surveys recorded nine non-native species, three of which were Tier 3 noxious species. By the third year of GWW monitoring 19 non-native, invasive or noxious species were recorded. However, during monitoring years, the abundance (by distribution code) of Tier 1 and 2 noxious plants is generally reduced in select INV sites in 2022, compared to 2020.

5.0 RECOMMENDATIONS

Based on post-construction vegetation monitoring in 2022, the following are recommendations for the project:

1. Where possible, attempt to avoid the location recorded for Riddell's goldenrod (*Solidago riddellii*) (near GWW-018) during future vegetation management activities of the RoW. Riddell's goldenrod is listed as as Threatened by ESEA, and Special Concern by SARA and COSEWIC. Extreme care should be taken at this location.

2. Follow-up monitoring and management is recommended at five sites for Tier 2 noxious plant species observed along the final preferred route. These plant species should be managed to reduce further species spread, according to responsibilities under the current Regulation of The Noxious Weeds Act. Sites include INV-510-R, -716-R and -721-R for oxeye daisy (*Leucanthemum vulgare*) and sites INV-203-R, -716-R and 812-R for hoary alyssum (*Berteroa incana*). Noxious and invasive plant species have the ability to spread rapidly on disturbed ground and the risk of spread along the RoW or into adjacent sites may increase with each season. All regulatory requirements and license commitments should be met. For plant species management, refer to the Rehabilitation and Invasive Species Management Plan (Manitoba Hydro 2019d).

3. Broadleaf herbicide control extended into the MMTP RoW from as a result of vegetation management along an adjacent transmission line RoW. Extensive foliar damage was visible affecting species composition and cover in areas of golden-winged warbler habitat. Direct and indirect contact with herbicide may also affect wildlife, including birds and their insect prey. It is recommended that future vegetation management in these areas follow the Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat (Manitoba Hydro 2016; Environment Canada IR EC/MH-003). It is also recommended that biologists be notified if future vegetation management (i.e., herbicide use) overlaps with environmental monitoring, to avoid these sites or adjust timing of surveys.

4. In this third year of monitoring, total mean plant cover has shown a general increase in the understory, particularly in the cover of tree seedlings and herbaceous forbs, since pre-construction surveys. Golden-winged warbler territories tend to contain patches of herbs and low shrubs (used for ground nests) and scattered mature trees or forest edge habitat used for song posts and foraging. Hydroelectric utility corridors can become preferred habitat for the golden-winged warbler (Environment and Climate Change Canada 2016; Manitoba Hydro 2016; Environment Canada IR EC/MH-003) if vegetation is suitably managed to maintain

an early-successional habitat, e.g., a heterogenous vegetation structure, with scattered mature trees and shrubs, and grassy herbaceous openings. Over the next two to five years, vegetation may require management to maintain or enhance critical golden-winged warbler habitat within the project RoW. The Right-of-Way Habitat Management Plan (Manitoba Hydro 2016) should be adhered to, which outlines vegetation management during the operation phase of the project.

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APPENDIX I. Definitions of selected technical terms. Taken from Cauboue et al. (1996), unless otherwise noted.

Abundance-Dominance – This term expresses the number of individuals of a plant species and their coverage in a phytosociological survey; it is based on the coverage of individuals for classes with a coverage higher than 5% and on the abundance for classes with a lower percentage.

Angiosperm – A seed borne in a vessel (carpel); thus one of a group of plants whose seeds are borne within a mature ovary or fruit (Raven et al. 1992).

Bog – Ombrotrophic peatlands generally unaffected by nutrient-rich groundwater that are acidic and often dominated by heath shrubs and Sphagnum mosses and that may include open-growing, stunted trees.

Canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees.

Canopy Closure – The degree of canopy cover relative to openings.

Classification – The systematic grouping and organization of objects, usually in a hierarchical manner.

Cluster Analysis – A multidimentional statistical technique used to group samples according to their degree of similarity.

Community-Type – A group of vegetation stands that share common characteristics, an abstract plant community.

Coniferous – A cone-bearing plant belonging to the taxonomic group Gymnospermae.

Cover – The area of ground covered with plants of one or more species, usually expressed as a percentage.

Deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season.

Dicotyledon – One of the two divisions of the Angiosperms; the embryo has two cotyledons, the leaves are usually net-veined, the stems have open bundles, and the flower parts are usually in fours or fives (Usher 1996).

Ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation.

Endangered Species - A species that is facing imminent extirpation or extinction (Government of Canada 2021).

Extirpated Species - A species that no longer exists in the wild in Canada, but exists elsewhere in the wild (Government of Canada 2021).

Fen – Wetland with a peat substrate, nutrient-rich waters, and primarily vegetated by shrubs and graminoids.

Flora – A list of the plant species present in an area.

Forb – A broad-leaved, non-woody plant that dies back to the ground after each growing season (Johnson et al. 1995).

Forest – A relatively large assemblage of tree-dominated stands.

Graminoid – A narrow-leaved plant that is grass-like; the term refers to grasses and plants that look like grasses.

Grassland – Vegetation consisting primarily of grass species occurring on sites that are arid or at least well drained.

Gymnosperm – A seed plant with seeds not enclosed in the ovary; the conifers are the most familiar group (Raven et al. 1992).

Habitat – The place in which an animal or plant lives; the sum of environmental circumstances in the place inhabited by an organism, population or community.

Herb (Herbaceous) – A plant without woody above-ground parts, the stems dying back to the ground each year (Johnson et al. 1995).

Invasive – Invasive species are plants that are growing outside of their country or region of origin and are out-competing or even replacing native plants (Invasive Species Council of Manitoba 2022).

Mitigation – Often the process or act of minimizing the negative effects of a proposed action.

