

**MANITOBA-MINNESOTA TRANSMISSION PROJECT
BOTANICAL AND VEGETATION ENVIRONMENTAL MONITORING
ANNUAL TECHNICAL REPORT**

**Prepared for:
Manitoba Hydro**



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SUMMARY

Botanical and vegetation post-construction surveys were conducted in 2020 for environmental monitoring of the Manitoba-Minnesota Transmission Project. Surveys were completed for wetlands, traditional use plant species, invasive plant species, golden-winged warbler habitat, and plant species of conservation concern, each with botanical summaries presented. The accuracy of effect predictions and the effectiveness of mitigation are discussed.

Sixteen wetland sites were re-visited for vegetation monitoring. These sites reflect the diversity of wetlands found in the region, from species poor sedge meadows to herb and shrub rich wetlands, with tall shrub canopies present. Species cover ranged from 17 to 83% vegetation cover, recorded from the herb and low shrub stratum. Species diversity in wetlands ranged from 0.95 to 2.80, with wide ranging species evenness at sites (0.46 to 0.84). When all vegetation canopies are considered together, the botanical measures are similar between surveys from pre-construction and post-construction monitoring. Three community types were identified based on species composition, abundance and structure. Wetland distribution and function remained unchanged at monitoring sites from clearing and construction activity.

Nineteen sites were re-visited to sample traditional use plant species, including eight invasive monitoring sites which supported total traditional plant cover >30%, recorded from all strata in pre-construction sampling. Total mean species cover in the herb and low shrub layers ranged widely from 3 to 81%. Sites were floristically diverse, with an average species richness of 30 species recorded in plots. The mean diversity measure was relatively high for all sites (2.7) and evenness ranged from 0.63 to 0.94. A tall shrub canopy was present in five sites (>1 to <2.5 m), while occasional tall shrub stems grew to tree canopy height (>2.5 m). Total vegetation cover (all strata) has significantly decreased ($p < 0.001$) in 2020, due to removal of mid and upper canopies. Three community types were identified based on degree of regeneration, vegetation structure and cover, and species assemblages at sites. The predicted change in vegetation cover and structure was accurate for traditional use plant species.

Three hundred roadside sites were surveyed for invasive plant presence along the FPR RoW and project components, and 13 additional sites were sampled quantitatively. A total of 70 noxious, invasive, or non-native species were recorded along the RoW throughout roadside surveys, and in all other vegetation sampling (ATK, GWW, INV, WET) in 2020. Thirty-two species are listed as noxious by the Noxious Weeds Regulation of Manitoba. Six notable species were recorded including two Tier 1 species, spotted knapweed (*Centaurea stoebe*) and red bartsia (*Odontites vulgaris*), and four Tier 2 species, hoary alyssum

(*Berteroa incana*), leafy spurge (*Euphorbia virgata*), ox-eye daisy (*Leucanthemum vulgare*), and scentless false mayweed (*Tripleurospermum inodorum*). Nineteen species are invasive (not considered noxious) and an additional 19 are non-native species. Descriptions of species cover, richness, and diversity measures are provided for monitoring. The effect prediction for invasive plant species was determined to be accurate.

Thirteen sites were re-visited to monitor golden-winged warbler (*Vermivora chrysoptera*) habitat that intersects the FPR RoW. Golden-winged warbler sites prior to clearing and construction activities were open hardwood canopies. Vegetation cover decreased from pre-construction values due to the removal of tree and shrub vegetation structure and associated species from the RoW (mean total species cover change of 107.6 to 49.5%). This season, mean species cover in sites ranged from 28 to 70% in the herb and low shrub layer, with an average richness of 32 species recorded. Mean diversity and evenness were relatively high for all sites, with 2.8 and 0.8 respectively. Very sparse cover of tall shrubs was present in 10 sites, with an average of 2.3%. Tree canopy cover was generally absent from sites. Vegetation cover has significantly decreased in 2020 overall, from all vegetation strata ($p < 0.001$). Two community types were determined based on emerging vegetation structure, and species assemblages and cover at sites.

Twenty-one environmentally sensitive sites were re-visited for species of conservation concern monitoring over the growing season, where species were observed in 10 sites. Observations of species of conservation concern were also recorded project wide, in all vegetation monitoring surveys and sampling. Thirty-one species of conservation concern were recorded throughout the RoW. No species at risk listed under either the Manitoba's *Endangered Species and Ecosystems Act* or the federal *Species at Risk Act* were observed during surveys throughout project monitoring. One Imperilled species, black ash (S2), is designated Threatened by the Committee on the Status of Endangered Wildlife in Canada, and observed in four sites. Ten species are ranked Critically Imperilled (S1 to S1S2) or Imperilled (S2 to S2S3), the remaining 21 species are ranked Vulnerable (S3 to S3S5). Species of conservation concern are observed from across a diversity of habitats, including from sandy soils, open grassland, wetlands, coniferous bogs and fens, and previously deciduous and coniferous forested sites. The effect prediction for species of conservation concern was determined to be accurate.

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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 2020, botanical and vegetation resources were assessed in Year I 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 established 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 species of conservation concern;
- Conduct environmental monitoring of wetlands;
- Conduct environmental monitoring of traditional use plant species;
- 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 wetlands, traditional use plant species, invasive plant species, golden-winged warbler habitat, and plant species of conservation concern.

2.1 Wetlands

Wetlands perform many important functions which include water storage, flood control, ground water recharge, sediment trapping, shoreline protection, nutrient cycling and carbon sequestration. Wetlands also provide valuable habitat for wildlife and plant species, and may support species of conservation concern. Wetland conservation is a priority under The Federal Policy on Wetland Conservation (Government of Canada 1991).

Wetland function includes three major components: habitat, hydrological and biogeochemical function (Halsey et al. 1997, Hanson et al. 2008). Wetland alteration can result in a loss of wetland function. Threats to wetlands include drainage, erosion and degradation, lowered water tables, increased run-off, and reduced plant productivity of adjacent areas.

Large intact wetlands are present in the Local Assessment Area (LAA) in addition to smaller degraded wetlands in cultivated areas. As described in Chapter 10 of the EIS, the Project LAA intersects approximately 1884 ha of wetlands, of which 56 ha are within the Project Development Area (PDA). Wetland classes occurring along the PDA include bog, fen, swamp, marsh, and shallow open water. Main effects to wetlands as a result of the project include site disturbance or loss of plants from construction, maintenance and decommissioning activities. To validate EIS predictions, verify implementation of mitigation measures, and to allow for adaptive management, post-construction monitoring will identify any changes to wetland area affected, and species composition and abundance. Monitoring activities for wetlands are identified in Table 2-1.

Mitigation measures identified in the Construction Environmental Protection Plan

- Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion. Construction matting will be used to protect the area from rutting and exposure to mineral soil during non-frozen ground conditions.
- Identify and flag a 30 m vegetated (shrub and herbaceous) buffer around site.
- Maintain shrub and herbaceous vegetation to the extent possible.
- The application of herbicide is prohibited.
- Refer to Clearing Management Plan for clearing prescription.

Table 2-1. Monitoring activities for wetlands.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Wetland desktop and field surveys	Wetland classification	74 sites surveyed in PDA, LAA	1 field season	Once	2014	Wetland class (bog, marsh, swamp, shallow open water)
Pre-construction	Ground surveys to confirm location and record baseline wetland information	Area of wetland intersected by the project, vegetation cover	PDA	Pre-construction	Once	Summer	Wetland class, species composition and abundance
Construction	Ground surveys to identify wetland changes not discernible from habitat mapping and to monitor wetland protection measures	Area of wetland affected by the project, vegetation cover	PDA	During construction	Annual	Summer	Wetland class, species composition and abundance
Post-construction	Ground surveys to identify wetland changes not discernible from habitat mapping	Area of wetland affected by the project, vegetation cover	PDA	2 yrs	Annual	Summer	Area affected (ha); species composition and abundance

2.2 Traditional Use Plant Species

As outlined in Chapter 11 of the EIS, a change in traditional plant species abundance and distribution is a concern to First Nations and Metis. Plants and plant communities have been identified as being particularly important to First Nations and Metis. These areas are valued for their provision of resources used by First Nations and Metis including gathering of food and medicines and harvesting plants and trees.

Several traditional use plant sites were visited during pre-construction surveys to validate sites and sample vegetation along the final preferred route. General harvesting areas were identified in traditional use reports. A total of 61 traditional use plants were observed during all surveys in 2017, with 44 of these species recorded in surveys only for traditional use plants (Szwaluk Environmental Consulting and Newman 2017). Aboriginal Traditional Knowledge (ATK) reports were submitted by Black River First Nation, Swan Lake First Nation, Long Plain First Nation, Peguis First Nation, Dakota Plains Wahpeton Oyate, Roseau River Anishinabe First Nation, Sagkeeng First Nation and the Manitoba Metis Federation (MMF).

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

Mitigation measures identified in the Construction Environmental Protection Plan

- Construction matting will be used along access trail to protect the area from rutting and exposure of soil during saturated soil conditions.
- Use existing access roads and trails to the extent possible.
- Refer to Clearing Management Plan for clearing prescription.
- 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 traditional use plant species.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Desktop, field surveys and ATK reports	Species names and locations	Sites identified in PDA, LAA	1 field season	Once	2014	Species composition and abundance
Pre-construction	Ground surveys to identify traditional use plant species	Species occurrence	PDA	Pre-construction	Once	Summer	Species composition and abundance
Construction	Ground surveys to confirm traditional use plant species presence and monitor protection measures	Species occurrence	ESS	During construction	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to confirm traditional use plant species presence	Species occurrence	ESS	2 yrs	Annual	Summer	Species composition and abundance

2.3 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 2020).

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). In 2018, a total of 32 noxious species were recorded during pre-construction surveys (Szwaluk Environmental Consulting 2018).

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 2-3.

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 2-3. 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

2.4 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 (S3B), by the Manitoba Conservation Data Centre (MBCDC). The golden-winged warbler is a ground-nesting songbird that breeds in shrubby habitats adjacent to mature stands of deciduous and mixedwood forest. It uses forest edge habitat and openings containing shrubs and grasses. Habitat is often regenerated by natural and human disturbances, including hydroelectric utility corridors, which can be preferred habitat for this species if corridors are maintained in a manner that retains shrubs and herbs along forest edges.

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 2019a).

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 2-4.

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 2-4. 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	Identified 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-construction	Once	Summer	Species composition and abundance
Construction	Ground surveys to identify vegetation changes not discernible from habitat mapping	Vegetation cover	PDA	During construction	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

2.5 Plant Species of Conservation Concern

Species of conservation concern include species of plants that are protected under *The Endangered Species and Ecosystems Act* (ESEA) in Manitoba, the federal *Species at Risk Act* (SARA), The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or are listed by the Manitoba Conservation Data Centre (MBCDC) as plants that are Critically Imperilled to Vulnerable. These species generally exist in low numbers and/or have limited distributions, however they play an important role in helping to preserve species diversity.

As described in Chapter 10 of the EIS, two plant species of conservation concern were previously known to occur (three historical locations) along the Project Development Area (PDA); six species were known to occur along the LAA (at 15 locations) and 62 species occurred along the Regional Assessment Area (RAA) (MBCDC records). No historical occurrences of protected plants are known to occur within the Project PDA or LAA. Protected species have historical occurrences within the RAA.

Field assessments in 2014 identified three species of conservation concern in the PDA (Manitoba Hydro 2015). During pre-construction surveys, a total of 37 species of conservation concern were recorded along the final preferred route (Szwaluk Environmental Consulting and Newman 2017). None of these species are listed under ESEA or SARA. Black ash (*Fraxinus nigra*) is designated as Threatened by COSEWIC.

Construction activities can potentially negatively affect plant species of conservation concern through the use of heavy equipment (crushing plants) and from clearing and grubbing (removal of roots) of vegetation. Herbicide use during maintenance activities can also negatively affect desirable species. To validate EIS predictions, verify implementation of mitigation measures, and to allow for adaptive management, post-construction monitoring will identify any impact to plant species of conservation concern. Monitoring activities for species of conservation concern are identified in Table 2-5.

Mitigation measures identified in the Construction Environmental Protection Plan

- Identify and flag prior to start of work.
- Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion.
- Provide 10m vegetated (shrub and herbaceous) buffer around site.
- Confine vehicle traffic to established trails to the extent possible.
- Construction matting will be used along access trail to protect the area from rutting and exposure of soil during saturated soil conditions.

- Use existing access roads and trails to the extent possible.
- Refer to Clearing Management Plan for clearing prescription.
- In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan for mitigation.
- Pre-construction surveys may be conducted to confirm presence of Species of Concern.

Table 2-5. Monitoring activities for species of conservation concern.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Baseline Information	Desktop, key person interviews and field surveys	Species names and locations	95 sites surveyed in PDA, LAA	1 field season	Once	2014	Species presence/absence
Pre-construction	Ground surveys to record species of concern	Species occurrence	PDA	Pre-construction	Once	Summer	Species presence/absence
Construction	Ground surveys to monitor species of concern and protection measures	Species occurrence	ESS	During construction	Annual	Summer	Species presence/absence
Post-construction	Ground surveys to monitor species of concern	Species occurrence	ESS	1yr	Annual	Summer	Species presence/absence

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 2020a), Botanical and Vegetation Pre-construction Surveys (Szwaluk Environmental Consulting and Newman 2017 and 2019a), and the Invasive Plant Pre-construction Survey (Szwaluk Environmental Consulting 2018). 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. Manitoba Hydro contacted landowners for access permission to sites selected on private lands. In 2020, previously surveyed sites (2017 through 2019) were reviewed to determine their location with reference to 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 2020a).

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

importance, identified through the environmental assessment process and preparation of the monitoring plan. Indicators included wetlands, traditional use plant species, invasive plant species, golden-winged warbler habitat, and plant species of conservation concern.

3.2 Environmental Monitoring

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

Environmental monitoring involved native vegetation surveys (quantitative) and rare plant surveys (non-quantitative) in selected habitats along the FPR and project components (e.g., Southern Loop corridor, access trails). In addition, roadside surveys were conducted for invasive plant species to determine composition and distribution throughout the RoW.

3.2.1 Native Vegetation Survey

Sites previously selected for native vegetation surveys were used for continued monitoring of wetlands, traditional use plant species, invasive plant species, and 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 m² quadrats nested within 2.5 m² 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 Rare Plant Survey

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).

Rare plant monitoring for species of conservation concern initially involved the review of species previously observed along the FPR RoW. Post-construction monitoring occurred at environmentally sensitive sites (identified in Manitoba Hydro 2020a) to investigate species presence/ absence after RoW clearing activities. Flowering times and preferred habitat for species were reviewed.

In the field, a combination of meander and transect plant searches were used which followed methods outlined by the Alberta Native Plant Council (2012). Parallel transects were favoured in more open and homogenous landscapes, while meander searches were conducted in areas of difficult terrain, unique habitats, and where unusual landscape features occur. Where rare plants were observed and monitored, the following information was recorded: GPS coordinates, number of individuals, population extent (metres), and phenology. Photographs were captured in the field.

3.2.3 Roadside Invasive Plant Survey

Roadside surveys for invasive and noxious plant species occurred along the FPR (i.e., managed access points, intersections with road crossings) to monitor species composition and distribution. Weed density distribution followed Adams et al. (2009) and involved determination of distribution classes (Appendix V).

At managed access points, surveys consisted of an approximate 20 m span, centred where activities occurred. Managed access routes used for the project were also scanned for invasive species problems, with focus on non-gravel roads as a pathway for species movement. At road crossings, surveys occurred near the centreline of the RoW (approximately 20 m span), focusing on the upslope of the ditch to the crest, where the RoW begins. At all sites, fields or stands parallel to the RoW were scanned for invasive species problems, determined from the roadside. Data was recorded on hand-held tablets using Survey123.

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 (MBCDC 2020a).

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.

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

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 _{e}

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

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 _{e}

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 ($\leq 25\%$).

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 five environmental indicators monitored, including wetlands (WET), traditional use plant species (ATK), invasive plant species (INV), golden-winged warbler habitat (GWW), and species of conservation concern (SCC). 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 approximately 360 plant species across 74 families, recorded in 2020. The accuracy of effect predictions and the effectiveness of mitigation for sites are also presented.

4.1 Wetlands

Sixteen wetland (WET) sites were sampled between July 21 to 23 for post-construction monitoring (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_FA528).

4.1.1 Data Analysis of Wetlands

Sixteen wetland sites were re-visited for vegetation monitoring. These sites reflect the diversity of wetlands found in the region, from species poor sedge meadows to herb and shrub rich wetlands, with tall shrub canopies present.

Across all sites, species cover ranged from 17 to 83% vegetation cover, recorded from the herb and low shrub stratum, sites ranging from species poor (7 species) to rich (33 species). Species diversity in wetlands ranged from low (0.95) to high (2.80), with wide ranging species evenness at sites, from 0.46 to 0.84. Sites with a low evenness are generally sites with a few dominating species, but also tended to be species poor. Sites with higher evenness values showed less domination of any species (a more even species distribution). Vegetation descriptions are provided for the lowest canopy (<1m) and the mid canopy (>1 to 2.5m, where present) in Table 4-1a. No tree canopy vegetation was recorded in wetland sites.

Vegetation cover in the herb and low shrub layer was significantly greater ($p=0.034$) in 2020 due to a higher water year (see Section 4.1.2), and better vegetation growth at several sites. Site photos from 2017 and 2020 show thinner growth and seasonal vegetation die back in 2017, not apparent during site sampling in 2020. Diversity and evenness measures in 2020 are significantly lower ($p=0.011$ and $p=0.002$) than those measured pre-construction, data not shown. When all vegetation canopies are considered together, the botanical measures are similar between surveys from pre-construction and monitoring, due to the removal of the tall shrub component with clearing, and the more vigorous growth of graminoids in the herb and low shrub layer in 2020.

Table 4-1a. Vegetation measures for species cover, richness, diversity and evenness in wetland monitoring sites, 2020.

Sites	Herb and Low Shrub Canopy				Tall Shrub Canopy			
	Species Cover	Species Richness	Diversity	Even.	Species Cover	Species Richness	Diversity	Even.
WET-120	50.8	33	2.59	0.74	9	5	1.31	0.81
WET-121	82.6	27	1.90	0.58	2.2	1	-	-
WET-123	75.8	19	1.65	0.56	-	-	-	-
WET-125	17.2	16	1.86	0.67	-	-	-	-
WET-137	78.0	15	1.46	0.54	-	-	-	-
WET-139	17.0	23	2.35	0.75	-	-	-	-
WET-141	42.6	15	1.60	0.59	-	-	-	-
WET-142	72.2	19	1.68	0.57	-	-	-	-
WET-186	36.6	8	0.95	0.46	-	-	-	-
WET-188	47.4	10	1.47	0.64	-	-	-	-
WET-194	42.0	12	1.66	0.67	-	-	-	-
WET-197	42.0	16	1.68	0.61	-	-	-	-
WET-199	28.4	7	1.23	0.63	-	-	-	-
WET-200	47.0	25	1.33	0.41	1.2	1	-	-
WET-201	48.6	25	1.72	0.54	-	-	-	-
WET-209	21.6	28	2.80	0.84	0.2	1	-	-
Mean	46.9	18.6	1.75	0.61	3.2	2.0	1.31	.81

4.1.1.1 Cluster Analysis and Community Typing

Sixteen wetland surveys sampled on the RoW, were examined through hierarchical cluster analyses. All sites are sedge wetlands, but are categorized into three community types, (Table 4-1b), based on species assemblages and cover, vegetation structure, and water table level.

Table 4-1b. Community types for wetland surveys on the RoW, 2020.

Community Type	Sites	Species, total	Species, mean
Hairy-fruited Sedge –Flat-leaved Bladderwort Meadow/ Standing Water	6	27	11.3
Woolly Sedge –Bluejoint Reedgrass Meadow/Willow –Dwarf Birch seedlings	7	58	26.4
Water Sedge –Mixed Sedge Meadow –Cattail	3	29	17.6

Hairy-fruited Sedge –Flat-leaved Bladderwort Meadow/ Standing Water

Six sites are characterized as a hairy-fruited sedge (*Carex lasiocarpa*) community. The water table tends to be high on average (75%). Sites are generally species poor, dominated by a lawn of hairy-fruited sedge. Frequent plants are wetland obligates and include floating

plants flat-leaved bladderwort (*Utricularia intermedia*) and various-leaved pondweed (*Potamogeton gramineus*), and swamp horsetail (*Equisetum fluviatile*). There is little grass, forb or woody seedling cover in the understory. Growth in the lowest canopy is moderate, with overall vegetation cover 40% on average, and no vegetation in the tall shrub or tree canopies.

Woolly Sedge –Bluejoint Reedgrass Meadow/Willow –Dwarf Birch seedlings

Seven sites are characterized as a woolly sedge (*Carex pellita*) community. Sites are generally species (forb) rich, with approximately 25 species unique to this group of sites. Woolly sedge dominates the understory accompanied generally by bluejoint reedgrass (*Calamagrostis canadensis*), and a diversity of forbs including asters (*Symphyotrichum* spp.), violets (*Viola* spp.), and Canada thistle (*Cirsium arvense*) as well as other wetland plants, such as marsh bellflower (*Campanula aparinoides*) and northern bugleweed (*Lycopus uniflorus*). These sites have a moderate cover of woody seedlings, including red-osier dogwood (*Cornus sericea*), dwarf birch (*Betula pumila*) and shrubby cinquefoil (*Dasiphora fruticosa*). The total vegetation cover in these sites can be high (60% in four sites) or low (19% in three sites), with occasional dwarf birch in the tall shrub canopy and no vegetation in the tree canopy. Woody debris and litter cover are high, while moss cover can be high or absent. Bare ground is present at moderate cover, while standing water is occasional and sparse.

Water Sedge –Mixed Sedge or Cattail Meadow

Three sites are distinguished by dominant cover of mixed sedges, prominently water sedge (*Carex aquatilis*), with either beaked sedge (*Carex utriculata*), lakeshore sedge (*Carex lacustris*) or narrow-leaved cattail (*Typha angustifolia*). In these sites, the sedge cover is complemented by other obligate wetland forbs, such as marsh bellflower, northern bugleweed, tufted loosestrife (*Lysimachia thyrsiflora*), water smartweed (*Persicaria amphibia*) and water-parsnip (*Sium suave*). There is little to no woody growth in the understory, though vegetation cover is high, despite the absence of tall shrub and tree canopies. Bare ground cover is moderate with negligible standing water (two sites), or absent with moderate cover of standing water (one site). Litter cover is high throughout.

4.1.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas cleared in 2019/2020, the effect prediction on wetlands from the EIS (Appendix III) included the following:

- Change in wetland cover class abundance, distribution, structure and function

Although some wetlands assessed showed a physical change in appearance from clearing and construction activities (i.e., sparse tree and shrub removal), wetland distribution and function remained unchanged. An increase in wetland vegetation total mean species cover occurred between pre-construction (37.5%) and post-construction values (54%), which could be a result of low disturbance, re-location of select plots (i.e., from construction activity, see below), and an improved growing season. Historical weather data for the Winnipeg region identifies increases in mean monthly (June through August) temperature (19.8 to 21.2°C) and total precipitation (54.8 to 65.7 mm), for sampling seasons 2017 and 2020 respectively (Government of Canada 2020a). Lower cover values were anticipated in 2020, as seen in other studies (Szwaluk Environmental Consulting and Newman 2019b) due to a change in structure and the removal of tree and tall shrub layers, and other low growing woody species on the RoW, during clearing and construction activities.

Mitigation measures identified in the Construction Environmental Protection Plan (Manitoba Hydro 2020a) were assessed at each wetland site sampled, see Table 4-1c. Construction activities mostly occurred on frozen ground conditions minimizing surface damage, rutting and erosion; during non-frozen ground conditions, construction matting was used to protect wetlands from rutting and soil exposure. Shrub and herbaceous vegetation were maintained where possible. Trees were removed by low-disturbance methods. Wetlands were identified with buffers (generally with reduced clearing) and flagging remaining after clearing activities was occasionally observed in the field. Recommended mitigation was effective for wetlands which minimized the disturbance from clearing and construction activities. Mitigation measures appear to have minimized surface disturbance (i.e., rutting, exposed soils). Field observations recorded in wetland sites are provided below.

Plot transect markers were re-established this year in a few sites, where original markers were not re-located from 2017 pre-construction surveys. Two sites were originally established in the tower footings at anchor points (WET-194, -201) and needed to be re-established. One parcel of land was avoided (unaccommodating landowner, WET-137) where the survey had to be moved and conducted across the road in the same wetland type.

Table 4-1c. Mitigation measures assessed at sites monitored for wetlands on the RoW.

Mitigation Measure	WET-100	WET-101	WET-103	WET-105	WET-107	WET-109	WET-111	WET-113	WET-115	WET-117	WET-119	WET-121	WET-123	WET-125	WET-127	WET-129	WET-131	WET-133	WET-135
Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion. Construction matting will be used to protect the area from rutting and exposure to mineral soil during non-frozen ground conditions.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Identify and flag a 30 m vegetated (shrub and herbaceous) buffer around site.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
The application of herbicide is prohibited.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maintain shrub and herbaceous vegetation to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Refer to Clearing Management Plan for clearing prescription.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations.

No major disturbances were noted at any wetland sites, and surface soils appeared relatively undisturbed, without major rutting observed. Few wetland sites had areas with minor amounts of exposed soil (e.g., WET-120, -125). Some vegetation disturbance and possible rutting along the equipment path was apparent at WET-197 (Photograph 4-1a). Disturbance appeared to be at least partially caused by use of ATV. Seasonal vegetation damage was observed around towers and where construction matting occurred. Site WET-123 had vegetation growth suppressed as a result of matting used along the equipment path (Photograph 4-1b).



Photograph 4-1a. Rutting in wetland at site WET-197.



Photograph 4-1b. Vegetation growth suppressed at site WET-123.

During a low-level flight, seasonal damage to vegetation was noted in certain areas on the RoW especially around tower placements and the equipment path, (e.g., near WET-123, -125). Several sites sampled also had abundant mulch cover present, with reduced species cover in these areas of the RoW (e.g., WET-188, -209). As a result of low disturbance to wetlands in 2020, wetland loss was determined to only include the area displaced by the tower foundations. Minor disturbances in monitored wetlands are anticipated to naturally recover along the RoW, as seen in other transmission projects (Manitoba Hydro 2020b). Photograph 4-1c shows typical RoW disturbance seen at most wetland sites.



Photograph 4-1c. RoW disturbance (upper linear feature) at site WET-142.

4.2 Traditional Use Plant Species

Eleven sites with abundant traditional use plants (ATK) were sampled for vegetation monitoring along the FPR RoW, from August 5 to 8 (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_FA529). Eight additional INV sites were included in the data analysis of traditional use plant species. These eight sites supported total traditional plant cover >30%, recorded from all strata (i.e., tree and tall shrub canopies, and the herb and low shrub understory) in 2017 pre-construction sampling.

4.2.1 Data Analysis of Traditional Use Plant Species

All sites were originally forested, frequently dominated by trembling aspen (*Populus tremuloides*), with some sites variously dominated by one of balsam poplar (*Populus balsamifera*), black ash (*Fraxinus nigra*), tamarack (*Larix laricina*), or eastern white cedar (*Thuja occidentalis*) or willows (*Salix* spp.). Site descriptions of species cover, richness and diversity measures for understory, and the upper canopies are found in Tables 4-2a and 4-2b, respectively.

Table 4-2a. Vegetation measures in herb and low shrub layer: species cover, richness, diversity and evenness in traditional use and select invasive species sites, 2020.

Sites	Herb and Low shrub layer			
	Species Cover	Species Richness	Diversity	Even.
ATK-131	24.8	33	3.15	0.90
ATK-165	54.6	40	2.68	0.73
ATK-179	28.4	29	2.79	0.83
ATK-215	68.2	27	2.07	0.63
ATK-216	15.2	40	3.35	0.91
ATK-219	37.2	23	2.19	0.70
ATK-220	80.8	44	2.78	0.74
ATK-222	31.0	20	2.22	0.74
ATK-223	28.2	28	2.72	0.82
ATK-224	58.8	30	2.28	0.67
ATK-226	48.0	27	2.33	0.71
INV-132	19.0	32	3.15	0.91
INV-153	13.0	25	3.03	0.94
INV-161	31.2	30	2.92	0.86
INV-164	77.2	35	2.52	0.71
INV-187	60.6	37	3.03	0.84
INV-196	35.8	21	2.55	0.84
INV-203	54.0	34	2.91	0.83
INV-218	3.0	11	2.25	0.94
Mean	40.5	29.8	2.68	0.80

Table 4-2b. Vegetation measures in tall shrub and tree canopies: species cover, richness, diversity and evenness in traditional use and select invasive species sites, 2020.

Sites	Tall Shrub Canopy				Tree Canopy			
	Species Cover	Species Richness	Diversity	Even.	Species Cover	Species Richness	Diversity	Even.
ATK-131	-	-	-	-	-	-	-	-
ATK-165	-	-	-	-	-	-	-	-
ATK-179	1.6	2	0.38	0.54	1	1	-	-
ATK-215	1.6	2	0.38	0.54	-	-	-	-
ATK-216	-	-	-	-	-	-	-	-
ATK-219	-	-	-	-	-	-	-	-
ATK-220	1	1	-	-	-	-	-	-
ATK-222	-	-	-	-	-	-	-	-
ATK-223	-	-	-	-	-	-	-	-
ATK-224	-	-	-	-	-	-	-	-
ATK-226	-	-	-	-	-	-	-	-
INV-132	-	-	-	-	-	-	-	-
INV-153	-	-	-	-	-	-	-	-
INV-161	-	-	-	-	-	-	-	-
INV-164	4.6	2	0.30	0.43	2	2	0.69	1
INV-187	20.2	5	0.99	0.62	17	4	1.07	0.77
INV-196	-	-	-	-	-	-	-	-
INV-203	-	-	-	-	3	2	0.64	0.92
INV-218	-	-	-	-	-	-	-	-
Mean	5.8	2.4	0.51	0.53	5.8	2.3	0.80	0.90

Total mean species cover in the herb and low shrub layers from 11 ATK and eight selected INV sites ranged widely from 3 to 81%. Sites were floristically diverse, with an average species richness of 30 species recorded in plots, ranging from 11 to 44 species per site. The diversity measure was relatively high for all sites, with an average of 2.7, (ranging from 2.07 to 3.35). The average evenness (0.8) was also high, (ranging from 0.63 to 0.94). A tall shrub canopy was present in five sites, with either extremely sparse cover (ATK-179, -215, -220; INV-164), to sparse cover (INV-187). Occasional tall shrub stems grew to tree canopy height (>2.5 m) in four sites, (ATK-179; INV-164, -187, -203), while one tree, green ash (*Fraxinus pennsylvanica*), was present in the tree canopy of a single site (INV-187; 2% cover, <4m in height).

Total vegetation cover (all strata) is significantly reduced ($p < 0.001$) in 2020, due to removal of mid and upper canopies. However, when only the herb and low shrub layer is considered, vegetation cover is comparable between pre-construction and monitoring surveys. All other measures (species richness, diversity and evenness) were similar between years, data not shown.

4.2.1.1 Cluster Analysis and Community Typing

Hierarchical cluster analyses were performed for 11 traditional use area surveys. Eight INV surveys had traditional use plants accounting for over 30% vegetation cover, and are included in the following ATK analysis, (Table 4-2c). The resulting three community types are separated based on degree of regeneration, vegetation structure and cover, and species assemblages at sites.

Table 4-2c. Community types for traditional use and select invasive species sites, 2020.			
Community Type	Surveys	Species, total	Species, mean
Sparse Willows- Speckled Alder Tall Shrubs/ Trembling Aspen – Dogwood seedlings –Bluejoint Reedgrass	7	109	34.9
Trembling Aspen seedling—Wild Red Raspberry	3	64	32.3
Early Regeneration: Herbaceous Forb Mix	9	125	28.2

Sparse Willows- Speckled Alder Tall Shrubs/ Trembling Aspen – Dogwood seedlings – Bluejoint Reedgrass

Seven sites are characterized by well-developed regeneration, with generally high vegetation cover overall (58%). The low canopy is co-dominated by herbaceous forbs and woody seedlings, primarily tall shrub and tree seedlings. The graminoid cover is moderate relative to the two other community types and is generally dominated by bluejoint reedgrass, with a mix of various grasses and sedges. Four sites have a sparse mid- and/or upper- canopy cover of tall shrubs, such as willows, speckled alder (*Alnus incana*) and red-osier dogwood, which reach between >1 and <4 m height. Woody regrowth is notably present in one site INV-187, with speckled alder in the mid- and upper canopies, and green ash in the upper canopy. On the ground, woody debris is high, bare soil cover is negligible, and litter cover is moderate.

Trembling Aspen seedling—Wild Red Raspberry

Three sites are characterized by a well-developed woody understory largely dominated by regenerating trembling aspen seedlings (<1 in height) and other woody shrubs, primarily wild red raspberry (*Rubus idaeus*), hazelnuts (*Corylus* spp), chokecherry (*Prunus virginiana*), and snowberry (*Symphoricarpos albus*). Herbaceous forbs include wild

sarsaparilla (*Aralia nudicaulis*) and poison ivy (*Toxicodendron rydbergii*), with a very sparse mix of grasses and sedges. Overall vegetation cover is high (63%). The mid-canopy is poorly developed, with occasional, sparse trembling aspen saplings (<2 m) present, while the upper tree canopy is absent. On the ground, woody debris is high, bare soil cover is low, and litter cover is negligible.

Early Regeneration: Herbaceous Forb Mix

Nine sites are distinguished by a poorly developed understory, with vegetation cover 26% overall. The lowest canopy (<1 m) is dominated by a mix of herbaceous forbs, but none are characteristic of sites and none dominate. Sites had sparsely emerging cover of tall shrub seedlings, and the cover of mixed grasses and sedges is also sparse. A single site (ATK-224) had several forbs with high cover, although this site had certain unique influences, surrounded by agriculture, with a small wetland nearby. At this site, ground disturbance was high, and species present included early colonizing non-native and native plants. A site restoration was newly initiated through topsoil addition and newly seeded to grass, (type unknown). In all sites, the mid and upper canopies are absent. On the ground, woody debris is high, bare soil cover can be prominent in some sites, and litter cover is low.

4.2.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas cleared in 2019/2020, the effect predictions on traditional use plant species from the EIS (Appendix III) included the following:

- Change in native vegetation cover class abundance, distribution and structure
- Change in traditional use plant species abundance and distribution

The predicted change in vegetation cover and structure was accurate for traditional use plant species sites. Vegetation total mean cover decreased from pre-construction values (2017 surveys), 129.4 to 43.7%, and structure has been modified to accommodate the transmission line. Clearing on the RoW has temporarily reduced vegetation cover due to the removal of multiple vegetation strata, including the tree layer, tall shrub, and low shrub and ground vegetation.

Mitigation measures identified in the Construction Environmental Protection Plan for traditional use plant species (Manitoba Hydro 2020a) were assessed at each site sampled (Table 4-2d). Select invasive plant sites (INV) on the RoW were included with traditional use where pre-construction cover of species was considered high (>30% cover). Where required, construction matting appeared to be used along access trails to protect the area from rutting and soil exposure during saturated soil conditions. Existing access roads and trails were used to the extent possible, and vehicle traffic on the RoW was confined to the

equipment path where possible. These types of disturbances were generally not noted at traditional use plant sites, however some minor rutting of soils was noted within the RoW, generally on the equipment path. Environmental monitoring determined that the recommended mitigation was implemented for traditional use plant species which minimized the ground disturbance from construction activities. Mitigation measures appear to have minimized surface disturbance. Observations recorded in the field are provided below.

Table 4-2d. Mitigation measures assessed at sites monitored for traditional use plant species on the RoW, including select invasive plant sites where cover of species considered for traditional use was high.

Mitigation Measure	ATK-131	ATK-165	ATK-179	ATK-215	ATK-219	ATK-220	ATK-221	ATK-222	ATK-223	INV-164	INV-187	INV-203	INV-204	INV-205	INV-206	INV-207	INV-208
Construction matting will be used along access trail to protect the area from rutting and exposure of soil during saturated soil conditions.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Use existing access roads and trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Refer to Clearing Management Plan for clearing prescription.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Confine vehicle traffic to established trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan for mitigation.	-	-	-	-	-	-	-	Y	-	-	-	-	-	-	-	Y	-

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations. Dash (-) means not applicable.

The RoW was generally totally cleared of previous tree canopies, although in some sites, intermittent tall willows remained as isolated and small patches were maintained on the RoW (e.g., ATK-165, -179; and INV-164, -187, -203), with some tall shrubs to tree height (<4 m). High-bush cranberry (*Viburnum opulus*) and speckled alder were tall shrubs also recorded in ATK-179. No other original tall shrub vegetation structure was retained in other sites after clearing on the RoW. Sites were generally covered with mulched wood. Regeneration of trembling aspen and tall shrubs was moderately to well-developed in some sites (i.e., ATK-215, -219, -220). Other sites were still in early stages of recovery as evidenced by low species numbers and cover. Photograph 4-2a shows traditional site ATK-165 with remaining and regenerating vegetation.



Photograph 4-2a. Well-developed herb and low shrub stratum, and regenerating and remaining tall shrubs.