Mixedwood – Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover.

Monocotyledon – A class of the Angiosperms; the seeds have a single cotyledon, the floral parts are in three or multiples of three, and the leaves have parallel veins (Usher 1996).

Non-vascular Plant – A plant without a vascular system (e.g., mosses and lichens).

Noxious Weed – A plant that is designated as a Tier 1, Tier 2 or Tier 3 noxious weed in the regulations and includes the seed of a noxious weed, whether it is still attached to the noxious weed or is separate from it (Manitoba Government 2022c).

Plot – A vegetation sampling unit used to delineate a fixed amount of area for the purpose of estimating plant cover, biomass, or density.

Pteridophyte – A division of the plant kingdom including ferns and their allies (horsetails and clubmosses).

Rare Species – Any indigenous species of flora that, because of its biological characteristics, or because it occurs at the fringe of its range, or for some other reasons, exists in low numbers or in very restricted areas of Canada but is not a threatened species.

Shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base.

Site – The place or category of places, considered from an environmental perspective, that determines the type and quality of plants that can grow there.

Species – A group of organisms having a common ancestry that are able to reproduce only among themselves; a general definition that does not account for hybridization.

Species of Special Concern – A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (Government of Canada 2021).

Stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests.

Stratum – A distinct layer within a plant community, a component of structure.

Terrestrial – Pertaining to land as opposed to water.

Threatened Species - A species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction (Government of Canada 2021).

Understory – Vegetation growing beneath taller plants such as trees or tall shrubs.

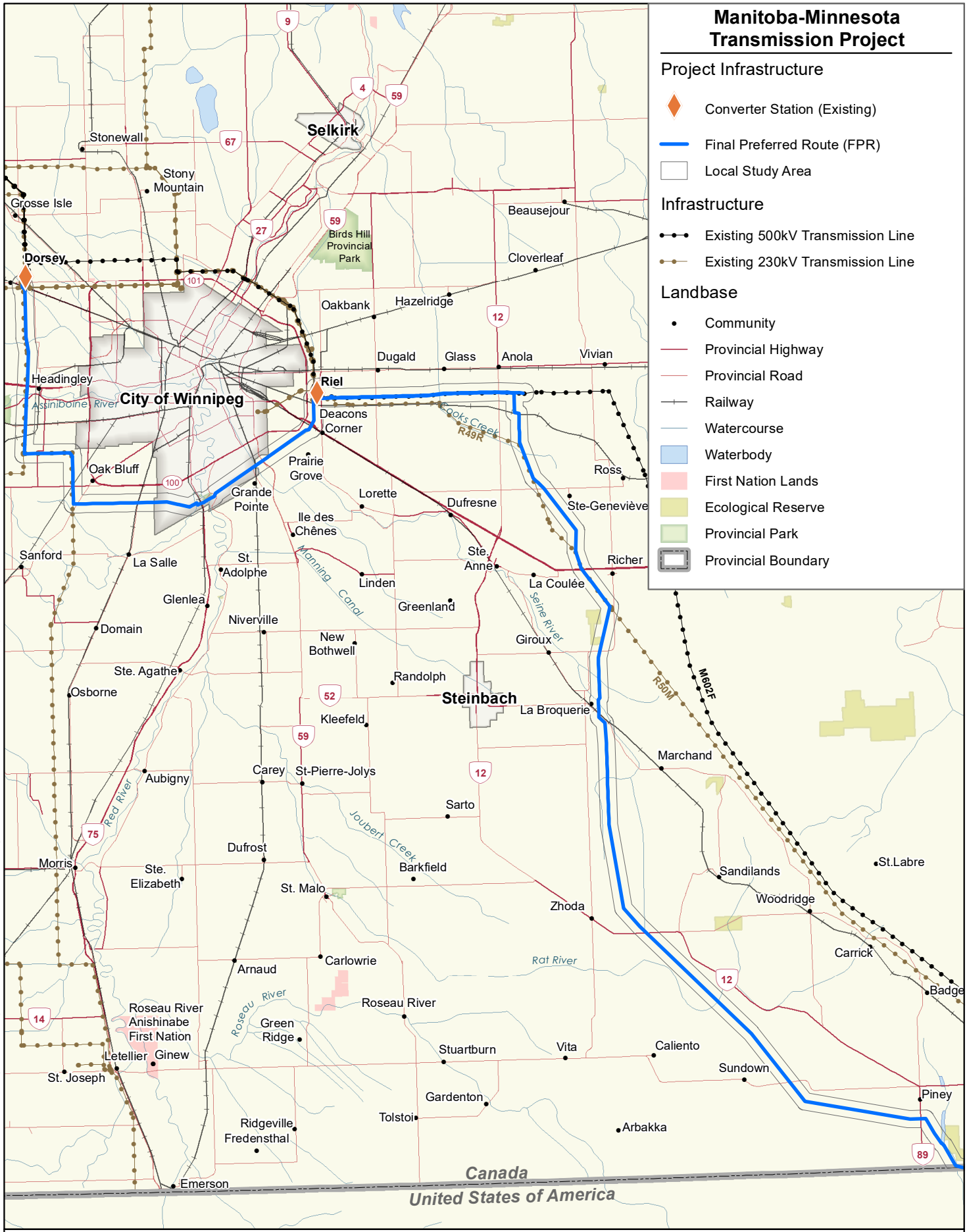
Vascular Plant – A plant having a vascular system (Usher 1996).

Vegetation – The general cover of plants growing on a landscape.

Vegetation Type – In phytosociology, the lowest possible level to be described.

Wetland – Land that is saturated with water long enough to promote hydric soils or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to wet environments.

APPENDIX II. Report maps.