Two monitoring sites for traditional use plants had applications of straw mulch, sites ATK-226 and INV-203. The equipment path in the vicinity of these sites was covered extensively with a wide swath (>20 m) and thick mat of straw mulch, stretching from Provincial Highway 201 and encompassing several towers, Photograph 4-2b. Scattered volunteer barley (mature *Hordeum vulgare*) had sprouted from the straw mulch throughout the equipment path. Off-RoW, eastern white cedar (*Thuja occidentalis*) and tamarack (*Larix laricina*) dominate the tree canopy. It was not possible to determine whether underlying soils may have been disturbed by any construction activities. The equipment path was relatively level under moist ground conditions, and possibly more compacted than the surrounding area on the RoW.

At site ATK-224, a large area of topsoil was applied around the tower footing in response to disturbance, and was seeded with unknown grasses. No regenerating vegetation growth, nor germination was apparent on the topsoil, as of 7 August. The transect was shifted slightly to capture the existing vegetation regeneration at this site. The area covered by topsoil was under and directly adjacent to tower footing. At site INV-132, an equipment staging occurred where the ground was bare of vegetation and compacted for approximately the first 10 m of the plot transect.



Photograph 4-2b. Swath of straw mulch along equipment path at ATK-226.

4.3 Invasive Plant Species

Noxious, invasive, and non-native (ranked SNA) species data was recorded several ways, project wide. A total of 300 roadside sites were surveyed for invasive plant presence in July along the FPR RoW and project components for invasive plant species, from the Dorsey converter station to the Minnesota border crossing, near Piney. Thirteen sites (INV) were sampled quantitatively, and originally determined to be at a greater risk for invasive and non-native plant species due to their proximity to roads, corridors or preexisting invasive occurrences. Finally, invasive species observations were recorded in and incidental to all other quantitative surveys (ATK, GWW and WET), (Field Activity ID MMTP_CON-FA527, 528 and 529) (Map 4-1, Appendix II).

Project-wide, 70 noxious, invasive, or non-invasive SNA species were recorded along the RoW throughout roadside (R) surveys, and all vegetation monitoring (ATK, GWW, INV, WET) in 2020. Many of these species listed as noxious, invasive or non-native, are found uniquely in the Roadside Invasive surveys.

Of the 70 species recorded, 32 species are listed in The Noxious Weeds Regulation under the Manitoba Noxious Weed Act as plants 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. Six notable noxious species recorded include two Tier 1 species, spotted knapweed (*Centaurea stoebe*) and red bartsia (*Odontites vulgaris*), and four Tier 2 species, hoary alyssum (*Berteroa incana*), leafy spurge (*Euphorbia*

virgata), ox-eye daisy (*Leucanthemum vulgare*), and scentless false mayweed (*Tripleurospermum inodorum*). Tier 1 and 2 provide the most severe listing for noxious species. The remaining 26 noxious species are listed as Tier 3.

While not considered noxious, 19 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 2020). An additional 19 are non-native species (ranked SNA), but considered neither noxious nor invasive. Non-native species growth may still lead to the exclusion of native plants.

Together, the noxious, invasive and non-invasive SNA species recorded along the RoW in 2020 include 18 families, most prominently represented are Asteraceae (20 species), Poaceae (12 spp.), Fabaceae (10 spp.) and Brassicaceae (6 spp.). All noxious weed, invasive and non-native (non-invasive) species are listed in Table 4-3a, along with the surveys where they occur.

Table 4-3a. Noxious, invasive and non-invasive non-native (SNA) species observation counts recorded from all sites project wide, 2020.

Species	Rank	Noxious Weed	Invasive Status	ATK	INV	WET	GW	R
<i>Agrostis stolonifera</i>	SNA			1	4		10	29
<i>Amaranthus blitoides</i>	SNA			1				
<i>Amaranthus retroflexus</i>	SNA		CFIA	1				68
<i>Ambrosia artemisiifolia</i>	S5	Tier 3						53
<i>Ambrosia trifida</i>	S4	Tier 3						7
<i>Artemisia absinthium</i>	SNA	Tier 3	CFIA					11
<i>Artemisia biennis</i>	SNA							13
<i>Asclepias speciosa</i>	S3S5	Tier 3						16
<i>Asclepias syriaca</i>	S3S4	Tier 3			1			12
<i>Avena sativa</i>	SNA		CFIA					13
<i>Bassia scoparia</i>	SNA	Tier 3						21
<i>Berteroa incana</i>	SNA	Tier 2	CFIA		1			3
<i>Brassica rapa</i>	SNA			1				42
<i>Bromus inermis</i>	SNA		CFIA		5	1	4	224
<i>Capsella bursa-pastoris</i>	SNA		CFIA					4
<i>Centaurea stoebe</i>	SNA	Tier 1	CFIA, ISCM					1
<i>Chenopodium album</i>	SNA	Tier 3	CFIA	1	1	1	1	86
<i>Cicuta maculata</i>	S4S5	Tier 3		2	2	1		9
<i>Cirsium arvense</i>	SNA	Tier 3	CFIA, ISCM	4	7	5	9	170
<i>Cirsium vulgare</i>	SNA	Tier 3		2	1			6
<i>Crepis tectorum</i>	SNA	Tier 3	CFIA					6

<i>Cyclchaena xanthiifolia</i>	SNA	Tier 3						8
<i>Echinochloa crus-galli</i>	SNA							9
<i>Elymus repens</i>	SNA		CFIA	2		1		128
<i>Erigeron canadensis</i>	S5	Tier 3		1				
<i>Erodium cicutarium</i>	SNA	Tier 3						2
<i>Erucastrum galicum</i>	SNA							2
<i>Euphorbia virgata</i>	SNA	Tier 2	CFIA, ISCM					1
<i>Fagopyrum tataricum</i>	SNA		CFIA					10
<i>Fallopia convolvulus</i>	SNA		CFIA	2				38
<i>Galeopsis tetrahit</i>	SNA	Tier 3		1				
<i>Hordeum jubatum</i>	S5	Tier 3				2		75
<i>Hordeum vulgare</i>	S5		CFIA	1	2			
<i>Lactuca serriola</i>	SNA	Tier 3	CFIA				1	23
<i>Lappula squarrosa</i>	SNA		CFIA					13
<i>Leucanthemum vulgare</i>	SNA	Tier 2	CFIA, ISCM		1			11
<i>Linaria vulgaris</i>	SNA	Tier 3	ISCM					4
<i>Lotus corniculatus</i>	SNA		CFIA		1			43
<i>Matricaria discoidea</i>	SNA							17
<i>Medicago lupulina</i>	SNA			1	2		2	87
<i>Medicago sativa</i>	SNA		CFIA		1			80
<i>Melilotus albus</i>	SNA		CFIA	1				83
<i>Melilotus officinalis</i>	SNA		CFIA					69
<i>Melilotus spp.</i>	SNA		CFIA	1	3	1		
<i>Myosotis scorpioides</i>	SNA			1		1		
<i>Odontites vulgaris</i>	SNA	Tier 1	CFIA, ISCM					2
<i>Pastinaca sativa</i>	SNA	Tier 3						3
<i>Petasites frigidus</i> var. <i>x vitifolius</i>	SNA			1	1			
<i>Phalaris arundinacea</i>	S5		CFIA	3	4	2		28
<i>Phleum pratense</i>	SNA			1	4		6	28
<i>Plantago major</i>	SNA		CFIA				1	54
<i>Poa annua</i>	SNA						1	
<i>Portulaca oleracea</i>	SNA							9
<i>Rumex crispus</i>	SNA					1		5
<i>Setaria pumila</i>	SNA			1				12
<i>Setaria viridis</i>	SNA		CFIA					10
<i>Silene csereii</i>	SNA		CFIA		1			3
<i>Silene latifolia</i>	SNA	Tier 3	CFIA					12
<i>Solanum triflorum</i>	SNA	Tier 3		1				
<i>Sonchus arvensis</i>	SNA	Tier 3	CFIA, ISCM	4	7	3	4	106

<i>Sonchus asper</i>	SNA	Tier 3						2
<i>Sonchus oleraceus</i>	SNA	Tier 3						9
<i>Taraxacum officinale</i>	SNA	Tier 3	CFIA	6	6	1	8	131
<i>Thlaspi arvense</i>	SNA	Tier 3	CFIA		1			73
<i>Tragopogon dubius</i>	SNA							9
<i>Trifolium hybridum</i>	SNA			1				53
<i>Trifolium pratense</i>	SNA		CFIA	3	4			56
<i>Trifolium repens</i>	SNA						1	8
<i>Tripleurospermum inodorum</i>	SNA	Tier 2	CFIA, ISCM					2
<i>Verbascum thapsus</i>	SNA							1
<i>Vicia cracca</i>	SNA		ISCM		1			34
2020				ATK	INV	WET	GWV	R
Noxious species only				9	10	6	5	29
Total Species: Noxious, invasive and non-native				25	24	11	13	62
Total Observations: Noxious, invasive, non-native				43	63	19	49	2147

4.3.1 Data Analysis of Invasive Plant Species

Roadside and Environmentally Sensitive Site (ESS) Surveys

Roadside surveys (300 sites) were surveyed for invasive plant species in July, along the FPR RoW and project components, from the Dorsey converter station to the Minnesota border crossing, near Piney. A total of 62 species were encountered in roadside surveys (invasive, noxious and/or non-native), including 29 of the noxious species observed in 2020. Roughly half the species noted (30 spp.) are unique to roadside sites.

The most threatening listed noxious weed species recorded in 2020 are two Tier 1 species, red bartsia and spotted knapweed, and four Tier 2 species, hoary alyssum, leafy spurge, ox-eye daisy and scentless false mayweed. These six species were observed across 21 roadside sites in July 2020, and their distribution at sites was coded into 13 distribution classes (following Adams et al., 2009), which are generally ordered by increasing density and/or abundance, see Appendix V. The mean distribution class is summarized for Tier 1 and 2 noxious species by year in Table 4-3b. Spotted knapweed (Tier 1) was recorded at one site with a rare occurrence in distribution (Class 1), and red bartsia (Tier 1) at two sites, both in a single patch (Class 3). Photograph 4-3a shows spotted knapweed on the RoW.

The remaining Tier 3 species include common ragweed (*Ambrosia artemisifolia*), giant ragweed (*Ambrosia trifida*), wormwood (*Artemisia absinthium*), showy milkweed (*Asclepias speciosa*), common milkweed (*Asclepias syriaca*), common kochia (*Bassia scoparia*), common lamb's-quarters (*Chenopodium album*), spotted water-hemlock (*Cicuta maculata*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), narrow-leaved hawks-beard

(*Crepis tectorum*), marsh-elder (*Cyclachaena xanthiifolia*), alfilaria (*Erodium cicutarium*), foxtail barley (*Hordeum jubatum*), prickly lettuce (*Lactuca serriola*), butter-and-eggs (*Linaria vulgaris*), wild parsnip (*Pastinaca sativa*), white cockle (*Silene latifolia*), field sow-thistle (*Sonchus arvensis*), spiny-leaved sow-thistle (*Sonchus asper*), common sow-thistle (*Sonchus oleraceus*), common dandelion (*Taraxacum officinale*), and field pennycress (*Thlaspi arvense*).

Table 4-3b. The mean distribution class of Tier 1 and 2 noxious species in roadside invasive sites by year, with number of sites where found.

Noxious species	2018	2020	# Sites (2018/20)
Tier 1			
<i>Centaurea stoebe</i>	-	1	1
<i>Odontites vulgaris</i>	7.3	3	8/2
Tier 2			
<i>Berteroa incana</i>	-	2.7	3
<i>Bromus japonicus</i>	2	-	2
<i>Euphorbia virgata</i>	-	5	2
<i>Leucanthemum vulgare</i>	-	6.9	11
<i>Silene vulgaris</i>	1	-	2
<i>Tripleurospermum inodorum</i>	2	3	3/2
Total species per year, and total sites	4	6	15/21



Photograph 4-3a. Spotted knapweed observed at site INV-377-R.

During pre-construction surveys (2018), four species designated Tier 1 or 2 were observed across 15 roadside sites on the RoW. Red bartsia was the only Tier 1 species observed and was recorded at eight sites with a distribution ranging from a few sporadically occurring individual plants (Class 2) to a continuous occurrence of plants with a few gaps (Class 11). Three Tier 2 species, Japanese brome (*Bromus japonicus*), bladder campion (*Silene vulgaris*) and scentless false mayweed were also recorded from 2018 roadside surveys. Off the RoW, two additional Tier 2 species, ox-eye daisy and hoary alyssum were recorded in a single quarry site during surveys of potential borrow areas in 2018.

In August 2020, 14 environmentally sensitive sites were surveyed for red bartsia (CEnvPP ECO-400's). This species flowers later in the growing season and becomes easier to detect when flowering. Red bartsia was observed at all 14 locations and maintained its presence in areas along the FPR RoW, compared to 2018 surveys. Abundance was varying at sites from a single patch of plants (Class 3) to a continuous occurrence of plants with a few gaps in distribution (Class 11). Photograph 4-3b shows red bartsia observed in 2020. Known observations of red bartsia were previously reported on during pre-construction surveys (Szwaluk Environmental Consulting and Newman 2017; 2019a).



Photograph 4-3b. Red bartsia observed at ECO-400A.

Quantitative Invasive Surveys (INV)

Thirteen quantitative surveys were conducted to monitor for invasive and non-native vegetation. Sites selected as INV sites include both forested sites and open sites. Site descriptions of species cover, richness and diversity measures are in Table 4-3c and 4-3d below.

Table 4-3c. Invasive monitoring plots: vegetation measures for species cover, richness, diversity and evenness, in the herb and low shrub canopy, 2020.

Sites	Herbs and Low Shrub Canopy			
	Species Cover	Species Richness	Diversity	Evenness
INV-122	68.2	40	2.81	0.76
INV-126	48.2	31	2.58	0.75
INV-132*	19.0	32	3.15	0.91
INV-135	39.6	33	2.57	0.73
INV-153*	13.0	25	3.03	0.94
INV-161*	31.2	30	2.92	0.86
INV-164*	77.2	35	2.52	0.71
INV-178	46.2	29	2.52	0.75
INV-180	28.0	37	3.04	0.84
INV-187*	60.6	37	3.03	0.84
INV-196*	35.8	21	2.55	0.84
INV-203*	54.0	34	2.91	0.83
INV-218*	3.0	11	2.25	0.94
Mean	40.3	30.4	2.76	0.82

Sites marked (*) were also examined through clustering with ATK sites for community typing due to their elevated cover of traditional use species, as recorded pre-construction (2017).

Table 4-3d. Invasive monitoring plots: vegetation measures for species cover, richness, diversity and evenness, in the mid- and tree canopies, 2020.

Sites	Tall Shrub Canopy				Tree Canopy			
	Species Cover	Species Richness	Diversity	Even.	Species Cover	Species Richness	Diversity	Even.
INV-122	12.2	4	1.09	0.79	20	2	0.20	0.29
INV-126	-	-	-	-	-	-	-	-
INV-132*	-	-	-	-	-	-	-	-
INV-135	-	-	-	-	-	-	-	-
INV-153*	-	-	-	-	-	-	-	-
INV-161*	-	-	-	-	-	-	-	-
INV-164*	4.6	2	0.30	0.43	2	2	0.69	1
INV-178	-	-	-	-	-	-	-	-
INV-180	1.4	4	1.28	0.92	-	-	-	-
INV-187*	20.2	5	0.99	0.62	17	4	1.07	0.77
INV-196*	-	-	-	-	-	-	-	-
INV-203*	-	-	-	-	3	2	0.64	0.92
INV-218*	-	-	-	-	-	-	-	-
Mean	9.6	3.8	0.91	0.69	10.5	2.5	0.65	0.74

Sites marked (*) were also examined with through clustering ATK sites for community typing due to their elevated cover of traditional use species, as recorded pre-construction (2017).

Species cover measures are presented separately for each vegetation strata (i.e., herb and low shrub layer, tall shrub, and tree canopies). Species cover values in the understory layer are wide-ranging from 3 to 77%. Richness in the understory, the number of species recorded, ranges from 11 to 40 species. The diversity measures and evenness are high throughout all sites for this year of regrowth, 2020.

The overall cover from all vegetation strata in 2020 (47.2%) is significantly reduced ($p < 0.003$) from pre-construction values (111.7%) due to removal of tree and tall shrub canopies. However, the average understory vegetation cover in 2020 (40.3%) though highly variable, is not significantly different ($p = 0.068$) from pre-construction cover value in the understory (54.9%), data not shown.

In INV sites, the cumulative cover of both noxious (1.14%) and non-native (0.85%) species in 2020 has risen slightly when compared to pre-construction values (0.97% and 0.48%, respectively) recorded in 2017. However, the cumulative cover of invasive species is much reduced in 2020 (2.29%) vs. cover recorded in 2017 (6.18%). Invasive cover was high in 2017 due to large patches of two invasive grasses, reed canarygrass (*Phalaris arundinaceae*, 41% in INV122) and smooth brome (*Bromus inermis*, 12% in INV161, and 11% INV203). While these invasives grasses were still present in 2020, their covers were much reduced (13%, 2% and 6% respectively), data not shown.

4.3.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas cleared in 2019/2020, the effect prediction on invasive plant species from the EIS (Appendix III) was accurate for the following:

- Change in invasive plant species abundance and distribution

Invasive plant species abundance and distribution have increased from pre-construction values. In 2017, 56 noxious, invasive or non-invasive SNA species were recorded and 59 species in 2018, compared to 70 species observed post-construction. The number of noxious Tier 1 and 2 species observed has also increased from four to six species. The distribution (number of sites) of noxious Tier 1 and 2 species has increased on the FPR RoW from pre-construction values, from 15 to 33 (including all ECO-400's containing red bartsia).

Mitigation measures identified in the Construction Environmental Protection Plan for invasive plant species (Manitoba Hydro 2020a) were assessed at each site sampled (i.e., red bartsia ECO-400's), see Table 4-3e. Vehicle traffic was confined to established trails to the extent possible, and it appears that biosecurity cleaning measures (Biosecurity Management Plan 2019c) were implemented during construction activities as a result of

low invasive species movement on the FPR, at pre-existing sites. In few areas, red bartsia was observed again in large patches on the RoW (e.g., ECO-400, -401A), see Photograph 4-3c. Recommended mitigation was effective where implemented for invasive plant species (i.e., red bartsia) which minimized the ground disturbance and infestation of species from construction activities. Mitigation measures appear to have minimized site disturbance.

Table 4-3e. Mitigation measures assessed at sites monitored for invasive species (red bartsia) on the RoW.

Mitigation Measure	E C O - 4 0 0	E C O - 4 0 0	E C O - 4 0 0	E C O - 4 0 0	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1	E C O - 4 0 1
Implement Biosecurity cleaning measures as per the Biosecurity Management Plan (Tier 1 Weeds).	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Confine vehicle traffic to established trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan for mitigation.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations. Dash (-) means not applicable.



Photograph 4-3c. Red bartsia observed on the RoW at ECO-401A (dark shade background).

Although, clearing and construction activities were carried out over the winter months, where the spread of invasive and non-native species is reduced, invasive species have the ability to spread rapidly in favorable habitats (i.e., bare soil conditions) and the risk of spread may increase with each season. Project wide, six noxious species designated Tier 1 or 2 were observed on the FPR RoW in 2020. A total of 70 invasive species were recorded this season, project wide. Invasive plants are capable of growing under a wide range of climatic and soil conditions, and produce seeds that are easily disseminated. The removal of native vegetation on the RoW and areas of exposed soil from clearing and construction activities provide an opportunity for invasive and non-native species to establish and proliferate (Szwaluk Environmental Consulting et al. 2016).

In many areas of the RoW, invasive species have been already established, due to the presence of a road or railway that intersects with the project. On-going and future land use (e.g., livestock grazing, ATV activity, etc.) along the RoW may increase the risk of spread of invasive species throughout the RoW, into sensitive sites or adjacent areas. Recommendations for invasive plant species observed in 2020 are identified in Section 5.0 of this monitoring report.

4.4 Golden-winged Warbler Habitat

Thirteen sites were sampled for golden-winged warbler (*Vermivora chrysoptera*) habitat (GWW) from August 5 to 9, along the FPR RoW (Map 4-1, Appendix II) (Field Activity ID MMTP_CON_FA529). The FPR intersects areas of critical golden-winged warbler habitat, according to the EIS (Chapter 9; Manitoba Hydro 2015).

4.4.1 Data Analysis of Golden-winged Warbler Habitat

In this season of monitoring, 2020, total mean species cover in sites ranged from 28 to 70% in the herb and low shrub layer. Sites were floristically diverse, with an average species richness of 32 species recorded in plots, (19 to 47 species). The diversity was relatively high for all sites, with an average of 2.8 (2.1 to 3.3) and average evenness (0.8) was also high. Some very sparse cover of tall shrubs was present in 10 sites, as an average of 2.3% cover and ranging from 0.2 to 10% cover, Table 4-4a. Tree canopy cover was generally absent from GWW sites, but for a single site (GWW-019) with a sparse growth (5% white spruce) reaching the tree canopy (>2.5 m in height), data not shown.

Table 4-4a. Golden-winged warbler habitat monitoring sites: vegetation measures for species cover, richness, diversity and evenness, 2020.

Sites	Herbs and low shrubs				Tall shrubs			
	Species Cover	Species Richness	Diversity	Even.	Species Cover	Species Richness	Diversity	Even.
GWW-001	49.4	42	3.29	0.88	0.4	1	-	-
GWW-004	58.4	34	2.68	0.76	0.8	1	-	-
GWW-006	51.2	22	2.11	0.68	1.2	3	1.10	1.00
GWW-008	51.4	30	2.67	0.78	3.4	3	0.58	0.53
GWW-009	39.0	34	3.17	0.90	0.2	1	-	-
GWW-010	39.8	39	3.15	0.86	-	-	-	-
GWW-013	38.4	47	3.15	0.82	-	-	-	-
GWW-015	28.4	27	2.59	0.79	5.4	2	0.26	0.38
GWW-016	41.4	27	2.55	0.77	0.2	1	-	-
GWW-018	69.6	35	2.90	0.82	10	6	1.45	0.81
GWW-019	56.4	19	2.28	0.78	0.6	2	0.64	0.92
GWW-022	49.0	26	2.63	0.81	-	-	-	-
GWW-024	41.6	35	3.05	0.86	0.8	1	-	-
Mean	47.2	32.1	2.79	0.81	2.3	2.1	0.81	0.73

Vegetation cover is significantly reduced in 2020 overall, from all vegetation strata ($p < 0.001$) and within the understory alone ($p < 0.001$), due to removal of mid and upper canopies, and the increased cover of bare ground and woody debris in 2020, as vegetation regenerates. The species richness over all strata is significantly reduced ($p = 0.004$) in 2020 due to removal of taller woody species in the upper canopies, but species richness is comparable in the understory between pre-construction and post-construction monitoring, data not shown.

4.4.1.1 Cluster Analysis and Community Typing

Community type groups within 13 sites of golden-winged warbler habitat on the RoW were examined through hierarchical cluster analyses. Two community types were determined (Table 4-4b) largely based on emerging vegetation structure, and species assemblages and cover at sites. Both community types share many understory species in common. Trembling aspen seedlings and saplings were found in nearly all sites, while balsam poplar seedlings and saplings were found occasionally. Inanimate ground cover is similar among sites of both community types: bare ground is generally sparse or absent and litter cover is moderate, while the cover of woody debris is variable among sites.

Table 4-4b. Community types for golden-winged warbler habitat surveys on the RoW, 2020.

Community Type	Surveys	Species, total	Species, mean
Dense Trembling Aspen seedling- Tall Shrub seedling – Herb Rich	4	78	38.3
Open Trembling Aspen seedling- Herb and Graminoid Rich	9	106	31.2

Dense Trembling Aspen seedling- Tall Shrub seedling – Herb Rich

Four sites are distinguished by a well-developed understory with high overall vegetation cover (57%), balanced between diverse herbaceous forbs and regrowth of woody seedlings mainly chokecherry, alder-leaved buckthorn (*Rhamnus alnifolia*) and trembling aspen, as well as Saskatoon (*Amelanchier alnifolia*) beaked hazelnut (*Corylus cornuta*) and downy arrowwood (*Viburnum rafinesquianum*). The forbs present are a mix of shade tolerant and more open species such as bastard toadflax (*Comandra umbellata*), umbellate hawkweed (*Hieracium umbellatum*), snakeroot (*Sanicula marilandica*), Lindley's aster (*Symphyotrichum ciliolatum*), veiny meadow-rue (*Thalictrum venulosum*), and poison-ivy. Graminoids are a minor component of the understory, with cover balanced equally among grasses and sedges.

Open Trembling Aspen seedling- Herb and Graminoid Rich

Nine sites are distinguished by a moderately well-developed understory, the vegetation cover overall measured 31% in sites. Trembling aspen seedlings are present in all sites but one, where balsam poplar seedlings are prominent. These sites are dominated generally by herbaceous forbs and grasses, with sedges as a minor component. Herbaceous forbs include a mix of often 'open' species such as Canada thistle, Canada goldenrod (*Solidago canadensis*), and prickly rose (*Rosa acicularis*). Prominent grasses are fowl bluegrass (*Poa palustris*), Kentucky bluegrass (*P. pratensis*), and bluejoint reedgrass, with hay sedge (*Carex foenea*).

4.4.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas cleared in 2019/2020, the effect predictions from the EIS (Appendix III) included the following:

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

A change in landscape intactness is a result of transmission RoW clearing. Removal and long-term loss of forest cover from RoW clearing is an effect of transmission line development (Manitoba Hydro et al. 2003). Fragmentation of large-scale corridor projects is frequently an inevitable consequence (Joro Consultants 2011). Vegetation cover decreased from pre-construction values (2017) due to the removal of tree and shrub vegetation structure and associated species from the RoW (mean total species cover change of 107.6 to 49.5%). A change in habitat availability has also occurred on the RoW in critical GWW habitat. Vegetation has been selectively cleared in areas to enhance suitability for GWW, see Photograph 4-4a.



Photograph 4-4a. Selective clearing on RoW at GWW-013 with available habitat.

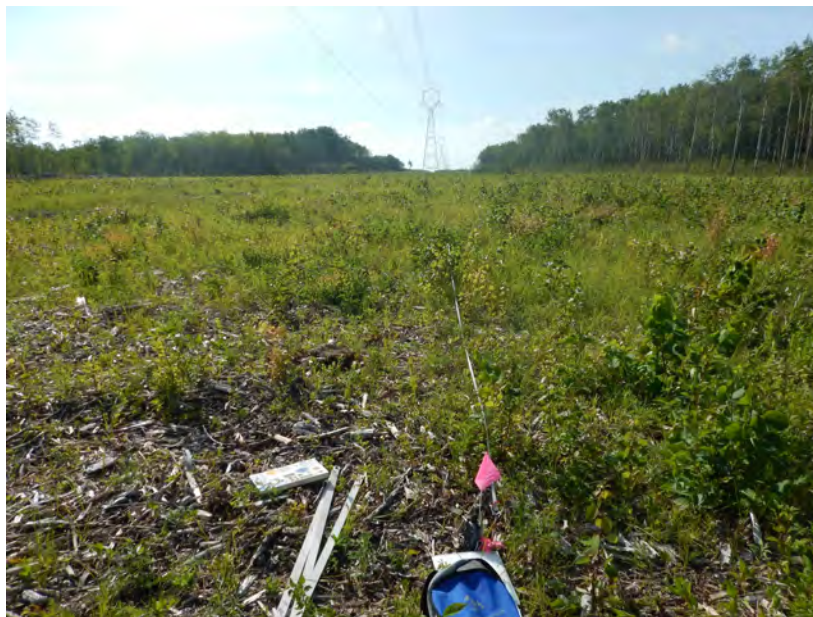
The Habitat Management Plan (Environment Canada IR EC/MH-003) provides information on RoW clearing activities for critical golden-winged warbler habitat. Mitigation measures identified in the Construction Environmental Protection Plan (Manitoba Hydro 2020a) were assessed at each golden-winged warbler site sampled, see Table 4-4c. Clearing and construction activities were carried out over the fall and winter months. Clearing prescriptions for GWW sites (Anola to La Broquerie) were available for reference in the Clearing Management Plan prior to construction.

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

Mitigation Measure	G W W - 0 0 1	G W W - 0 0 4	G W W - 0 0 6	G W W - 0 0 8	G W W - 0 0 9	G W W - 0 1 0	G W W - 0 1 3	G W W - 0 1 5	G W W - 0 1 6	G W W - 0 1 8	G W W - 0 1 9	G W W - 0 2 2	G W W - 0 2 4
Refer to Clearing Management Plan for detailed clearing prescriptions.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Retain shrubs and herbaceous vegetation <4m tall to the extent possible.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Typically, 5-10 perch trees must be retained per span where feasible.	Y	Y	N	Y	N	N	Y	N	N	N	Y	Y	N

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations.

Mitigation at GWW sites includes whether: shrubs and herbaceous vegetation <4 m tall was retained to the extent possible; and whether five to ten perch trees were retained per span where feasible. Perch sites trees are small groups of three to five trees within 10 m of the cleared edge of the RoW. Pre-construction, golden-winged warbler sites were primarily open hardwood canopies, dominated by trembling aspen, with occasional balsam poplar and/or bur oak (*Quercus macrocarpa*). Construction clearing at GWW sites removed perch areas for GWW from seven sites monitored along the RoW (i.e., GWW-006, -009; -010; -015; -016; -018; -024). Photograph 4-4b shows RoW clearing at GWW-009, without obvious perch areas remaining. Linear RoW boundaries occasionally had individual or small clumps of trees remaining just inside the RoW edges, which may provide perch opportunity for GWW.



Photograph 4-4b. RoW clearing at GWW-009.

Although tall shrub vegetation occasionally remained on the RoW, these areas of shrub cover were often associated with depressions or small wetlands areas. Where patches of tall shrubs were retained (e.g., GWW-019, -022), the mid-canopy supported species such as willows, beaked hazelnut, and shrubs from the honeysuckle family (*Viburnum lentago*; *V. opulus*; *V. rafinesquianum*). Tall shrub vegetation (<4 m) was not retained at GWW-001.

Regenerating low shrub vegetation was approaching or beginning to exceed 1 m height in areas of the RoW. Next growing season, tall shrub cover is expected to increase in this stratum. Herbaceous vegetation was moderately to well developed on the RoW, especially off the centre line. Mulched wood ground cover was common along the RoW.

Trees were felled into the RoW to avoid damage to standing trees. Merchantable trees were stockpiled at accessible locations. Some minor rutting was recorded through monitoring site GWW-006, where vegetation was observed growing in ruts. Minor soil disturbance (snub site) was observed at GWW-009.

A large mature oak tree remains unaffected on the RoW at HERT-201, approximately 12 m from the center line, near GWW-008 (Photograph 4-4c). Although not aged, this tree is likely old growth (>100 years) due to the size of the trunk diameter. Such slow growing old growth trees can remain on the RoW, where they do not interfere with vegetation clearance requirements for safe operation of the transmission line. Site GWW-008 has been selectively cleared to enhance golden-winged warbler habitat.



Photograph 4-4c. Old growth oak tree remaining on RoW at selectively cleared site GWW-008.

4.5 Species of Conservation Concern

Twenty-one sites (ECO) were visited for species of conservation concern (SCC) post-construction monitoring over the 2020 growing season (Map 4-1, Appendix II) (Field Activity ID MMTP_CON-FA526). Sites surveyed were located on private and crown lands. Quantitative and qualitative observations of species of conservation concern were recorded project wide, throughout all aspects of monitoring, including in and incidental to all vegetation monitoring surveys.

4.5.1 Monitoring for Species of Conservation Concern

Thirty-one species of conservation concern were recorded throughout the RoW, from ECO plots, and in and incidental to 35 other monitoring plots (ATK, INV, WET, GWW) project wide in 2020, Table 4-5a. No species at risk listed under either the Manitoba's *Endangered Species and Ecosystems Act* or the federal *Species at Risk Act* were observed during surveys throughout project monitoring. One Imperilled species, black ash (S2), is designated Threatened by COSEWIC (as of 2018) and was observed in four sites (ECO-307D; INV-153; ATK-216; ATK-219).

Table 4-5a. Counts of species of conservation concern (SCC) and observations by survey type, 2020.

	ECO	WET	ATK	INV	GWW
Critically Imperilled and Imperilled (S1-S2S3)	5	1	4	2	0
Vulnerable (S3-S3S5)	3	8	12	6	7
Total number of SCC	5	8	16	8	7
Total observations of SCC	10	17	24	9	11

Ten species are ranked Critically Imperilled (S1 to S1S2) or Imperilled (S2 to S2S3), the remaining 21 species are ranked Vulnerable (S3 to S3S5), Table 4-5b. Species of conservation concern are observed from across a diversity of habitats, including from sandy soils, open grassland, wetlands, coniferous bogs and fens, and previously deciduous and coniferous forested sites.

Table 4-5b. Species of conservation concern recorded in 2020.

Species	Common Name	Rank
Critically Imperilled and Imperilled species (S1 to S2S3)		
<i>Arethusa bulbosa</i>	Dragon's-mouth Orchid	S2
<i>Bromus kalmii</i>	Wild Chess	S2S3
<i>Chelone glabra</i>	White Turtlehead	S2
<i>Corispermum villosum</i>	Hairy Bugseed	S1S2
<i>Cyperus squarrosus</i>	Awned Flatsedge	S1S2
<i>Cypripedium arietinum</i>	Ram's-head Lady's-slipper	S2S3

<i>Fraxinus nigra</i>	Black Ash	S2
<i>Impatiens noli-tangere</i>	Western Jewelweed	S1
<i>Osmorrhiza claytonii</i>	Hairy Sweet Cicely	S2?
<i>Ostrya virginiana</i>	Hop-hornbeam	S2
Vulnerable species (S3 to S3S5)		
<i>Agalinis tenuifolia</i>	Narrow-leaved Agalinis	S3
<i>Amphicarpaea bracteata</i>	Hog-peanut	S3S5
<i>Asarum canadense</i>	Wild Ginger	S3S4
<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
<i>Asclepias syriaca</i>	Common Milkweed	S3S4
<i>Betula occidentalis</i>	River Birch	S3S5
<i>Cardamine parviflora</i>	Small Bitter Cress	S3S4
<i>Carex prairea</i>	Prairie Sedge	S3S4
<i>Carex tetanica</i>	Rigid Sedge	S3
<i>Corispermum americanum</i>	American Bugseed	S3
<i>Dryopteris cristata</i>	Crested Shield Fern	S3S4
<i>Iris versicolor</i>	Blue Flag	S3S4
<i>Lonicera involucrata</i>	Black Twinberry	S3S4
<i>Muhlenbergia racemosa</i>	Marsh Muhly	S3S4
<i>Pascopyrum smithii</i>	Western Wheatgrass	S3
<i>Pedicularis lanceolata</i>	Swamp Lousewort	S3S4
<i>Pteridium aquilinum</i>	Bracken Fern	S3S4
<i>Salix pellita</i>	Satin Willow	S3S4
<i>Scirpus pallidus</i>	Green Bulrush	S3S4
<i>Typha angustifolia</i>	Narrow-leaved Cattail	S3S4

ECO site monitoring for Species of Conservation Concern

Five species of conservation concern were observed at 10 of the 21 ECO sites monitored along the FPR. Western jewelweed (*Impatiens noli-tangere*) is ranked Critically Imperilled (S1), while the remaining four species are ranked Imperilled (S2 to S2S3), dragon's mouth orchid (*Arethusa bulbosa*), black ash, hairy sweet cicely (*Osmorhiza claytonii*) and hop-hornbeam (*Ostrya virginiana*).

Near REDACTED, surveys were conducted for dragon's-mouth orchid along a proposed access trail that was avoided during clearing and construction activities. A new access trail was shifted west to avoid the environmentally sensitive sites. In 2020, dragon's-mouth orchid was observed at three of the five sites along the originally proposed trail, REDACTED. A fourth site was also observed to support this species REDACTED. Greater than 35 plants were observed at all sites combined. Photograph 4-5a shows dragon's-mouth orchid observed at REDACTED. These plants were observed along the forest edge, within the opening of the wet trail. Tall shrubs and trees included willows,

speckled alder, red-osier dogwood, black spruce (*Picea mariana*), tamarack, and eastern white cedar. Understory species dominantly included alder-leaved buckthorn, Labrador-tea (*Rhododendron groenlandicum*), northern starflower (*Lysimachia borealis*), dewberry (*Rubus pubescens*), miterwort (*Mitella nuda*), and peatmoss (*Sphagnum* spp.).



Photograph 4-5a. Dragon's-mouth orchid observed at REDACTED

Along Lonesand Road, surveys were conducted for three species of concern. The RoW in this area had portions with standing water from spring rain events. Only hairy sweet cicely was observed at REDACTED (one plant). Compact groundsel (*Packera tridenticulata*, S2) at REDACTED and closed gentian (*Gentiana rubricaulis*, S2S3) at REDACTED were not observed during surveys this season in this area.

Near Provincial Road 201, hairy sweet cicely was observed at REDACTED. Photograph 4-5b shows hairy sweet cicely observed at REDACTED. Both black ash seedlings and wild ginger (*Asarum canadense*, S3S4) were observed in the understory at these sites. At REDACTED, black ash saplings were present in the tall shrub stratum (<3 m). Danger trees were removed at the site but eight black ash individuals were recorded with minor amounts of shrub and herbaceous vegetation remaining.

West of Road REDACTED, western jewelweed was observed at REDACTED, where numerous individuals (>100) were recorded at this site (Photograph 4-5c). At REDACTED, a meander search was undertaken for hop-hornbeam saplings and seedlings, which are found throughout the vicinity of the site.



Photograph 4-5b. Hairy sweet cicely observed at REDACTED.