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Manitoba Hydro

Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan, SEC
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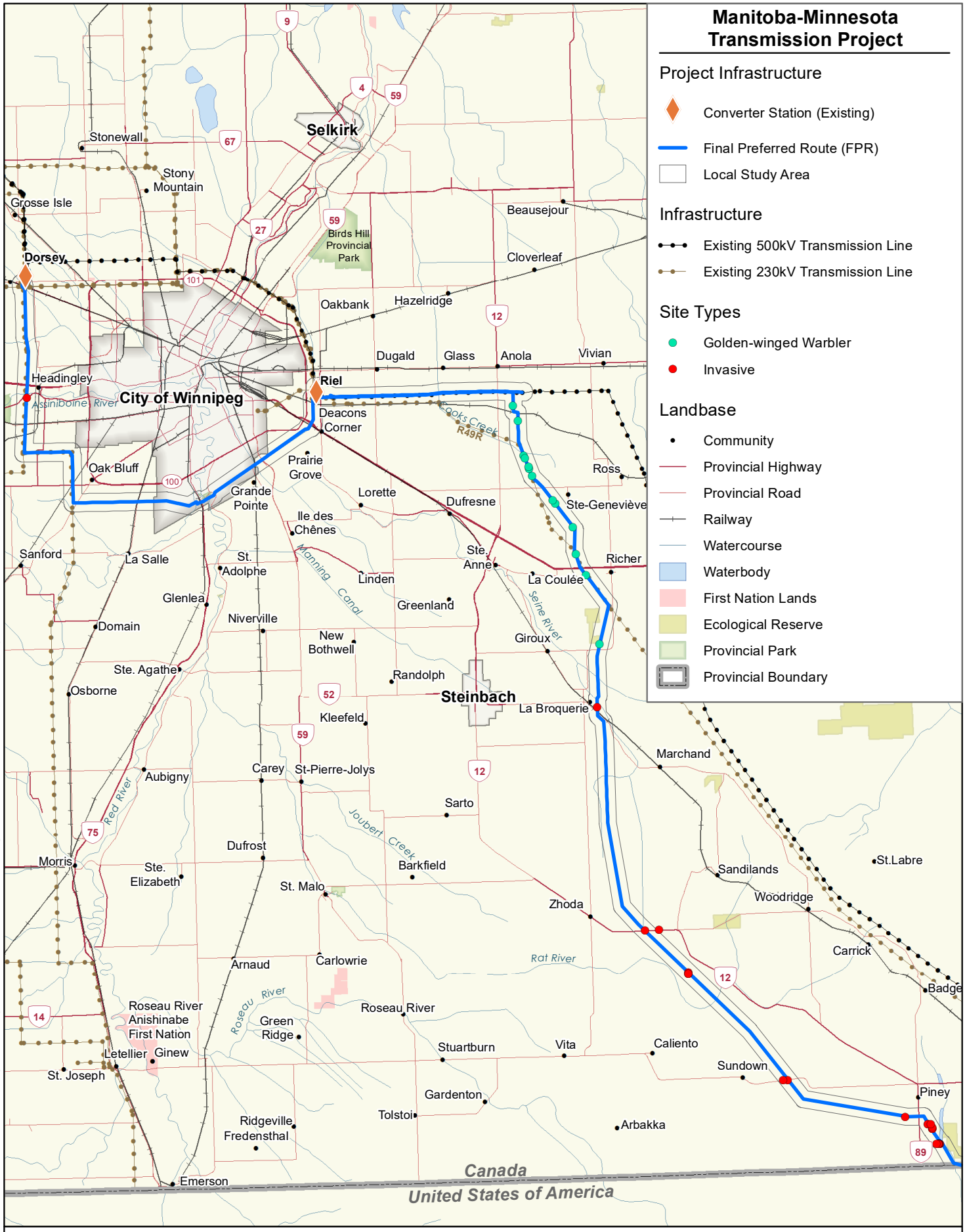
MMTP Project Area

Map 1-1


Manitoba-Minnesota Transmission Project
Project Infrastructure
Converter Station (Existing)
Final Preferred Route (FPR)
Local Study Area
Infrastructure
Existing 500kV Transmission Line
Existing 230kV Transmission Line
Site Types
Golden-winged Warbler
Invasive
Landbase
Community
Provincial Highway
Provincial Road
Railway
Watercourse
Waterbody
First Nation Lands
Ecological Reserve
Provincial Park
Provincial Boundary
Selkirk
Stonewall
Stony Mountain
Grosse Isle
Dorsey
Birds Hill Provincial Park
Beausejour
Cloverleaf
Oakbank
Hazelridge
Dugald
Glass
Anola
Vivian
Headingley
Riel
City of Winnipeg
Assiniboine River
Deacons Corner
Brooks Creek
R49R
Prairie Grove
Oak Bluff
Grande Pointe
Lorette
Dufresne
Ste-Geneviève
Ile des Chênes
Ross
Sanford
La Salle
St. Adolphe
Manning Canal
Ste. Anne
Richer
Linden
La Coulée
Glenlea
Greenland
Seine River
Niverville
Domain
New Bothwell
Giroux
Ste. Agathe
Randolph
Osborne
Steinbach
La Broquerie
Kleefeld
Marchand
Carey
St-Pierre-Jolys
Aubigny
Red River
Sarto
Joubert Creek
Dufrost
Morris
Barkfield
Ste. Elizabeth
St. Malo
Sandilands
St.Labre
Woodridge
Zhoda
Carrick
Rat River
Arnaud
Carlowrie
Badger
Roseau River Anishinabe First Nation
Roseau River
Green Ridge
Roseau River
Stuartburn
Vita
Caliento
Sundown
Letellier
Ginew
St. Joseph
Gardenton
Piney
Tolstoi
Arbakka
Ridgeville
Fredensthal
Emerson
Canada
United States of America
Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan, SEC
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Distribution of Vegetation Sites
Map 4-1
Manitoba Hydro
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APPENDIX III. Potential environmental effects on botanical and vegetation resources as a result of the Project. Effects were identified from the Environmental Impact Statement, Chapter 9 and 10 (Manitoba Hydro 2015).

Number	Potential Environmental Effect
1	Change in vegetation landscape intactness.
2	Change in native vegetation cover class abundance, distribution and structure.
3	Change in wetland cover class abundance, distribution, structure and function.
4	Change in invasive plant species abundance and distribution.
5	Change in rare plant species abundance and distribution.
6	Change in traditional use plant species abundance and distribution.
7	Change in habitat availability.

APPENDIX IV. Project commitments for botanical and vegetation pre-construction surveys and environmental monitoring. Reference documents include the Environment Act Licence (Sustainable Development 2019), the Report on Public Hearing (Manitoba Clean Environment Commission 2017), the National Energy Board Certificate (National Energy Board 2019), and Environmental Impact Statement (Manitoba Hydro 2015).

Commitment Document	Page/Section or Clause	Environmental Component	Commitment Description Summary	Objectives to meet intent of Commitment
Licence	Clause 1	Future sampling, analysis and reporting	1. The Licensee shall, in addition to any of the specifications, limits, terms and conditions specified in this Licence, upon the request of the Director: a) sample, monitor, analyse or investigate specific areas of concern regarding any segment, component or aspect of the Development for such duration and at such frequencies as may be specified; b) determine the environmental impact associated from the Development; c) conduct specific investigations in response to the data gathered during environmental monitoring programs; and d) provide the Director, within such time as may be specified, with such reports, drawings, specifications, analytical data, descriptions of sampling and other information as may from time to time be requested.	Monitor the transmission line as specified; submit annual technical report detailing results and analysis of sampling program and recommendations for improvements where required.
Licence	Clause 10	Environmental Protection Plan	10. The Licensee shall submit, for approval of the Director of the Environmental Approvals Branch, a construction Environmental Protection Plan prior to construction, and an operations Environmental Protection Plan at least 90 days prior to in-service of the Development. The plans shall describe the approach to be used by the Licensee to ensure that mitigative measures are applied systematically, and in a manner consistent with the commitments made in the EIS and supporting information,	Manitoba Hydro to develop and submit Environmental Protection Plan.

			during construction or operation of the Development. The plans shall: a) include information obtained from Indigenous communities prior to and during construction and operation of the Development regarding the locations of specifically identified sites used for the exercise of Indigenous rights-based activities in the vicinity of the project (such as plant harvesting, ceremonial practices, hunting, and trapping); b) include mitigation measures and/or buffer zones for the specific sites identified to minimize impacts to the sites from construction and operation activities; c) for specifically identified plant harvesting sites, identify measures to minimize impacts to the sites by implementing mitigation measure such as flagging of the area, buffers zones, selective clearing, construction matting, and non-chemical vegetation management; and d) include mitigation measures to reduce adverse effects on wildlife and wildlife habitat (e.g., timing windows, setbacks, and buffers).	
Licence	Clause 12	Invasive species management plan	The Licensee shall, prior to construction of the Development, submit management plans addressing the following topics for review by the Eastern Region IRMT and approval by the Director of the Environmental Approvals Branch: a) erosion protection and sediment control; b) rehabilitation and invasive species management, and c) waste and recycling.	Manitoba Hydro to develop and submit rehabilitation and invasive species management plan.

Licence	Clause 28	ROW clearing plan	The Licensee shall, prior to construction of the Development, submit a plan for clearing of the transmission line right-of-way for approval of the Director of the Environmental Approvals Branch. The plan shall: a) describe the clearing methods to be used; and b) describe opportunities for retention of low-growth vegetation along the transmission line right-of-way, to the extent possible, without impeding maintenance activities or vegetation clearance requirements.	Manitoba Hydro to develop and submit ROW clearing plan.
Licence	Clause 29	Timber Harvesting	The Licensee shall, prior to construction of the Development, consult with the Regional Forester of the Forestry and Peatlands Branch related to the clearing of timber in association with the Development. Where an opportunity exists, a plan for timber operations may be established and timber shall be harvested and delivered to an approved destination identified by a scaling plan. In the event that no market exists, a timber valuation (Timber Damage Appraisal) shall be applied.	Manitoba Hydro to consult with Regional Forester regarding timber clearing.
Licence	Clause 35	Wetlands	The Licensee shall carry out activities associated with the Development that may disturb wetlands in the Caliento, Sundown, and Piney Bogs only under frozen ground conditions. Maintenance activities within these bogs shall be conducted under frozen ground conditions unless required to ensure the safe and reliable operation of the Development, in which case mitigation measures to reduce impacts to the bogs shall be implemented.	Visual observations during monitoring of the transmission line RoW wetlands.

Licence	Clause 36	Wetlands	The Licensee shall, within three months of the completion of construction of the Development, submit a plan for approval of the Director of the Environmental Approvals Branch to ensure that there is no net loss of wetland benefits related to Class 3, 4, and 5 wetlands (as defined by the Stewart & Kantrud Classification System) that are altered or destroyed during construction of the Development.	Monitor wetlands, visual observations during monitoring of the transmission line RoW wetlands.
Licence	Clause 37	Golden Winged Warbler Habitat Management	The Licensee shall implement the plan titled "Right-of-Way Habitat Management Plan for Managing Critical Golden-winged Warbler Habitat during Construction and Operation of the Manitoba-Minnesota Transmission Project" submitted as supporting information on April 29, 2016, or any subsequent versions approved by the Director of the Environmental Approvals Branch.	Manitoba Hydro to develop and implement habitat management plan for golden winged warbler.
Licence	Clause 38	Invasive Species	The Licensee shall, prior to construction of the Development, submit a detailed biosecurity plan for approval of the Director of the Environmental Approvals Branch. The plan shall describe measures to be implemented to control the spread of invasive species as well as the spread of soil borne diseases from field to field in agricultural areas during construction of the Development.	Manitoba Hydro to develop and submit biosecurity plan. Follow biosecurity plan when accessing ROW. Monitor transmission line RoW for invasive species.