Photograph 4-5c. Western jewelweed observed at REDACTED.

Remaining species of conservation concern not observed at the time of the surveys included: dwarf dandelion (*Krigia biflora*, S2S3) at REDACTED; slender sedge (*Carex gracilima*, S2S3) at REDACTED; and compact groundsel at REDACTED. Four sites were monitored for an historical record of ram's-head lady's-slipper (*Cypripedium arietinum*, S2S3) that overlapped with the RoW (REDACTED), not observed this season or during pre-construction surveys (2019).

4.5.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the project areas cleared in 2019/2020, the effect prediction on rare plant species from the EIS (Appendix III) was accurate for the following:

- Change in rare plant species abundance and distribution

In sites observed (ECO), the abundance of rare plant species was variable between pre-construction and post-construction surveys. Decreases in estimates were seen in some sites (REDACTED and slender sedge) while other sites showed estimate increases (ECO-307 and hairy sweet cicely; REDACTED and western jewelweed). Number of individuals remained the same at REDACTED (hairy sweet cicely) between pre-construction and post-construction surveys. The distribution of rare plants (number of sites observed) decreased from pre-construction surveys (2017 and 2019). Rare plants were previously recorded in 17 (non-historical) locations designated as environmentally sensitive, compared to 10 locations observed in this season.

Mitigation measures identified in the Construction Environmental Protection Plan for species of conservation concern (Manitoba Hydro 2020a) were assessed at each site surveyed (i.e., REDACTED, see Table 4-5c. Recommended mitigation measures differed in sites monitored. Observations recorded in the field in 2020 are provided below.

For select sites, pre-construction surveys were completed to confirm the presence of a species of conservation concern (REDACTED). Nearly all sites were identified and flagged prior to clearing, and construction activities generally occurred on frozen or dry ground to minimize surface damage, rutting and erosion. Where prescribed, a 10 m vegetated buffer was observed around sites, except at REDACTED. Photograph 4-5d shows a shrub and herbaceous buffer remaining at site REDACTED.

Existing access roads and trails were used to the extent possible, and traffic was confined to these areas. Construction matting was used where required along access trails to protect the area from rutting and soil exposure during saturated soil conditions (e.g., REDACTED). A new access trail was shifted to avoid sensitive sites REDACTED.

Construction clearing largely adhered to prescriptions in the management plan. However, two sites showed higher levels of site disturbance, with exposed soil and rutting (ECO-302A and -302D). At ECO-302A, notable rutting was observed near construction matting adjacent to the TransCanada Hwy and along the RoW between towers 280 and 281 (Photograph 4-5e). Exposed soil was noted at tower 280, approximately 50 m x 50 m. At ECO-302D rutting was observed along the RoW at various locations off the matting, between towers 292 to 295. See recommendations in Section 5.0.

Table 4-5c. Mitigation measures assessed at sites monitored for plant species of conservation concern on the RoW.

Mitigation Measure	ECO-301	ECO-301A	ECO-302A	ECO-302B	ECO-302C	ECO-302D	ECO-303	ECO-304	ECO-304A	ECO-304B	ECO-305	ECO-305A	ECO-306	ECO-307	ECO-307A	ECO-307D	ECO-310	ECO-311	ECO-312	ECO-313	ECO-314
Construction matting will be used along access trail to protect the area from rutting and exposure of soil during saturated soil conditions.	-	-	Y	Y	-	Y	-														
Use existing access roads and trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y														
Refer to Clearing Management Plan for clearing prescription.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-
Confine vehicle traffic to established trails to the extent possible.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-
In the event of ground disturbance refer to Rehabilitation and Invasive Species Management Plan for mitigation.	-	-	N	-	-	N	-														
Pre-construction surveys may be conducted to confirm presence of species of concern.			Y	Y	Y	Y															
Identify and flag prior to start of work.							N		Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion.							Y		Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-
Provide 10 m vegetated (shrub and herbaceous) buffer around site.							N		Y	Y	Y	Y	Y	Y	Y	N	-	-	-	-	-

Note: Y/N (yes/no) denotes whether mitigation measure was implemented, based on field observations. Dash (-) means not applicable.



Photograph 4-5d. Vegetated buffer remaining at ECO-307.



Photograph 4-5e. Site disturbance observed at ECO-302A.

Environmental monitoring determined that the recommended mitigation was generally implemented for species of conservation concern. Mitigation measures appear to have minimized ground surface disturbance from construction activities at these sites.

Three prairie grassland sites were also visited for post-construction environmental monitoring (ECO-100, -101 and -102). Prairie site ECO-100 was avoided during clearing and construction activities. Native plants observed here included big bluestem (*Andropogon gerardii*), June grass (*Koeleria macrantha*), many-flowered aster (*Symphyotrichum ericoides*), and Canada goldenrod (*Solidago canadensis*). In other sites, mitigation measures were implemented where required and included the use of existing access roads and trail to the extent possible, confining traffic to established trails, and using construction matting to protect the area from rutting under saturated soil conditions.

4.6 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 I post-construction monitoring. Both traditional use plant (ATK) and golden-winged warbler (GWW) sites showed decreases in total species richness between pre-construction and post-construction monitoring. Species richness at traditional use plant sites decreased

from 37.2 to 31.3, while golden-winged warbler sites decreased from 40.4 to 34.1. Wetland sites (WET) remained unchanged between pre-construction and post-construction monitoring, with 19.8 species in both years. Hypothesis I will be again tested in Year II post-construction monitoring (2021) over successive years, for traditional use plant species, golden-winged warbler habitat, and wetlands.

Hypothesis 2 (*Invasive and non-native species abundance is related to transmission line clearing and construction activities along the right-of-way*) proved to be true in Year I post-construction monitoring. Invasive plant species abundance and distribution have increased from pre-construction values. In pre-construction surveys, 56 noxious, invasive or non-invasive SNA species were recorded on the RoW in 2017, with 59 species in 2018, and 70 species observed during post-construction monitoring (2020). The number of noxious Tier 1 and 2 species and occurrences observed on the RoW over this time has also increased from four species in 15 sites (2017) to six species in 33 sites (2020).

5.0 RECOMMENDATIONS

Based on post-construction vegetation monitoring in 2020, the following are recommendations for the project:

1. Vegetation management for noxious plant species observed along the final preferred route is recommended. Species with the highest threat (Tier 1 and 2) should be managed to reduce further species spread, according to responsibilities under the current Regulation of The Noxious Weeds Act. These include sites identified for red bartsia (*Odontites vulgaris*) spotted knapweed, (*Centaurea stoebe*), hoary alyssum (*Berteroa incana*), leafy spurge (*Euphorbia virgata*), ox-eye daisy (*Leucanthemum vulgare*), and scentless false mayweed (*Tripleurospermum inodorum*). On July 27, a field tour occurred for several noxious plant sites to discuss the plants and follow-up management (Mr. E. Johansson, Manitoba Hydro and Mr. G. Hora, Manitoba Weed Supervisors Association).

Restriction on equipment movement through patches is recommended. Manual/mechanical weed management treatment (e.g., hand pulling, mowing, etc.) is desirable, with continued monitoring. Where herbicides are used as control, it is recommended that spot treatment occur and avoid broadcast application. Environmentally sensitive sites should be avoided (e.g., traditional use plant sites, species of conservation concern, golden-winged warbler habitat, wetlands, etc.). All regulatory requirements and license commitments should be met.

2. Where construction matting may be used for future project activities, matting should be removed when no longer required in areas during the growing season, to reduce seasonal vegetation disturbance. Although beneficial for the landscape (i.e., mats reduce rutting), suppressing native vegetation in areas longer than required for project activities, risks the chance for encroachment of undesirable species in areas stressed from prolonged matting use.
3. The duration of post-construction monitoring for invasive plant species is one year (completed in 2020). It is recommended that Manitoba Hydro conduct future environmental monitoring for sites occupying noxious species designated as Tier 1 and 2. These 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.
4. Exposed soil and rutting from clearing and construction activities was observed in some sites during surveys. At ECO-302A, rutting was observed near construction matting adjacent to the TransCanada Hwy, and along the RoW between towers 280 and 281. Exposed soil was noted at tower 280, approximately 50 m x 50 m. At ECO-

302D rutting was observed along the RoW at various locations off the matting, between towers 292 to 295. Ruts should be levelled when conditions are suitable and disturbed areas seeded with a lowland species rehabilitation mix for ECO-302A and upland mix for ECO-302D. Future follow-up monitoring on any seeding treatment to check efficacy, survival, and continued presence of native species is recommended.

5. Exposed soil was observed at tower 483, approximately 60 x 60 m. Noxious weed ox-eye daisy was recorded in the ditch near this tower. This site was recommended to be seeded with an upland species mix to reduce the chance of ox-eye daisy infestation. Subsequent season follow-up monitoring of the seeded area is recommended to determine whether seeding treatment results in continued cover of native species at this site.
6. For invasive species management and site rehabilitation, refer to the Rehabilitation and Invasive Species Management Plan (Manitoba Hydro 2019d).

6.0 REFERENCES

Adams, B.W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, A. Burkinshaw, J. Carlson and K. France. 2009. Range Health Assessment for Grassland, Forest and Tame Pasture. Pub. No. T/044. Revised April 2009. Alberta Environment and Sustainable Resource Development. Edmonton, AB. 152 pp.

Alberta Native Plant Council. 2006. Plant Collection Guidelines for Researchers, Students and Consultants. Published by the Alberta Native Plant Council. <http://www.anpc.ab.ca/>

Alberta Native Plant Council. 2012. ANPC Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. Alberta Native Plant Council, Edmonton, AB.

Canadian Food Inspection Agency. 2008. Invasive Alien Plants in Canada. Ottawa, ON. 72pp.

Cauboue, M., Strong, W.L., Archambault, L. and Sims, R.A. 1996. Terminology of Ecological Land Classification in Canada. Natural Resources Canada, Canadian Forest Service – Quebec. Sainte-Foy, Quebec. Information Report LAU-X-114E.

Committee on the Status of Endangered Wildlife in Canada. 2020. <https://www.cosewic.ca/index.php/en-ca/>

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford.

Government of Canada. 1991. The Federal Policy on Wetland Conservation. Director General, Canadian Wildlife Service, Ottawa, Ontario. <http://publications.gc.ca/collections/Collection/CW66-116-1991E.pdf>.

Government of Canada. 2020a. Historical Climate Data. https://climate.weather.gc.ca/historical_data/search_historic_data_e.html

Government of Canada. 2020b. Species at Risk Act. <https://laws-lois.justice.gc.ca/eng/acts/s-15.3/>

Halsey, L.A., D.H. Vitt and S.C. Zoltai. 1997. Climate and physiographic controls on wetland type and distribution in Manitoba, Canada. *Wetlands*, 17(2): 243-262.

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough, and J. Kirkby. 2008. Wetland Ecological Functions: Assessment: An Overview of Approaches. Canadian Wildlife Service: Technical Report Series Number 497. Atlantic Region. 56 pp.

Invasive Species Council of Manitoba. 2020. <http://invasivespeciesmanitoba.com/site>

Johnson, D., Kershaw, L., MacKinnon, A. and Pojar, J. 1995. Plants of the Western Boreal Forest and Aspen Parkland. Natural Resources Canada, Canadian Forest Service. Lone Pine, Edmonton, Alberta.

Joro Consultants Inc. 2011. Bipole III Fragmentation: Technical Report Final Draft. Prepared for MMM Group and Manitoba Hydro.

Kent, M. and Coker, P. 1996. Vegetation Description and Analysis, A Practical Approach. England.

Maechler, M., Rousseeuw, P., Struyf, A., Hubert, M. and Hornik, K. 2019. Cluster: Cluster Analysis Basics and Extensions. R package version 2.1.0.

Manitoba Clean Environment Commission. 2017. Manitoba-Minnesota Transmission Project, Report on Public Hearing.

Manitoba Government. 2020a. Manitoba Conservation Data Centre. https://www.gov.mb.ca/sd/environment_and_biodiversity/cdc/index.html

Manitoba Government. 2020b. The Endangered Species and Ecosystems Act. <https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php>

Manitoba Government. 2020c. The Noxious Weeds Act. <http://web2.gov.mb.ca/laws/statutes/ccsm/n110e.php>

Manitoba Hydro and Nisichawayasihk Cree Nation. 2003. Wuskwatim Transmission Project, Environmental Impact Statement.

Manitoba Hydro. 2015. Manitoba-Minnesota Transmission Project, Environmental Impact Statement.

Manitoba Hydro. 2019a. Manitoba-Minnesota Transmission Project, Environmental Monitoring Plan.

Manitoba Hydro. 2019b. Manitoba-Minnesota Transmission Project, Construction Environmental Protection Plan.

Manitoba Hydro. 2019c. Manitoba-Minnesota Transmission Project, Biosecurity Management Plan.

Manitoba Hydro. 2019d. Manitoba-Minnesota Transmission Project, Rehabilitation and Invasive Species Management Plan.

Manitoba Hydro. 2020a. Manitoba-Minnesota Transmission Project, Construction Environmental Protection Mapbook. Environmentally Sensitive Site Locations.

Manitoba Hydro. 2020b. Effects of Wetlands within the Bipole III Transmission Line Project.

National Energy Board. 2019. Manitoba-Minnesota Transmission Project, National Energy Board Certificate EC-059.

R Core Team 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <http://www.R-project.org/>

Raven, P.H, Ray, F.E. and Eichhorn, S.E. 1992. Biology of Plants. Fifth Edition. Worth Publishers Inc. New York, New York.

Redburn, M.J. and Strong, W.L. 2008. Successional development of silviculturally treated and untreated high-latitude *Populus tremuloides* clearcuts in northern Alberta, Canada. Forest Ecology and Management, 255: 2937-2949.

Strong, W.L., E.T. Oswald, and D.J. Downing. 1990. The Canadian Vegetation Classification System, First Approximation, Ecological Land Classification Series No. 25. Environment Canada, National Vegetation Working Group, Ottawa, 22 pp.

Strong, W.L 2016. Biased richness and evenness relationships with Shannon-Wiener index values. Ecological Indicators, 67: 703-713.

Sustainable Development. 2019. Manitoba-Minnesota Transmission Project, Environment Act Licence No. 3288.

Szwaluk Environmental Consulting Ltd., K. Newman and Calyx Consulting. 2016. Bipole III Terrestrial Ecosystems and Vegetation Pre-construction and Environmental Monitoring Annual Technical Report (Year II). Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2017. Manitoba-Minnesota Transmission Project Botanical and Vegetation Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting. 2018. Manitoba-Minnesota Transmission Project Invasive Plant Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2019a. Manitoba-Minnesota Transmission Project Botanical and Vegetation Pre-construction Survey. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and K. Newman. 2019b. Bipole III Terrestrial Ecosystems and Vegetation Environmental Monitoring Annual Technical Report (Year VI). Prepared for Manitoba Hydro.

Usher, G. 1996. The Wordsworth Dictionary of Botany. Wordsworth Editions Ltd. Hertfordshire, England.

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 multidimensional 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 2020b).

Extirpated Species - A species that no longer exists in the wild in Canada, but exists elsewhere in the wild (Government of Canada 2020b).

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 2020).

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 2020c).

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 2020b).

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 2020b).

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.

Manitoba-Minnesota Transmission Project

Project Infrastructure

-  Converter Station (Existing)
-  Final Preferred Route (FPR)
-  Local Study Area

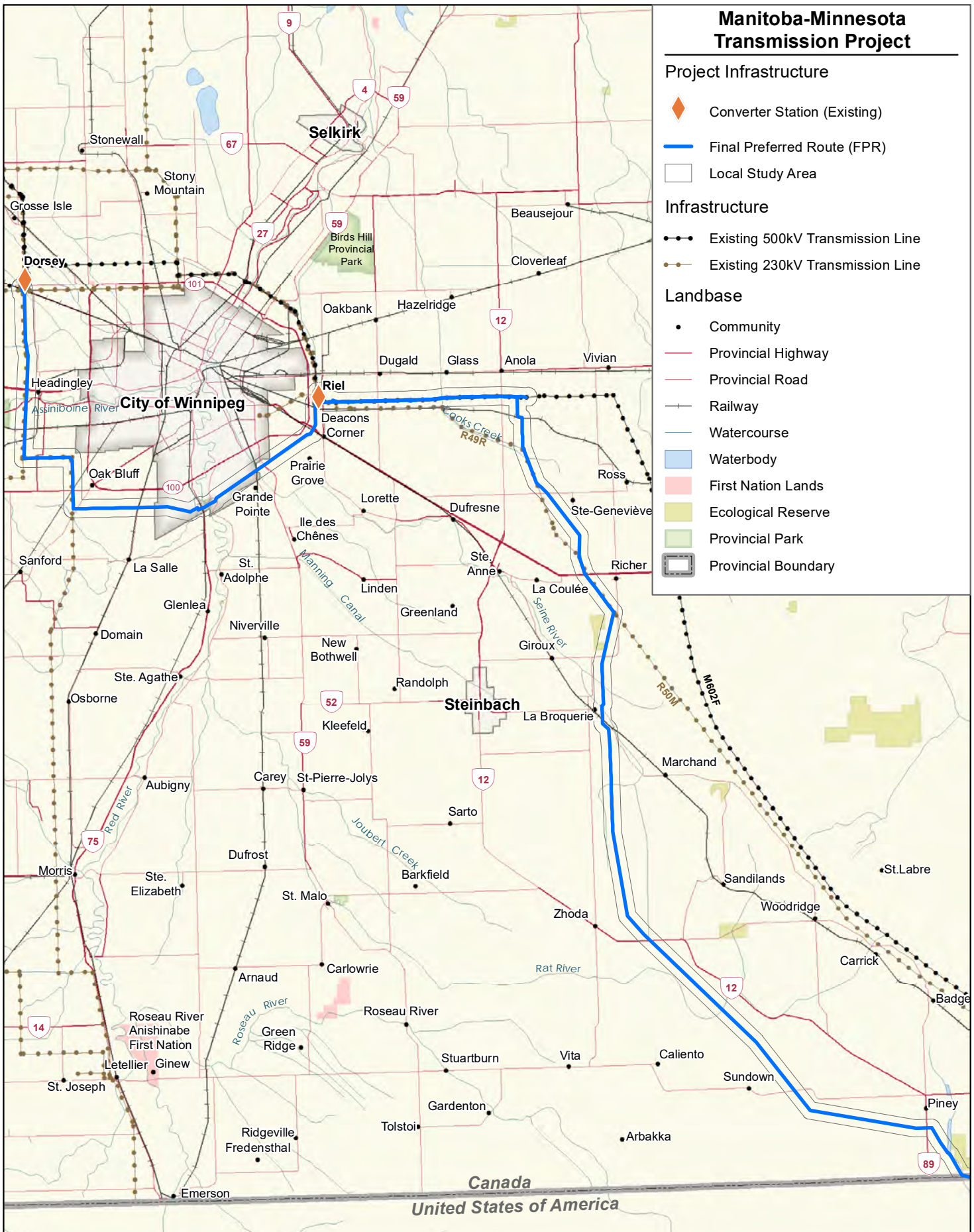
Infrastructure

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

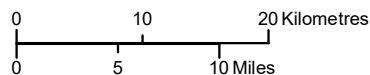
Landbase

-  Community
-  Provincial Highway
-  Provincial Road
-  Railway
-  Watercourse
-  Waterbody
-  First Nation Lands
-  Ecological Reserve
-  Provincial Park
-  Provincial Boundary