Licence	Clause 49	Vegetation Management Plan	The Licensee shall, within six months of the completion ·of construction of the Development, submit for review by the Eastern Region IRMT and approval of the Director of the Environmental Approvals Branch, a plan for the management of vegetation along the Dorsey international power line right-of-way. The plan shall describe the methods to be used for vegetation control and for communication to the public and Indigenous communities during operation of the Development.	Manitoba Hydro to develop vegetation management plan.
Licence	Clause 50	Integrated vegetation management review and reporting	The Licensee shall conduct reviews, and report to the Director of the Environmental Approvals Branch, on the results of integrated vegetation management practices implemented on the Dorsey international power line right-of-way of the Development 5 and 10 years after; the completion of construction and as determined by the Director thereafter.	Manitoba Hydro to conduct reviews and report on integrated vegetation management.
Licence	Clause 52	Herbicide Use	The Licensee shall provide notification to local Indigenous communities a minimum of 30 days prior to the application of herbicides within the transmission right-of-way of the Development.	Manitoba Hydro to provide notification to Indigenous communities.
Licence	Clause 53	Monitoring	The Licensee shall, prior to construction, submit a monitoring plan for the Development for the approval of the Director of the Environmental Approvals Manitoba Hydro - Manitoba-Minnesota Transmission Project Branch. The plan shall describe monitoring programs to be undertaken in relation to the Development, including proposed programs for: a) collection of baseline information; b) pre-construction surveys of the eastern tiger salamander and mottled duskywing butterfly obligate plant host, in areas of	Manitoba Hydro to conduct pre-construction surveys.

			likely habitat; c) inclusion of the least bittern and the short-eared owl in surveys; d) pre-construction surveys for traditional use plant species and invasive plant species in areas of the Development where information on these plant species is insufficient.	
Licence	Clause 56	Reporting	The Licensee shall submit annual reports to the Director of the Environmental Approvals Branch, on the results of monitoring programs approved pursuant to Clause 53 of this Licence for the duration of the monitoring programs. The reports shall: a) report on the accuracy of predictions made in the EIS and supporting information, b) report on the success of the mitigation measures employed during construction and operation, c) provide a description of the adaptive management measures undertaken to address issues, and commitments for future mitigation; d) identify any unexpected environmental effects of the Development; e) identify additional mitigation measures to address unanticipated environmental effects, if required; f) report on how input from the monitoring advisory group, formed pursuant to Clause 55 of this licence, was incorporated into the monitoring program; and g) propose changes to the monitoring programs based on the results of the annual assessments.	Manitoba Hydro to submit annual monitoring report.

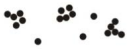
NEB Certificate	Condition 10	Construction Environmental Protection Plan	Manitoba Hydro must file with the Board for approval, at least ninety (90) days prior to commencing construction, an updated Project-specific Construction Environmental Protection Plan (CEPP) which includes: a) all environmental protection, mitigation and monitoring measures and commitments, as set out in its Application, draft CEPP, or otherwise agreed to in its subsequent filings during both the Manitoba Clean Environment Commission hearing process and the Board's EH-001-2017 proceeding, and including any criteria that will be used to implement those measures; b) any updates from outstanding pre-construction surveys; c) the following plans: i) clearing management plan ii) blasting plan iii) erosion protection and sediment control plan iv) golden-winged warbler habitat management plan v) cultural and resource heritage protection plan vi) navigation and navigation safety plan (see Condition 9) vii) waste and recycling management plan viii) emergency preparedness and response plan (see Condition 14) ix) rehabilitation and invasive species management plan x) biosecurity management plan xi) access management plan xii) environmental monitoring plan xiii) integrated vegetation management plan; d) orthophoto maps of the Project footprint, which include the identification of environmental features, Manitoba Hydro's Environmentally Sensitive Sites, and mitigation measures to be applied.	Manitoba Hydro to develop and file CEPP.

NEB Certificate	Condition 23	Post-construction Monitoring Reports	Manitoba Hydro must file with the Board, on or before 31 January following the first year of Project operations and for a period of at least ten (10) years after commencing operations, annual post-construction monitoring reports. These reports must include: a) a description of monitoring methods used; b) identification, including on a map or diagram, of any reclamation or other environmental issues which arose during construction or in the course of the previous year; c) a description of the valued components or issues that were assessed or monitored, as outlined in Manitoba Hydro's Environmental Monitoring Plan (see Condition 10); d) the monitoring results, including a comparison to measurable goals; e) an assessment of the effectiveness of the mitigation measures implemented and the accuracy the environmental assessment predictions; f) a description of any corrective actions taken, their observed success and current status; and, g) a schedule outlining when further corrective actions will be implemented or monitoring conducted to address any unresolved issues.	Manitoba Hydro to complete post-construction monitoring and submit reports.
NEB Certificate	Condition 26	Wetland Offset Measures	Manitoba Hydro must file with the Board for approval, within ninety (90) days of commencing operation of the Project, a Wetland Offset Measures Plan which outlines how permanent loss to wetlands resulting from the Project will be offset or compensated for. This plan must include: a) a description of site-specific details and maps showing the locations of permanent wetland loss as a result of Project activities at Dorsey Converter	Manitoba Hydro to develop and file wetland offset measures plan.

			Station and the transmission tower locations, as well as any other locations where wetlands were affected by the Project; b) an explanation of how wetland function will be measured during the post-construction monitoring program, and any resulting accidental permanent loss to wetlands quantified and reported to the Board as part of Condition 23; c) a list of the offset or compensation measures that will be implemented to address permanent loss of wetlands as identified in a) and b) above; d) an explanation of the expected effectiveness of each offset measure described in c) and the relative value of each offset measure towards achieving the offset; e) the decision-making criteria for selecting specific offset measures and offset ratios that would be used under what circumstances; f) a schedule indicating when measures will be implemented and estimated completion date(s); g) evidence and summary of consultation with provincial and federal authorities, any non-governmental expert bodies, and any impacted Indigenous communities regarding the plan; and, h) this summary must include a description of any issues or concerns raised regarding the plan by Indigenous communities, and how Manitoba Hydro has addressed or responded to them.	
CEC Report	Page 77	Vegetation and Wetlands	Manitoba Hydro expand traditional-use and invasive-plant surveys, with input from Indigenous and local knowledge holders, prior to construction, to include areas within the Local Assessment Area on Crown and private land that were not	Manitoba Hydro to conduct pre-construction surveys along transmission line ROW for invasive species, and traditional use

			sampled or that were insufficiently sampled in preparation for the EIS. An example would be the area affected by the change to the Piney border crossing.	plants and in areas that were insufficiently sampled during EIS preparation.
CEC Report	Page 143	Integrated Vegetation Management	Manitoba Hydro submit to Manitoba Sustainable Development a review of integrated vegetation-management practices for the ROW on an annual basis for the first 10 years of operations and as determined by the department after 10 years.	Manitoba Hydro to develop and implement vegetation control plan.
EIS, Chapter 10	10-116	Rare Plants	Survey for SCC and SAR plant species in areas not previously surveyed that have the potential to provide habitat for SCC; monitor changes in rare plant species occurrences in areas along the PDA.	Pre-construction surveys and environmental monitoring.
EIS, Chapter 10	10-116	Invasive Plants Species	Monitor existing invasive plant species at construction sites and equipment clearing sites, if construction occurs during the growing season; monitor compliance for clean equipment.	Environmental monitoring.

APPENDIX V. Weed density distribution classes.

Class	Description of Abundance In Polygon	Distribution
0	None	
1	Rare	
2	A few sporadically occurring individual plants	
3	A single patch	
4	A single patch plus a few sporadically occurring plants	
5	Several sporadically occurring plants	
6	A single patch plus several sporadically occurring plants	
7	A few patches	
8	A few patches plus several sporadically occurring plants	
9	Several well-spaced patches	
10	Continuous uniform occurrences of well-spaced plants	
11	Continuous occurrence of plants with a few gaps in the distribution	
12	Continuous dense occurrence of plants	
13	Continuous occurrence of plants with a distinct linear edge in the polygon	

Source: Adams et al. (2009).

APPENDIX VI. Location of vegetation sample plots and sites visited.

Site	Easting	Northing	Datum	UTM Zone	Date
MM-GWW-001	682148	5494993	NAD83	14 U	08-08-2022
MM-GWW-004	680541	5503310	NAD83	14 U	08-08-2022
MM-GWW-006	679262	5505807	NAD83	14 U	08-08-2022
MM-GWW-008	678933	5509103	NAD83	14 U	07-08-2022
MM-GWW-009	676776	5511944	NAD83	14 U	07-08-2022
MM-GWW-010	676474	5512327	NAD83	14 U	07-08-2022
MM-GWW-013	673975	5515270	NAD83	14 U	07-08-2022
MM-GWW-015	673596	5516107	NAD83	14 U	07-08-2022
MM-GWW-016	673532	5516435	NAD83	14 U	06-08-2022
MM-GWW-018	000000	0000000	NAD83	14 U	06-08-2022
MM-GWW-019	672298	5521970	NAD83	14 U	06-08-2022
MM-GWW-022	671699	5523733	NAD83	14 U	06-08-2022
MM-GWW-024	673133	5517451	NAD83	14 U	06-08-2022
MM-Tower-323	681875	5487368	NAD83	14 U	04-08-2022
MM-INV-377-R	687642	5460331	NAD83	14 U	04-08-2022
MM-INV-019-R	612878	5524726	NAD83	14 U	05-08-2022
MM-INV-203-R	704891	5442322	NAD83	14 U	03-08-2022
MM-INV-210-R	283934	5436103	NAD83	15 U	03-08-2022
MM-INV-210-R	283938	5436158	NAD83	15 U	03-08-2022
MM-INV-210-R	283945	5436302	NAD83	15 U	03-08-2022
MM-INV-379-R	692860	5455299	NAD83	14 U	04-08-2022
MM-INV-385-R	719081	5437810	NAD83	14 U	03-08-2022
MM-INV-386-R	283500	5436737	NAD83	15 U	03-08-2022
MM-INV-387-R	283443	5436727	NAD83	15 U	03-08-2022
MM-INV-716-R	704360	5442302	NAD83	14 U	03-08-2022
MM-INV-721-R	284678	5434246	NAD83	15 U	03-08-2022
MM-INV-721-R	284632	5434245	NAD83	15 U	03-08-2022
MM-INV-721-R	284574	5434249	NAD83	15 U	03-08-2022
MM-INV-721-R	284541	5434252	NAD83	15 U	03-08-2022
MM-INV-721-R	284520	5434253	NAD83	15 U	03-08-2022
MM-INV-721-R	284486	5434256	NAD83	15 U	03-08-2022
MM-INV-721-R	284259	5434267	NAD83	15 U	03-08-2022
MM-INV-812-R	689363	5460380	NAD83	14 U	04-08-2022
MM-INV-813-R	692865	5455092	NAD83	14 U	04-08-2022
MM-INV-814-R	692875	5455106	NAD83	14 U	04-08-2022
MM-INV-510-R	283800	5436717	NAD83	15 U	03-08-2022

APPENDIX VII. Species of conservation concern recorded at or near surveys.