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Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan, SEC
Date Created: September 24, 2020



**MMTP
Project Area**

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

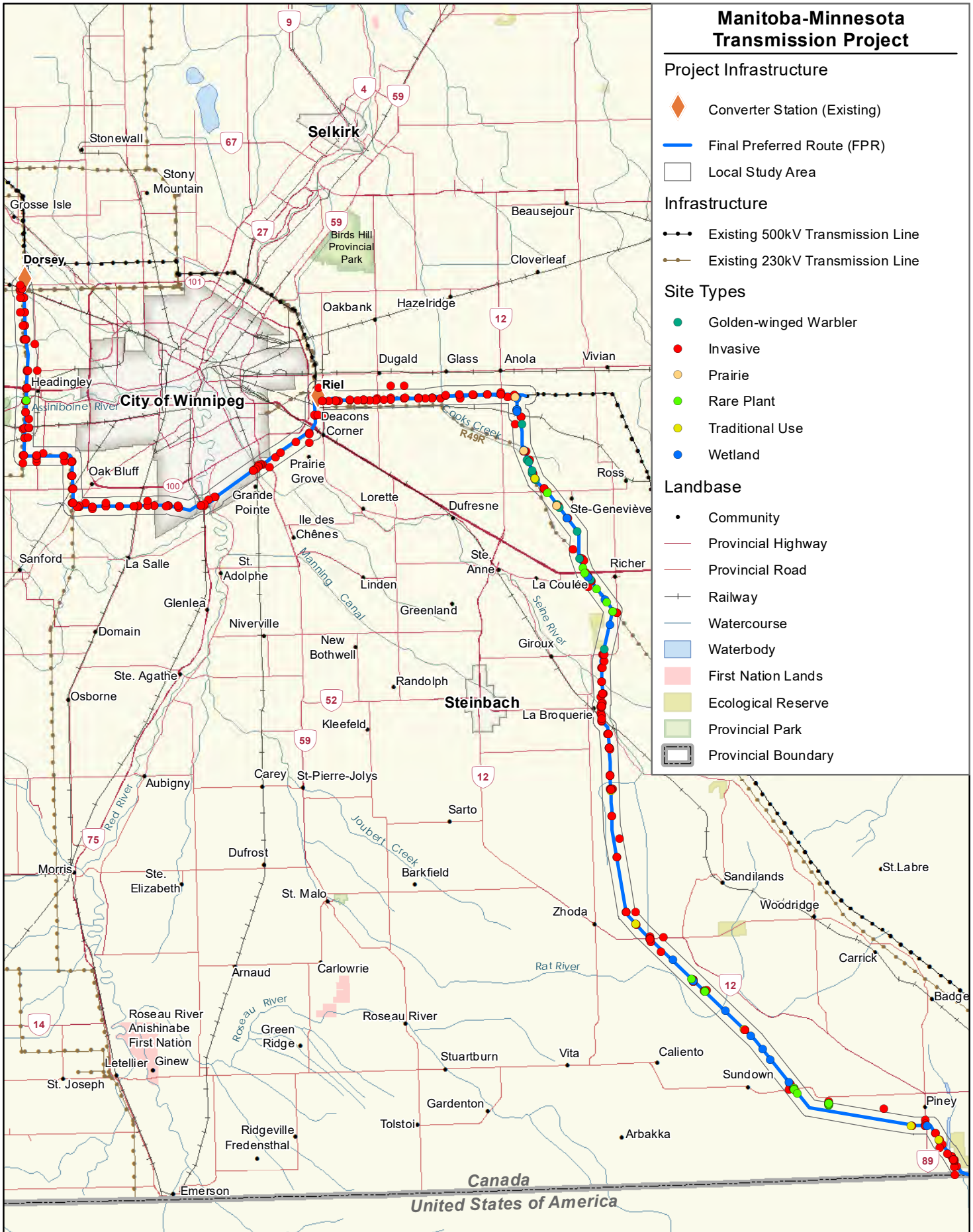
Site Types

- Golden-winged Warbler
- Invasive
- Prairie
- Rare Plant
- Traditional Use
- Wetland

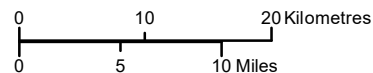
Landbase

- Community
- Provincial Highway
- Provincial Road
- Railway
- Watercourse
- Waterbody
- First Nation Lands
- Ecological Reserve
- Provincial Park
- Provincial Boundary

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Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCAN, SEC
Date Created: September 25, 2020



MMTP Distribution of Vegetation Sites

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 Licencee 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 Licencee 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 Licencee 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.

			<p>during construction or operation of the Development. The plans shall:</p> <p>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);</p> <p>b) include mitigation measures and/or buffer zones for the specific sites identified to minimize impacts to the sites from construction and operation activities;</p> <p>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</p> <p>d) include mitigation measures to reduce adverse effects on wildlife and wildlife habitat (e.g., timing windows, setbacks, and buffers).</p>	
Licence	Clause 12	Invasive species management plan	<p>The Licencee 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:</p> <p>a) erosion protection and sediment control;</p> <p>b) rehabilitation and invasive species management, and</p> <p>c) waste and recycling.</p>	Manitoba Hydro to develop and submit rehabilitation and invasive species management plan.

Licence	Clause 28	ROW clearing plan	<p>The Licencee 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:</p> <ul style="list-style-type: none"> 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	<p>The Licencee 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.</p>	Manitoba Hydro to consult with Regional Forester regarding timber clearing.
Licence	Clause 35	Wetlands	<p>The Licencee 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.</p>	Visual observations during monitoring of the transmission line RoW wetlands.

Licence	Clause 36	Wetlands	The Licencee 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 Licencee 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 Licencee 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 Licencee 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 Licencee 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 Licencee 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 Licencee 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	<p>The Licencee 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:</p> <ul style="list-style-type: none"> 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.









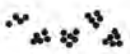
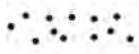

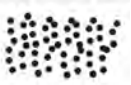

NEB Certificate	Condition 10	Construction Environmental Protection Plan	<p>Manitoba Hydro must file with the Board for approval, at least ninety (90) days prior to commencing construction, an updated Project-specific Construction Environmental Protection Plan (CEPP) which includes:</p> <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.
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NEB Certificate	Condition 23	Post Construction Monitoring Reports	<p>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:</p> <ul style="list-style-type: none"> 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	<p>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:</p> <ul style="list-style-type: none"> 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.

			<p>Station and the transmission tower locations, as well as any other locations where wetlands were affected by the Project;</p> <p>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;</p> <p>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;</p> <p>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;</p> <p>e) the decision-making criteria for selecting specific offset measures and offset ratios that would be used under what circumstances;</p> <p>f) a schedule indicating when measures will be implemented and estimated completion date(s);</p> <p>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,</p> <p>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.</p>	
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	UTM Zone	Easting	Northing	Site	UTM Zone	Easting	Northing
MM-ECO-100	14 U	671576	5525219	MM-ATK-220	14 U	698968	5449447
MM-ECO-101	14 U	672568	5518878	MM-ATK-222	14 U	680089	5503874
MM-ECO-102	14 U	676547	5512270	MM-ATK-223	14 U	719019	5437895
MM-ECO-301	14 U	612876	5524852	MM-ATK-224	15 U	283879	5435907
MM-ECO-301A	14 U	675390	5513810	MM-ATK-226	14 U	705165	5442028
MM-ECO-302A	14 U	679652	5504715	MM-GWW-001	14 U	682148	5494993
MM-ECO-302B	14 U	679903	5504120	MM-GWW-004	14 U	680541	5503310
MM-ECO-302C	14 U	681327	5502221	MM-GWW-006	14 U	679262	5505807
MM-ECO-302D	14 U	682533	5500614	MM-GWW-008	14 U	678933	5509103
MM-ECO-303	14 U	683222	5499546	MM-GWW-009	14 U	676776	5511944
MM-ECO-304	14 U	694328	5453911	MM-GWW-010	14 U	676474	5512327
MM-ECO-304A	14 U	692674	5455480	MM-GWW-013	14 U	673975	5515270
MM-ECO-304B	14 U	694270	5453930	MM-GWW-015	14 U	673596	5516107
MM-ECO-305	14 U	694292	5453924	MM-GWW-016	14 U	673532	5516435
MM-ECO-305a	14 U	704915	5442331	MM-GWW-018	14 U	672979	5517754
MM-ECO-306	14 U	704951	5442249	MM-GWW-019	14 U	672298	5521970
MM-ECO-307	14 U	704966	5442236	MM-GWW-022	14 U	671699	5523733
MM-ECO-307A	14 U	704965	5442210	MM-GWW-024	14 U	673133	5517451
MM-ECO-307D	14 U	705344	5441723	MM-INV-122	14 U	671743	5523616
MM-ECO-310	14 U	709132	5440347	MM-INV-126	14 U	672595	5518757
MM-ECO-311	14 U	709132	5440434	MM-INV-132	14 U	674973	5514242
MM-ECO-312	14 U	709128	5440456	MM-INV-135	14 U	676535	5512260
MM-ECO-313	14 U	709132	5440475	MM-INV-153	14 U	681977	5489657
MM-ECO-314	14 U	709123	5440487	MM-INV-161	14 U	682803	5483133
MM-ECO-400	14 U	681876	5488477	MM-INV-164	14 U	682968	5478200
MM-ECO-400A	14 U	681855	5488121	MM-INV-178	14 U	684843	5463481
MM-ECO-400B	14 U	681860	5488016	MM-INV-180	14 U	687709	5460238
MM-ECO-400C	14 U	681889	5488175	MM-INV-187	14 U	692843	5455318
MM-ECO-401A	14 U	681902	5487074	MM-INV-196	14 U	699070	5449361
MM-ECO-401B	14 U	681921	5486648	MM-INV-203	14 U	704965	5442303
MM-ECO-401C	14 U	682653	5484789	MM-INV-218	14 U	681993	5488606
MM-ECO-401D	14 U	682659	5484763	MM-SCC-402	14 U	709122	5440535
MM-ECO-401E	14 U	682817	5483152	MM-SCC-403	14 U	709110	5440519
MM-ECO-401F	14 U	682788	5483130	MM-SCC-404	14 U	709124	5440469
MM-ECO-401G	14 U	682853	5483135	MM-WET-120	14 U	671723	5525049
MM-ECO-401H	14 U	682927	5479878	MM-WET-121	14 U	671704	5523672
MM-ECO-401I	14 U	682927	5479863	MM-WET-123	14 U	671762	5523477
MM-ECO-401J	14 U	682980	5478210	MM-WET-125	14 U	672565	5518845
MM-ATK-131	14 U	673864	5515469	MM-WET-137	14 U	677764	5510671
MM-ATK-165	14 U	682972	5478040	MM-WET-139	14 U	680270	5503621
MM-ATK-179	14 U	685974	5462026	MM-WET-141	14 U	682278	5500965
MM-ATK-215	14 U	675366	5513828	MM-WET-142	14 U	682881	5497929

Site	UTM Zone	Easting	Northing	Site	UTM Zone	Easting	Northing
MM-ATK-216	14 U	683219	5499542	MM-WET-186	14 U	690378	5457772
MM-ATK-219	14 U	694299	5453976	MM-WET-188	14 U	692901	5455286
MM-WET-194	14 U	696741	5451633	MM-INV-53-R	14 U	626318	5512191
MM-WET-197	14 U	699737	5448678	MM-INV-54-R	14 U	626334	5512177
MM-WET-199	14 U	701235	5447052	MM-INV-56-R	14 U	627388	5512202
MM-WET-200	14 U	702132	5445798	MM-INV-57-R	14 U	627415	5512199
MM-WET-201	14 U	704300	5443083	MM-INV-58-R	14 U	628272	5512226
MM-WET-209	15 U	282507	5437749	MM-INV-59-R	14 U	628274	5512225
MM-INV-2-R	14 U	612641	5537090	MM-INV-61-R	14 U	629878	5512232
MM-INV-3-R	14 U	612630	5537085	MM-INV-62-R	14 U	629924	5512251
MM-INV-4-R	14 U	612920	5526213	MM-INV-64-R	14 U	631151	5511913
MM-INV-5-R	14 U	612674	5535447	MM-INV-65-R	14 U	631163	5511977
MM-INV-6-R	14 U	612674	5535446	MM-INV-69-R	14 U	634292	5512233
MM-INV-8-R	14 U	612719	5533808	MM-INV-76-R	14 U	640089	5516403
MM-INV-9-R	14 U	612707	5533807	MM-INV-77-R	14 U	640734	5516873
MM-INV-10-R	14 U	612770	5532179	MM-INV-78-R	14 U	640743	5516869
MM-INV-11-R	14 U	612743	5532155	MM-INV-80-R	14 U	642757	5518070
MM-INV-13-R	14 U	613015	5528343	MM-INV-81-R	14 U	643404	5518566
MM-INV-14-R	14 U	613018	5528337	MM-INV-82-R	14 U	645220	5519822
MM-INV-18-R	14 U	612852	5524723	MM-INV-83-R	14 U	646846	5520785
MM-INV-19-R	14 U	612873	5524715	MM-INV-84-R	14 U	647496	5523067
MM-INV-20-R	14 U	612823	5523370	MM-INV-85-R	14 U	648390	5524726
MM-INV-21-R	14 U	612824	5523368	MM-INV-86-R	14 U	651695	5524816
MM-INV-22-R	14 U	612744	5521509	MM-INV-87-R	14 U	651695	5524905
MM-INV-23-R	14 U	612627	5518201	MM-INV-88-R	14 U	653333	5524931
MM-INV-24-R	14 U	612622	5518200	MM-INV-89-R	14 U	653336	5524930
MM-INV-26-R	14 U	614146	5518107	MM-INV-91-R	14 U	654979	5524962
MM-INV-27-R	14 U	614152	5518107	MM-INV-92-R	14 U	654992	5524992
MM-INV-28-R	14 U	613001	5526348	MM-INV-93-R	14 U	656630	5524982
MM-INV-31-R	14 U	617425	5518171	MM-INV-94-R	14 U	656628	5525139
MM-INV-32-R	14 U	617432	5518178	MM-INV-96-R	14 U	658266	5525065
MM-INV-34-R	14 U	618378	5517470	MM-INV-97-R	14 U	658265	5525055
MM-INV-35-R	14 U	618392	5517454	MM-INV-98-R	14 U	659902	5525073
MM-INV-38-R	14 U	618459	5514187	MM-INV-99-R	14 U	659903	5525107
MM-INV-39-R	14 U	618432	5514162	MM-INV-101-R	14 U	661580	5525162
MM-INV-40-R	14 U	618974	5512043	MM-INV-102-R	14 U	661581	5525185
MM-INV-41-R	14 U	619000	5512038	MM-INV-103-R	14 U	663221	5525399
MM-INV-42-R	14 U	619204	5512055	MM-INV-104-R	14 U	663221	5525346
MM-INV-43-R	14 U	619212	5512044	MM-INV-105-R	14 U	664888	5525064
MM-INV-44-R	14 U	620849	5512076	MM-INV-106-R	14 U	664860	5525412
MM-INV-45-R	14 U	620855	5512078	MM-INV-107-R	14 U	666496	5525471
MM-INV-46-R	14 U	622457	5512088	MM-INV-108-R	14 U	666502	5525464
MM-INV-47-R	14 U	622467	5512112	MM-INV-111-R	14 U	668137	5525514
MM-INV-48-R	14 U	624114	5512120	MM-INV-112-R	14 U	668137	5525499
MM-INV-49-R	14 U	624124	5512121	MM-INV-114-R	14 U	669788	5525504

Site	UTM Zone	Easting	Northing	Site	UTM Zone	Easting	Northing
MM-INV-51-R	14 U	625765	5512161	MM-INV-115-R	14 U	669769	5525548
MM-INV-52-R	14 U	625781	5512163	MM-INV-116-R	14 U	671732	5523641
MM-INV-116-R	14 U	671408	5525445	MM-INV-226-R	14 U	479748	5487420
MM-INV-117-R	14 U	671728	5523639	MM-INV-227-R	14 U	479786	5487368
MM-INV-117-R	14 U	671407	5525454	MM-INV-300-R	14 U	612373	5538295
MM-INV-126-R	14 U	672584	5518746	MM-INV-301-R	14 U	612371	5538292
MM-INV-127-R	14 U	672632	5518743	MM-INV-302-R	14 U	612742	5521514
MM-INV-130-R	14 U	673837	5515432	MM-INV-303-R	14 U	612706	5520256
MM-INV-131-R	14 U	673841	5515480	MM-INV-304-R	14 U	612701	5520262
MM-INV-134-R	14 U	676577	5512279	MM-INV-305-R	14 U	612151	5538258
MM-INV-135-R	14 U	676539	5512281	MM-INV-306-R	14 U	612186	5537081
MM-INV-136-R	14 U	677828	5510663	MM-INV-307-R	14 U	612222	5535438
MM-INV-137-R	14 U	677769	5510668	MM-INV-310-R	14 U	613951	5531548
MM-INV-138-R	14 U	680223	5503751	MM-INV-313-R	14 U	614205	5528420
MM-INV-139-R	14 U	680224	5503677	MM-INV-315-R	14 U	614160	5517395
MM-INV-146-R	14 U	682052	5494359	MM-INV-316-R	14 U	614914	5518444
MM-INV-147-R	14 U	682036	5494347	MM-INV-317-R	14 U	617446	5517471
MM-INV-149-R	14 U	681867	5492713	MM-INV-318-R	14 U	618466	5514260
MM-INV-150-R	14 U	681864	5492710	MM-INV-320-R	14 U	622447	5512521
MM-INV-151-R	14 U	681896	5491071	MM-INV-323-R	14 U	627389	5512705
MM-INV-152-R	14 U	681920	5491068	MM-INV-327-R	14 U	634711	5512900
MM-INV-154-R	14 U	681815	5488026	MM-INV-328-R	14 U	635536	5513210
MM-INV-155-R	14 U	681885	5488026	MM-INV-329-R	14 U	640139	5516355
MM-INV-156-R	14 U	681915	5486383	MM-INV-330-R	14 U	640375	5516617
MM-INV-157-R	14 U	681910	5486308	MM-INV-332-R	14 U	640983	5517065
MM-INV-159-R	14 U	682654	5484779	MM-INV-333-R	14 U	641023	5517070
MM-INV-160-R	14 U	682676	5484763	MM-INV-334-R	14 U	642108	5516849
MM-INV-162-R	14 U	682877	5479864	MM-INV-339-R	14 U	646884	5519739
MM-INV-166-R	14 U	683090	5474951	MM-INV-340-R	14 U	647529	5523015
MM-INV-167-R	14 U	683091	5474951	MM-INV-342-R	14 U	648432	5523052
MM-INV-170-R	14 U	683685	5470037	MM-INV-347-R	14 U	612187	5538697
MM-INV-171-R	14 U	683713	5470036	MM-INV-348-R	14 U	656588	5526561
MM-INV-177-R	14 U	684859	5463501	MM-INV-349-R	14 U	658226	5526603
MM-INV-178-R	14 U	684824	5463499	MM-INV-350-R	14 U	671661	5525271
MM-INV-180-R	14 U	687727	5460267	MM-INV-351-R	14 U	671663	5525273
MM-INV-181-R	14 U	687719	5460257	MM-INV-352-R	14 U	672261	5522816
MM-INV-195-R	14 U	699040	5449375	MM-INV-353-R	14 U	672240	5522798
MM-INV-196-R	14 U	699055	5449372	MM-INV-354-R	14 U	673668	5516018
MM-INV-202-R	14 U	704882	5442335	MM-INV-355-R	14 U	673679	5516016
MM-INV-203-R	14 U	704901	5442328	MM-INV-356-R	14 U	674981	5514248
MM-INV-207-R	14 U	719076	5437868	MM-INV-357-R	14 U	674980	5514169
MM-INV-208-R	14 U	720712	5437882	MM-INV-358-R	14 U	675303	5513879
MM-INV-209-R	14 U	720737	5437880	MM-INV-359-R	14 U	675316	5513878
MM-INV-210-R	14 U	722417	5436149	MM-INV-360-R	14 U	679956	5504226
MM-INV-211-R	14 U	722429	5436063	MM-INV-361-R	14 U	680568	5503157

Site	UTM Zone	Easting	Northing	Site	UTM Zone	Easting	Northing
MM-INV-212-R	14 U	724085	5433756	MM-INV-362-R	14 U	680628	5503166
MM-INV-213-R	14 U	724086	5433753	MM-INV-363-R	14 U	683697	5499374
MM-INV-364-R	14 U	681997	5489677	MM-INV-613-R	14 U	649204	5524744
MM-INV-365-R	14 U	681984	5489676	MM-INV-614-R	14 U	650031	5524774
MM-INV-367-R	14 U	682822	5483151	MM-INV-615-R	14 U	650055	5524761
MM-INV-368-R	14 U	682899	5483002	MM-INV-616-R	14 U	650426	5524773
MM-INV-369-R	14 U	682913	5479867	MM-INV-617-R	14 U	652635	5524820
MM-INV-370-R	14 U	683163	5478227	MM-INV-618-R	14 U	653361	5524839
MM-INV-371-R	14 U	682978	5478208	MM-INV-619-R	14 U	654092	5524853
MM-INV-373-R	14 U	685937	5463480	MM-INV-620-R	14 U	654762	5524875
MM-INV-374-R	14 U	686008	5462074	MM-INV-621-R	14 U	655804	5524901
MM-INV-375-R	14 U	686015	5461995	MM-INV-622-R	14 U	660742	5525016
MM-INV-376-R	14 U	687656	5460347	MM-INV-623-R	14 U	661530	5525034
MM-INV-377-R	14 U	687644	5460329	MM-INV-624-R	14 U	662593	5525059
MM-INV-378-R	14 U	692858	5455328	MM-INV-625-R	14 U	669772	5525722
MM-INV-379-R	14 U	692859	5455352	MM-INV-626-R	14 U	671466	5525270
MM-INV-380-R	14 U	694217	5453994	MM-INV-626-R	14 U	670585	5525253
MM-INV-381-R	14 U	694224	5453997	MM-INV-627-R	14 U	671501	5521984
MM-INV-382-R	14 U	704510	5442845	MM-INV-629-R	14 U	672810	5518744
MM-INV-383-R	14 U	704490	5442843	MM-INV-630-R	14 U	673232	5517705
MM-INV-384-R	14 U	709121	5440823	MM-INV-631-R	14 U	676674	5512285
MM-INV-385-R	14 U	719083	5437868	MM-INV-632-R	14 U	678479	5506950
MM-INV-386-R	14 U	721920	5436955	MM-INV-633-R	14 U	679752	5505656
MM-INV-387-R	14 U	721917	5436946	MM-INV-635-R	14 U	682213	5494385
MM-INV-388-R	14 U	722432	5435214	MM-INV-636-R	14 U	682246	5493548
MM-INV-389-R	14 U	722725	5435622	MM-INV-637-R	14 U	682001	5492714
MM-INV-390-R	14 U	724166	5433624	MM-INV-638-R	14 U	682123	5489686
MM-INV-391-R	14 U	724171	5433606	MM-INV-639-R	14 U	681757	5489289
MM-INV-392-R	14 U	724196	5432924	MM-INV-640-R	14 U	681841	5487352
MM-INV-393-R	14 U	724508	5432948	MM-INV-641-R	14 U	681850	5487058
MM-INV-400-R	14 U	650025	5524813	MM-INV-643-R	14 U	683180	5478225
MM-INV-500-R	14 U	618425	5515833	MM-INV-644-R	14 U	682922	5478206
MM-INV-501-R	14 U	618417	5515819	MM-INV-646-R	14 U	684007	5472348
MM-INV-502-R	14 U	618520	5512545	MM-INV-647-R	14 U	641228	5517085
MM-INV-503-R	14 U	618497	5512545	MM-INV-648-R	14 U	658277	5525170
MM-INV-600-R	14 U	629637	5512100	MM-INV-649-R	14 U	659929	5525003
MM-INV-601-R	14 U	629974	5512283	MM-INV-650-R	14 U	664857	5525538
MM-INV-602-R	14 U	631142	5512220	MM-INV-651-R	14 U	666495	5525586
MM-INV-603-R	14 U	633882	5512281	MM-INV-652-R	14 U	679579	5505795
MM-INV-604-R	14 U	634290	5512337	MM-INV-653-R	14 U	679435	5505795
MM-INV-605-R	14 U	635484	5513205	MM-INV-654-R	14 U	680270	5502492
MM-INV-606-R	14 U	640470	5516617	MM-INV-655-R	14 U	683698	5499369
MM-INV-607-R	14 U	640768	5516962	MM-INV-656-R	14 U	681793	5488013
MM-INV-608-R	14 U	646871	5521008	MM-INV-700-R	14 U	612157	5537913
MM-INV-610-R	14 U	647845	5523074	MM-INV-701-R	14 U	613224	5522608

Site	UTM Zone	Easting	Northing	Site	UTM Zone	Easting	Northing
MM-INV-611-R	14 U	647984	5526348	MM-INV-702-R	14 U	613193	5521597
MM-INV-612-R	14 U	648462	5524723	MM-INV-703-R	14 U	613189	5521524
MM-INV-706-R	14 U	614125	5518223	-	-	-	-
MM-INV-707-R	14 U	614159	5517822	-	-	-	-
MM-INV-708-R	14 U	619197	5512279	-	-	-	-
MM-INV-709-R	14 U	619975	5512572	-	-	-	-
MM-INV-710-R	14 U	620853	5511864	-	-	-	-
MM-INV-712-R	14 U	687704	5460490	-	-	-	-
MM-INV-713-R	14 U	687744	5459904	-	-	-	-
MM-INV-714-R	14 U	688995	5458720	-	-	-	-
MM-INV-715-R	14 U	694487	5454132	-	-	-	-
MM-INV-716-R	14 U	704352	5442275	-	-	-	-
MM-INV-718-R	14 U	715717	5439865	-	-	-	-
MM-INV-719-R	14 U	720692	5438527	-	-	-	-
MM-INV-720-R	14 U	720730	5438115	-	-	-	-
MM-INV-721-R	14 U	723324	5434549	-	-	-	-
MM-INV-722-R	14 U	723882	5434166	-	-	-	-
MM-INV-723-R	14 U	723872	5434165	-	-	-	-
MM-INV-724-R	14 U	724152	5433780	-	-	-	-
MM-INV-725-R	14 U	724161	5433729	-	-	-	-
MM-INV-726-R	14 U	724240	5431990	-	-	-	-
MM-INV-800-R	14 U	612541	5533797	-	-	-	-
MM-INV-801-R	14 U	612603	5532173	-	-	-	-
MM-INV-802-R	14 U	612859	5532172	-	-	-	-
MM-INV-803-R	14 U	613091	5528346	-	-	-	-
MM-INV-804-R	14 U	612893	5526212	-	-	-	-
MM-INV-805-R	14 U	612788	5524730	-	-	-	-
MM-INV-806-R	14 U	612551	5521404	-	-	-	-
MM-INV-807-R	14 U	613137	5520318	-	-	-	-
MM-INV-808-R	14 U	612497	5518201	-	-	-	-
MM-INV-809-R	14 U	612525	5517361	-	-	-	-
MM-INV-810-R	14 U	618276	5517459	-	-	-	-
MM-INV-811-R	14 U	618303	5515829	-	-	-	-
MM-INV-812-R	14 U	689357	5460383	-	-	-	-
MM-INV-813-R	14 U	692865	5455092	-	-	-	-
MM-INV-814-R	14 U	692874	5455092	-	-	-	-
MM-INV-815-R	14 U	618369	5512548	-	-	-	-
MM-INV-816-R	14 U	618361	5512542	-	-	-	-

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

Site	Species	Common Name	Rank
REDACTED	<i>Agalinis tenuifolia</i>	Narrow-leaved Agalinis	S3
	<i>Amphicarpaea bracteata</i>	Hog-peanut	S3S5
	<i>Amphicarpaea bracteata</i>	Hog-peanut	S3S5
	<i>Arethusa bulbosa</i>	Dragon's Mouth Orchid	S2
	<i>Arethusa bulbosa</i>	Dragon's Mouth Orchid	S2
	<i>Arethusa bulbosa</i>	Dragon's Mouth Orchid	S2
	<i>Arethusa bulbosa</i>	Dragon's-mouth orchid	S2
	<i>Asarum canadense</i>	Wild Ginger	S3S4
	<i>Asarum canadense</i>	Wild Ginger	S3S4
	<i>Asarum canadense</i>	Wild Ginger	S3S4
	<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
	<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
	<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
	<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Asclepias syriaca</i>	Common Milkweed	S3S4
	<i>Betula occidentalis</i>	River Birch	S3S5

	<i>Betula occidentalis</i>	River Birch	S3S5
	<i>Betula occidentalis</i>	River Birch	S3S5
	<i>Betula occidentalis</i>	River Birch	S3S5
	<i>Bromus kalmii</i>	Wild Chess	S2S3
	<i>Bromus kalmii</i>	Wild Chess	S2S3
	<i>Carex prairea</i>	Prairie Sedge	S3S4
	<i>Carex prairea</i>	Prairie Sedge	S3S4
	<i>Carex tetanica</i>	Rigid Sedge	S3
	<i>Chelone glabra</i>	White Turtlehead	S2
	<i>Corispermum americanum</i>	American Bugseed	S3
	<i>Corispermum americanum</i>	American Bugseed	S3
	<i>Corispermum americanum</i>	American Bugseed	S3
	<i>Corispermum villosum</i>	Hairy Bugseed	S1S2
	<i>Cyperus squarrosus</i>	Awed Flatsedge	S1S2
	<i>Cypripedium arietinum</i>	Ram's-head lady's-slipper	S2S3
	<i>Dryopteris cristata</i>	Crested Shield Fern	S3S4
	<i>Dryopteris cristata</i>	Crested Shield Fern	S3S4
	<i>Fraxinus nigra</i>	Black Ash	S2
	<i>Fraxinus nigra</i>	Black Ash	S2
	<i>Fraxinus nigra</i>	Black Ash	S2
	<i>Fraxinus nigra</i>	Black Ash	S2
	<i>Impatiens noli-tangere</i>	Western Jewelweed	S1
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Iris versicolor</i>	Blue Flag	S3S4
	<i>Lonicera involucrata</i>	Black Twinberry	S3S4
	<i>Muhlenbergia racemosa</i>	Marsh Muhly	S3S4
	<i>Muhlenbergia racemosa</i>	Marsh Muhly	S3S4
	<i>Osmorhiza claytonii</i>	Hairy Sweet Cicely	S2
	<i>Osmorhiza claytonii</i>	Hairy Sweet Cicely	S2
	<i>Osmorhiza claytonii</i>	Hairy Sweet Cicely	S2
	<i>Osmorhiza claytonii</i>	Hairy Sweet Cicely	S2
	<i>Ostrya virginiana</i>	Hop-hornbeam	S2
	<i>Ostrya virginiana</i>	Hop-hornbeam	S2
	<i>Pascopyrum smithii</i>	Western Wheatgrass	S3
	<i>Pedicularis lanceolata</i>	Swamp Lousewort	S3S4
	<i>Pedicularis lanceolata</i>	Swamp Lousewort	S3S4
	<i>Pedicularis lanceolata</i>	Swamp Lousewort	S3S4
	<i>Pteridium aquilinum</i>	Braken Fern	S3S4
	<i>Salix pellita</i>	Satin Willow	S3S4
	<i>Salix pellita</i>	Satin Willow	S3S4
	<i>Salix pellita</i>	Satin Willow	S3S4
	<i>Salix pellita</i>	Satin Willow	S3S4
	<i>Scirpus pallidus</i>	Green Bulrush	S3S4
	<i>Typha angustifolia</i>	Narrow-leaved Cattail	S3S4

[illegible]

APPENDIX VIII. List of flora recorded in MMTP surveys and sampling, 2020.

Family/Species	Common Name	MBCDC Rank
VASCULAR SPECIES		
Pteridophytes – Ferns and Allies		
DENNSTAEDTIACEAE	BRACKEN FAMILY	
<i>Pteridium aquilinum</i>	Bracken Fern	S3S4
DRYOPTERACEAE	WOOD FERN FAMILY	
<i>Dryopteris cristata</i>	Crested Shield Fern	S3S4
EQUISETACEAE	HORSETAIL FAMILY	
<i>Equisetum arvense</i>	Common Horsetail	S5
<i>Equisetum fluviatile</i>	Swamp Horsetail	S5
<i>Equisetum hyemale</i>	Common Scouring-rush	S5
<i>Equisetum pratense</i>	Meadow Horsetail	S4S5
<i>Equisetum sylvaticum</i>	Wood Horsetail	S5
OPHIOGLOSSACEAE	ADDER'S TONGUE FAMILY	
<i>Botrypus virginianus</i>	Rattlesnake Fern	S4
Gymnosperms		
CUPRESSACEAE	CYPRESS FAMILY	
<i>Thuja occidentalis</i>	Eastern White Cedar	S4?
PINACEAE	PINE FAMILY	
<i>Larix laricina</i>	Tamarack	S5
<i>Picea glauca</i>	White Spruce	S5
<i>Picea mariana</i>	Black Spruce	S5
<i>Pinus banksiana</i>	Jack Pine	S5
Angiosperms - Monocotyledons		
ALISMATACEAE	ARROWHEAD FAMILY	
<i>Alisma triviale</i>	Common Water Plantain	S5
CYPERACEAE	SEDGE FAMILY	
<i>Carex aquatilis</i>	Water Sedge	S5
<i>Carex aurea</i>	Golden Sedge	S5
<i>Carex bebbii</i>	Bebb's Sedge	S5
<i>Carex buxbaumii</i>	Brown Sedge	S4S5
<i>Carex capillaris</i>	Hair-like Sedge	S5
<i>Carex chordorrhiza</i>	Prostrate Sedge	S4S5

<i>Carex foenea</i>	Hay Sedge	S5
<i>Carex granularis</i>	Granular Sedge	S4?
<i>Carex interior</i>	Inland Sedge	S4?
<i>Carex lacustris</i>	Lakeshore Sedge	S5
<i>Carex lasiocarpa</i>	Hairy-fruited Sedge	S5
<i>Carex leptalea</i>	Bristle-stalked Sedge	S5
<i>Carex pellita</i>	Woolly Sedge	S5
<i>Carex prairea</i>	Prairie Sedge	S3S4
<i>Carex pseudocyperus</i>	Cyperus-like Sedge	S4
<i>Carex rostrata</i>	Beaked Sedge	S4
<i>Carex</i> spp.	A Sedge	
<i>Carex tetanica</i>	Rigid Sedge	S3
<i>Carex utriculata</i>	Beaked Sedge	S5
<i>Carex vaginata</i>	Sheathed Sedge	S5
<i>Cyperus squarrosus</i>	Awned Flatsedge	S1S2
<i>Eleocharis acicularis</i>	Needle Spike-rush	S5
<i>Eleocharis palustris</i>	Creeping Spike-rush	S5
<i>Eleocharis</i> sp.	A Spike-rush	
<i>Eriophorum</i> sp.	Cotton-grass	S5
<i>Schoenoplectus tabernaemontani</i>	Soft-stem Bulrush	S5
<i>Scirpus pallidus</i>	Green Bulrush	S3S4
IRIDACEAE	IRIS FAMILY	
<i>Iris versicolor</i>	Blue Flag	S3S4
<i>Sisyrinchium montanum</i>	Blue-eyed Grass	S5
JUNCACEAE	RUSH FAMILY	
<i>Juncus alpinoarticulatus</i>	Alpine rush	S5
<i>Juncus arcticus</i> var. <i>balticus</i>	Baltic Rush	S5
<i>Juncus dudleyi</i>	Dudley's Rush	S5
<i>Juncus nodosus</i>	Knotted Rush	S5
<i>Juncus tenuis</i>	Slender Rush	S4S5
<i>Juncus vaseyi</i>	Big-head Rush	S4
<i>Juncus</i> sp.	A Rush	
JUNCAGINACEAE	ARROW-GRASS FAMILY	
<i>Triglochin maritima</i>	Seaside Arrow-grass	S5
<i>Triglochin palustris</i>	Marsh Arrow-grass	S4S5
LEMNACEAE	DUCKWEED FAMILY	
<i>Lemna turionifera</i>	Turion Duckweed	SU
LILIACEAE	LILY FAMILY	