Site	Species	Common Name	Rank
MM-GWW-001	*Amphicarpaea bracteata*	Hog-peanut	S3S5
MM-GWW-018	*Agalinis tenuifolia*	Narrow-leaved Agalinis	S3
MM-GWW-009	*Lonicera involucrata*	Black Twinberry	S3S4
MM-GWW-018	*Solidago riddellii*	Riddell's Goldenrod	S2S3
MM-GWW-013	*Scirpus pallidus*	Pale Bulrush	S3S4

APPENDIX VIII. List of flora recorded in MMTP surveys and sampling, 2022.

Family/Species	Common Name	MB Rank
VASCULAR SPECIES		
Pteridophytes – Ferns and Allies		
EQUISETACEAE	HORSETAIL FAMILY	
Equisetum arvense	Common Horsetail	S5
Equisetum hyemale	Common Scouring-rush	S5
Gymnosperms		
PINACEAE	PINE FAMILY	
Larix laricina	Tamarack	S5
Picea glauca	White Spruce	S5
Picea mariana	Black Spruce	S5
Angiosperms - Monocotyledons		
CYPERACEAE	SEDGE FAMILY	
Carex aurea	Golden Sedge	S5
Carex bebbii	Bebb's Sedge	S5
Carex foenea	Hay Sedge	S5
Carex granularis	Granular Sedge	S4?
Carex pellita	Woolly Sedge	S5
Carex vaginata	Sheathed Sedge	S5
Carex spp.	A sedge	-
Eleocharis sp.	A spike-rush	-
Scirpus pallidus	Green Bulrush	S3S4
JUNCACEAE	RUSH FAMILY	
Juncus arcticus var. *balticus*	Baltic Rush	S5
Juncus longistylis	Long-styed Rush	S4
JUNCAGINACEAE	ARROW-GRASS FAMILY	
Triglochin maritima	Seaside Arrow-grass	S5
LILIACEAE	LILY FAMILY	
Anticlea elegans	White Camas	S5
Maianthemum canadense	Canada May Flower	S5
Maianthemum stellatum	Solomon’s Seal	S5
POACEAE	GRASS FAMILY	

Agrostis stolonifera	Creeping Bentgrass	SNA
Andropogon gerardii	Big Bluestem	S5
Beckmannia syzigachne	Slough Grass	S5
Bromus ciliatus	Fringed Brome	S5
Bromus inermis	Smooth Brome	SNA
Calamagrostis canadensis	Bluejoint Reedgrass	S5
Danthonia spicata	Poverty Oat Grass	S4S5
Deschampsia cespitosa	Tufted Hairgrass	S4S5
Echinochloa crus-galli	Barnyard Grass	SNA
Elymus canadensis	Great Plains Wild Rye	S4S5
Elymus repens	Quackgrass	SNA
Elymus trachycaulus ssp. *trachycaulus*	Slender Wildrye	S5
Elymus trachycaulus ssp. *subsecundus*	One-sided Wildrye	SNR
Hordeum jubatum	Wild Barley	S5
Oryzopsis asperifolia	Rice Grass	S5
Phalaris arundinacea	Reed Canarygrass	S5
Phleum pratense	Timothy	SNA
Poa palustris	Fowl Bluegrass	S5
Poa pratensis	Kentucky Bluegrass	S5
SMILACACEAE	GREENBRIAR FAMILY	
Smilax lasioneura	Carrion Flower	S4S5
TYPHACEAE	CAT-TAIL FAMILY	
Typha latifolia	Common Cat-tail	S4S5
Angiosperms – Dicotyledons		
ANACARDIACEAE	SUMAC FAMILY	
Toxicodendron rydbergii	Poison Ivy	S5
APIACEAE	CARROT FAMILY	
Cicuta maculata	Spotted Water Hemlock	S4S5
Sanicula marilandica	Seneca Snakeroot	S5
Sium suave	Water Parsnip	S5
Zizia aptera	Heart-leaved Alexander	S5
APOCYNACEAE	DOGBANE FAMILY	
Apocynum androsaemifolium	Spreading Dogbane	S5
ASCLEPIADACEAE	MILKWEED FAMILY	
Asclepias sp	A milkweed	-
ASTERACEAE	ASTER FAMILY	

Achillea millefolium	Yarrow	S5
Ambrosia artemisiifolia	Common Ragweed	S5
Artemisia campestris	Field Wormwood	S4S5
Artemisia ludoviciana	Prairie Sage	S5
Cirsium arvense	Canada Thistle	SNA
Cirsium vulgare	Bull Thistle	SNA
Doellingeria umbellata	Flat-topped White Aster	S5
Erigeron glabellus	Smooth Fleabane	S5
Euthamia graminifolia	Flat-topped Goldenrod	S5
Eutrochium maculatum	Spotted Joe Pye Weed	S5
Hieracium umbellatum	Northern Hawkweed	S5
Leucanthemum vulgare	Oxeye Daisy	SNA
Liatris ligulistylis	Meadow Blazing Star	S4
Packera paupercula	Balsam Groundsel	S5
Petasites frigidus var. *sagittatus*	Arrow-leaved Coltsfoot	S5
Rudbeckia hirta	Black-eyed Susan	S5
Solidago canadensis	Canada Goldenrod	S5
Solidago riddellii	Riddell's Goldenrod	S2S3
Solidago spp.	A goldenrod	-
Sonchus arvensis	Field Sow-thistle	SNA
Symphyotrichum ciliolatum	Lindley's Aster	S5
Symphyotrichum ericoides	Many-flowered Aster	S4
Symphyotrichum laeve	Smooth Aster	S5
Symphyotrichum puniceum	Purple-stemmed Aster	S5
Taraxacum officinale	Common Dandelion	SNA
Tragopogon dubius	Goat's-beard	SNA
BETULACEAE	BIRCH FAMILY	
Alnus incana	Speckled Alder	S5
Betula papyrifera	Paper Birch	S5
Betula pumila	Dwarf Birch	S5
Corylus cornuta	Beaked Hazelnut	S5
BORAGINACEAE	BORAGE FAMILY	
Lithospermum canescens	Hoary Puccoon	S5
BRASSICACEAE	MUSTARD FAMILY	
Berteroa incana	Hoary Alyssum	SNA
CAMPANULACEAE	BELLFLOWER FAMILY	
Campanula rotundifolia	Harebells	S5

CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Lonicera involucrata	Black Twinberry	S3S4
Symphoricarpos albus	Snowberry	S4S5
Symphoricarpos occidentalis	Western Snowberry	S5
Viburnum lentago	Nannyberry	S4
Viburnum opulus	High-bush Cranberry	S5
Viburnum rafinesquianum	Downy Arrowwood	S4S5
CORNACEAE	DOGWOOD FAMILY	
Cornus sericea	Red-osier Dogwood	S5
ELAEAGNACEAE	OLEASTER FAMILY	
Shepherdia canadensis	Soapberry	S5
ERICACEAE	HEATH FAMILY	
Arctostaphylos uva-ursi	Common Bearberry	S5
FABACEAE	PEA FAMILY	
Amphicarpaea bracteata	Hog-peanut	S3S5
Astragalus agrestis	Field Milkvetch	S5
Lathyrus venosus	Wild Peavine	S5
Lathyrus sp	A peavine	-
Lotus corniculatus	Bird's-foot Trefoil	SNA
Medicago lupulina	Black Medic	SNA
Medicago sativa	Alfalfa	SNA
Melilotus albus	White Sweetclover	SNA
Trifolium hybridum	Alsike Clover	SNA
Trifolium pratense	Red Clover	SNA
Trifolium repens	White Clover	SNA
Vicia americana	American Vetch	S5
Vicia cracca	Tufted Vetch	SNA
FAGACEAE	BEECH FAMILY	
Quercus macrocarpa	Bur Oak	S5
GROSSULARIACEAE	CURRANT FAMILY	
Ribes oxyacanthoides	Northern Gooseberry	S5
HIPPURIDACEAE	MARE'S-TAIL FAMILY	
Hippuris vulgaris	Common Mare's-tail	S5

LAMIACEAE	MINT FAMILY	
Agastache foeniculum	Giant Hyssop	S5
Dracocephalum parviflorum	American Dragon-head	S5
Lycopus americanus	Water Hore-hound	S5
Mentha arvensis	Mint	S5
Prunella vulgaris	Heal-all	S4
Stachys pilosa	Marsh Hedge-nettle	S5
ONAGRACEAE	EVENING PRIMROSE FAMILY	
Oenothera biennis	Evening-primrose	S5
PLANTAGINACEAE	PLANTAIN FAMILY	
Plantago major	Common Plantain	SNA
POLYGONACEAE	SMARTWEED FAMILY	
Persicaria amphibia	Water Smartweed	S5
PRIMULACEAE	PRIMROSE FAMILY	
Lysimachia ciliata	Fringed Loosestrife	S5
PYROLACEAE	WINTERGREEN FAMILY	
Pyrola asarifolia	Pink Pyrola	S5
Pyrola sp.	A wintergreen	-
RANUNCULACEAE	CROWFOOT FAMILY	
Anemone canadensis	Canada Anemone	S5
Anemone quinquefolia	Wood Anemone	S5
Aquilegia canadensis	Wild Columbine	S5
Ranunculus acris	Common Buttercup	SNA
Thalictrum venulosum	Veiny Meadowrue	S5
RHAMNACEAE	BUCKTHORN FAMILY	
Endotropis alnifolia	Alder-leaved Buckthorn	S5
ROSACEAE	ROSE FAMILY	
Amelanchier alnifolia	Saskatoon	S5
Dasiphora fruticosa	Shrubby cinquefoil	S5
Fragaria virginiana	Smooth Wild Strawberry	S5
Geum aleppicum	Yellow Avens	S5
Geum macrophyllum	Large-leaved Avens	S4S5
Prunus virginiana	Chokecherry	S5

Rosa acicularis	Prickly Rose	S5
Rubus idaeus	Raspberry	S5
Rubus pubescens	Trailing Dewberry	S5
Spiraea alba	Meadowsweet	S5
RUBIACEAE	MADDER FAMILY	
Galium boreale	Northern Bedstraw	S5
Galium triflorum	Sweet-scented Bedstraw	S5
SALICACEAE	WILLOW FAMILY	
Populus balsamifera	Balsam Poplar	S5
Populus tremuloides	Trembling Aspen	S5
Salix bebbiana	Bebb's Willow	S5
Salix interior	Sandbar Willow	S5
Salix spp.	A willow	-
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
Mitella nuda	Mitrewort	S5
SCROPHULARIACEAE	FIGWORT FAMILY	
Agalinis tenuifolia	Narrow-leaved Agalinis	S3
VIOLACEAE	VIOLET FAMILY	
Viola spp.	A violet	-

Available in accessible formats upon request