<i>Maianthemum canadense</i>	Canada May Flower	S5
<i>Maianthemum stellatum</i>	Solomon's Seal	S5
<i>Triantha glutinosa</i>	Sticky False Asphodel	S4S5
ORCHIDACEAE	ORCHID FAMILY	
<i>Arethusa bulbosa</i>	Dragon's-mouth Orchid	S2
<i>Coeloglossom viride</i> var. <i>virescens</i>	Long-bracted Orchid	S5
<i>Cypripedium arietinum</i>	Ram's-head Lady's-slipper	S2S3
<i>Cypripedium parviflorum</i>	Yellow Lady's-slipper	S5?
<i>Cypripedium reginae</i>	Showy Lady's-slipper	S4
<i>Cypripedium</i> sp.	Lady's-slipper	
POACEAE	GRASS FAMILY	
<i>Agrostis scabra</i>	Ticklegrass	S5
<i>Agrostis stolonifera</i>	Creeping Bentgrass	SNA
<i>Andropogon gerardii</i>	Big Bluestem	S5
<i>Avena sativa</i>	Cultivated Oats	SNA
<i>Beckmannia syzigachne</i>	Slough Grass	S5
<i>Bromus ciliatus</i>	Fringed Brome	S5
<i>Bromus inermis</i>	Smooth Brome	SNA
<i>Bromus kalmii</i>	Wild Chess	S2S3
<i>Calamagrostis canadensis</i>	Bluejoint Reedgrass	S5
<i>Calamagrostis stricta</i>	Northern Reedgrass	S5
<i>Cinna latifolia</i>	Slender Woodreed	S5
<i>Danthonia spicata</i>	Poverty Oat Grass	S4S5
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	S4S5
<i>Dichanthelium</i> sp.	A Panic grass	
<i>Echinochloa crus-galli</i>	Barnyard Grass	SNA
<i>Elymus canadensis</i>	Great Plains Wild Rye	S4S5
<i>Elymus repens</i>	Quackgrass	SNA
<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	Slender Wildrye	S5
<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	One-sided Wildrye	SNR
<i>Festuca</i> sp.	A Fescue	
<i>Glyceria grandis</i>	Tall Mannagrass	S5
<i>Glyceria striata</i>	Fowl Manna Grass	S5
<i>Hordeum jubatum</i>	Wild Barley	S5
<i>Hordeum vulgare</i>	Common Barley	SNA
<i>Muhlenbergia glomerata</i>	Bog Muhly	S4
<i>Muhlenbergia racemosa</i>	Marsh Muhly	S3S4
<i>Muhlenbergia</i> sp.	A Muhly grass	
<i>Oryzopsis asperifolia</i>	Rice Grass	S5
<i>Panicum capillare</i>	Common Panicgrass	S4S5
<i>Pascopyrum smithii</i>	Western Wheatgrass	S3

<i>Phalaris arundinacea</i>	Reed Canarygrass	S5
<i>Phleum pratense</i>	Timothy	SNA
<i>Phragmites australis</i>	Common Reed	S5
<i>Poa annua</i>	Annual Bluegrass	SNA
<i>Poa palustris</i>	Fowl Bluegrass	S5
<i>Poa pratensis</i>	Kentucky Bluegrass	S5
<i>Poa</i> spp.	A Bluegrass	
<i>Scolochloa festucacea</i>	Common Rivergrass	S4S5
<i>Setaria pumila</i>	Yellow Foxtail	SNA
<i>Setaria viridis</i>	Green Foxtail	SNA
<i>Spartina gracilis</i>	Alkali Cordgrass	S4
POTAMOGETONACEAE	PONDWEED FAMILY	
<i>Potamogeton gramineus</i>	Various-leaved Pondweed	S5
<i>Potamogeton</i> sp.	A Pondweed	
SMILACACEAE	GREENBRIAR FAMILY	
<i>Smilax lasioneura</i>	Carrion Flower	S4S5
TYPHACEAE	CAT-TAIL FAMILY	
<i>Typha angustifolia</i>	Narrow-leaved Cattail	S3S4
<i>Typha</i> spp.	A Cattail	
Angiosperms - Dicotyledons		
ACERACEAE	MAPLE FAMILY	
<i>Acer negundo</i>	Manitoba Maple	S5
ACORACEAE	SWEET-FLAG FAMILY	
<i>Acorus americanus</i>	Sweet Flag	S4S5
AMARANTHACEAE	AMARANTH FAMILY	
<i>Amaranthus blitoides</i>	Prostrate Pigweed	SNA
<i>Amaranthus retroflexus</i>	Redroot Pigweed	SNA
ANACARDIACEAE	SUMAC FAMILY	
<i>Toxicodendron rydbergii</i>	Poison Ivy	S5
APIACEAE	CARROT FAMILY	
<i>Cicuta maculata</i>	Spotted Water Hemlock	S4S5
<i>Osmorrhiza claytonii</i>	Hairy Sweet Cicely	S2?
<i>Sanicula marilandica</i>	Seneca Snakeroot	S5
<i>Sium suave</i>	Water Parsnip	S5
<i>Zizia aptera</i>	Heart-leaved Alexander	S5

<i>Zizia aurea</i>	Golden Alexanders	S4S5
APOCYNACEAE	DOGBANE FAMILY	
<i>Apocynum androsaemifolium</i>	Spreading Dogbane	S5
ARALIACEAE	GINSENG FAMILY	
<i>Aralia hispida</i>	Bristly Sarsaparilla	S4S5
<i>Aralia nudicaulis</i>	Wild Sarsaparilla	S5
ARISTOLOCHIACEAE	BIRTHWORT FAMILY	
<i>Asarum canadense</i>	Wild Ginger	S3S4
ASCLEPIADACEAE	MILKWEED FAMILY	
<i>Asclepias incarnata</i>	Swamp Milkweed	S3S4
<i>Asclepias ovalifolia</i>	Dwarf Milkweed	S4S5
<i>Asclepias speciosa</i>	Showy Milkweed	S3S5
<i>Asclepias syriaca</i>	Common Milkweed	S3S4
ASTERACEAE	ASTER FAMILY	
<i>Achillea millefolium</i>	Yarrow	S5
<i>Agoseris glauca</i>	False Dandelion	S4S5
<i>Ambrosia artemisiifolia</i>	Common Ragweed	S5
<i>Ambrosia trifida</i>	Giant Ragweed	S4
<i>Antennaria</i> sp.	An Everlasting	
<i>Artemisia absinthium</i>	Wormwood	SNA
<i>Artemisia biennis</i>	Biennial Wormwood	SNA
<i>Artemisia ludoviciana</i>	Prairie Sage	S5
<i>Centaurea stoebe</i>	Spotted Knapweed	S5
<i>Cirsium arvense</i>	Canada Thistle	SNA
<i>Cirsium vulgare</i>	Bull Thistle	SNA
<i>Cirsium</i> sp.	A Thistle	
<i>Crepis tectorum</i>	Narrow-leaved Hawks-beard	SNA
<i>Cyclchaena xanthiifolia</i>	Marsh-elder	SNA
<i>Doellingeria umbellata</i>	Flat-topped White Aster	S5
<i>Erigeron canadensis</i>	Canada Horse-weed	S5
<i>Erigeron glabellus</i>	Smooth Fleabane	S5
<i>Euthamia graminifolia</i>	Flat-topped Goldenrod	S5
<i>Eutrochium maculatum</i>	Spotted Joe Pye Weed	S5
<i>Helianthus</i> sp.	A Sunflower	
<i>Heliopsis helianthoides</i>	False Sunflower	S5
<i>Heterotheca villosa</i>	Hairy Golden-aster	S5
<i>Hieracium umbellatum</i>	Northern Hawkweed	S5
<i>Lactuca biennis</i>	Tall Blue Lettuce	S4

<i>Lactuca serriola</i>	Prickly Lettuce	SNA
<i>Leucanthemum vulgare</i>	Ox-eye Daisy	SNA
<i>Liatris ligulistylis</i>	Meadow Blazing Star	S4
<i>Liatris punctata</i>	Dotted Blazing Star	S4
<i>Matricaria discoidea</i>	Pineapple Weed	SNA
<i>Packera paupercula</i>	Balsam Groundsel	S5
<i>Petasites frigidus</i> var. <i>palmatus</i>	Palmate-leaved Coltsfoot	S5
<i>Petasites frigidus</i> var. <i>sagittatus</i>	Arrow-leaved Coltsfoot	S5
<i>Petasites frigidus</i> var. <i>x vitifolius</i>	Vine-leaved Coltsfoot	SNA
<i>Rudbeckia hirta</i>	Black-eyed Susan	S5
<i>Senecio</i> sp.	Groundsel	
<i>Solidago canadensis</i>	Canada Goldenrod	S5
<i>Solidago nemoralis</i>	Field Goldenrod	S5
<i>Solidago rigida</i>	Stiff Goldenrod	S5
<i>Solidago</i> spp.	A Goldenrod	
<i>Sonchus arvensis</i>	Field Sow-thistle	SNA
<i>Sonchus asper</i>	Spiny-leaved Sow-thistle	SNA
<i>Sonchus oleraceus</i>	Common Sow-thistle	SNA
<i>Symphyotrichum boreale</i>	Northern Bog Aster	S4S5
<i>Symphyotrichum ciliolatum</i>	Lindley's Aster	S5
<i>Symphyotrichum ericoides</i>	Many-flowered Aster	S4
<i>Symphyotrichum laeve</i>	Smooth Aster	S5
<i>Symphyotrichum lanceolatum</i>	Panicled Aster	S4S5
<i>Symphyotrichum lateriflorum</i>	Calico Aster	S4
<i>Symphyotrichum puniceum</i>	Purple-stemmed Aster	S5
<i>Symphyotrichum</i> spp.	An Aster	
<i>Taraxacum officinale</i>	Common Dandelion	SNA
<i>Tragopogon dubius</i>	Goat's-beard	SNA
<i>Tripleurospermum inodorum</i>	Scentless False Mayweed	SNA
BALSAMINACEAE	TOUCH-ME-NOT FAMILY	
<i>Impatiens capensis</i>	Jewelweed	S5
<i>Impatiens noli-tangere</i>	Western Jewelweed	S1
BETULACEAE	BIRCH FAMILY	
<i>Alnus alnobetula</i>	Green Alder	S5
<i>Alnus incana</i>	Speckled Alder	S5
<i>Betula occidentalis</i>	River Birch	S3S5
<i>Betula papyrifera</i>	Paper Birch	S5
<i>Betula pumila</i>	Dwarf Birch	S5
<i>Corylus cornuta</i>	Beaked Hazelnut	S5
<i>Corylus</i> spp.	A Hazelnut	
<i>Ostrya virginiana</i>	Hop-hornbeam	S2

BORAGINACEAE	BORAGE FAMILY	
<i>Lappula squarrosa</i>	Bristly Stickseed	SNA
<i>Lithospermum canescens</i>	Hoary Puccoon	S5
<i>Myosotis scirpoides</i>	Marsh Forget-me-not	SNA
BRASSICACEAE	MUSTARD FAMILY	
<i>Berteroa incana</i>	Hoary Alyssum	SNA
<i>Brassica rapa</i>	Bird's Rape	SNA
<i>Capsella bursa-pastoris</i>	Shepherd's Purse	SNA
<i>Cardamine parviflora</i>	Small Bitter Cress	S3S4
<i>Erucastrum galicum</i>	Dog-mustard	SNA
<i>Lepidium densiflorum</i>	Common Pepper-grass	S5
<i>Pastinaca sativa</i>	Wild Parsnip	SNA
<i>Thlaspi arvense</i>	Field Pennycress	SNA
CAMPANULACEAE	BELLFLOWER FAMILY	
<i>Campanula aparinoides</i>	Marsh Bellflower	S5
<i>Campanula rotundifolia</i>	Harebells	S5
<i>Lobelia kalmii</i>	Kalm's Lobelia	S5
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
<i>Lonicera dioica</i>	Twining Honeysuckle	S5
<i>Lonicera involucrata</i>	Black Twinberry	S3S4
<i>Symphoricarpos albus</i>	Snowberry	S4S5
<i>Symphoricarpos occidentalis</i>	Western Snowberry	S5
<i>Viburnum lentago</i>	Nannyberry	S4
<i>Viburnum opulus</i>	High-bush Cranberry	S5
<i>Viburnum rafinesquianum</i>	Downy Arrowwood	S4S5
CARYOPHYLLACEAE	PINK FAMILY	
<i>Moehringia lateriflora</i>	Blunt-leaved sandwort	S5
<i>Silene csereii</i>	Smooth Catchfly	SNA
<i>Silene latifolia</i>	White Cockle	SNA
<i>Stellaria longifolia</i>	Long-leaved Stitchwort	S5
<i>Stellaria sp.</i>	A Stitchwort	
CELASTRACEAE	STAFF-TREE FAMILY	
<i>Parnassia palustris</i>	Grass of Parnassus	S5
CHENOPODIACEAE	GOOSEFOOT FAMILY	
<i>Bassia scoparia</i>	Summer Cypress	SNA
<i>Blitum capitatum</i>	Strawberry Blite	S4S5
<i>Chenopodium simplex</i>	Maple-leaved Goosefoot	S5

<i>Chenopodium album</i>	Lamb's-quarters	SNA
<i>Chenopodium</i> sp.	A Goosefoot	
<i>Corispermum americanum</i>	American Bugseed	S3
<i>Corispermum villosum</i>	Hairy Bugseed	S1S2
CONVOLVULACEAE	MORNING GLORY FAMILY	
<i>Calystegia sepium</i>	Hedge Bindweed	S4S5
CORNACEAE	DOGWOOD FAMILY	
<i>Cornus canadensis</i>	Bunchberry	S5
<i>Cornus sericea</i>	Red-osier Dogwood	S5
CUCURBITACEAE	GOURD FAMILY	
<i>Echinocystis lobata</i>	Wild Cucumber	S4S5
ERICACEAE	HEATH FAMILY	
<i>Rhododendron groenlandicum</i>	Labrador Tea	S5
<i>Vaccinium angustifolium</i>	Blueberry	S4
<i>Vaccinium myrtilloides</i>	Velvet-leaf Blueberry	S5
EUPHORBIACEAE	SPURGE FAMILY	
<i>Euphorbia virgata</i>	Leafy Spurge	SNA
FABACEAE	PEA FAMILY	
<i>Amphicarpaea bracteata</i>	Hog-peanut	S3S5
<i>Glycyrrhiza lepidota</i>	Wild Licorice	S4S5
<i>Lathyrus ochroleucus</i>	Cream-coloured Vetchling	S4S5
<i>Lathyrus palustris</i>	Marsh Vetchling	S5
<i>Lathyrus venosus</i>	Wild Peavine	S5
<i>Lotus corniculatus</i>	Bird's-foot Trefoil	SNA
<i>Medicago lupulina</i>	Black Medic	SNA
<i>Medicago sativa</i>	Alfalfa	SNA
<i>Melilotus albus</i>	White Sweetclover	SNA
<i>Melilotus officinalis</i>	Yellow Sweet Clover	SNA
<i>Trifolium hybridum</i>	Alsike Clover	SNA
<i>Trifolium pratense</i>	Red Clover	SNA
<i>Trifolium repens</i>	White Clover	SNA
<i>Vicia americana</i>	American Vetch	S5
<i>Vicia cracca</i>	Tufted Vetch	SNA
FAGACEAE	BEECH FAMILY	
<i>Quercus macrocarpa</i>	Bur Oak	S5

FUMARIACEAE	FUMITORY FAMILY	
<i>Corydalis</i> sp.	A Corydalis	
GENTIANACEAE	GENTIAN FAMILY	
<i>Gentiana</i> sp.	A Gentian	
<i>Halenia deflexa</i>	Spurred Gentian	S5
GERANIACEAE	GERANIUM FAMILY	
<i>Erodium cicutarium</i>	Alfilaria	SNA
<i>Geranium bicknellii</i>	Bicknell's Geranium	S5
GROSSULARIACEAE	CURRANT FAMILY	
<i>Ribes lacustre</i>	Swamp Gooseberry	S4
<i>Ribes oxycanthoides</i>	Northern Gooseberry	S5
<i>Ribes triste</i>	Swamp Red Currant	S5
HIPPURIDACEAE	MARE'S-TAIL FAMILY	
<i>Hippuris vulgaris</i>	Common Mare's-tail	S5
LAMIACEAE	MINT FAMILY	
<i>Agastache foeniculum</i>	Giant Hyssop	S5
<i>Dracocephalum parviflorum</i>	American Dragon-head	S5
<i>Galeopsis tetrahit</i>	Common Hemp-nettle	SNA
<i>Lycopus americanus</i>	Water Hore-hound	S5
<i>Lycopus uniflorus</i>	Northern Bugleweed	S4S5
<i>Mentha arvensis</i>	Mint	S5
<i>Monarda fistulosa</i>	Wild Bergamot	S4
<i>Prunella vulgaris</i>	Heal-all	S4
<i>Scutellaria galericulata</i>	Marsh Skullcap	S5
<i>Scutellaria lateriflora</i>	Mad-dog Skullcap	S4
<i>Stachys palustris</i>	Marsh Hedge-nettle	S5
LENTIBULARIACEAE	BLADDERWORT FAMILY	
<i>Utricularia intermedia</i>	Flat-leaved Bladderwort	S4S5
MENYANTHACEAE	BOGBEAN FAMILY	
<i>Menyanthes trifoliata</i>	Bogbean	S5
OLEACEAE	OLIVE FAMILY	
<i>Fraxinus nigra</i>	Black Ash	S2
<i>Fraxinus pennsylvanica</i>	GreenAsh	S4S5
ONAGRACEAE	EVENING PRIMROSE FAMILY	

<i>Chamerion angustifolium</i>	Fireweed	S5
<i>Epilobium ciliatum</i> ssp. <i>glandulosum</i>	Northern Willowherb	S5
<i>Epilobium leptophyllum</i>	Linear-leaf Willowherb	S4S5
<i>Epilobium palustre</i>	Marsh Willowherb	S5
PARNASSIACEAE	GRASS OF PARNASSUS FAMILY	
<i>Parnassia palustris</i>	Northern Grass-of-Parnassus	S5
PLANTAGINACEAE	PLANTAIN FAMILY	
<i>Plantago major</i>	Common Plantain	SNA
POLYGALACEAE	MILKWORT FAMILY	
<i>Polygala senega</i>	Seneca Root	S4
POLYGONACEAE	SMARTWEED FAMILY	
<i>Fagopyrum tataricum</i>	Tartary Buckwheat	SNA
<i>Fallopia convolvulus</i>	Black Bindweed	SNA
<i>Persicaria amphibia</i>	Water Smartweed	S5
<i>Persicaria lapathifolia</i>	Pale Smartweed	S5
<i>Polygonum aviculare</i>	Prostrate Knotweed	SU
<i>Rumex crispus</i>	Curly Dock	SNA
<i>Rumex fueginus</i>	Golden Dock	S4S5
<i>Rumex occidentalis</i>	Western Dock	S4S5
<i>Rumex</i> sp.	A Dock	
PORTULACACEAE	PURSLANE FAMILY	
<i>Portulaca oleracea</i>	Common Purslane	SNA
PRIMULACEAE	PRIMROSE FAMILY	
<i>Lysimachia borealis</i>	Northern Starflower	S5
<i>Lysimachia ciliata</i>	Fringed Loosestrife	S5
<i>Lysimachia thysiflora</i>	Tufted Loosestrife	S5
PYROLACEAE	WINTERGREEN FAMILY	
<i>Pyrola asarifolia</i>	Pink Wintergreen	S5
<i>Pyrola</i> sp.	A Wintergreen	
RANUNCULACEAE	CROWFOOT FAMILY	
<i>Actaea rubra</i>	Baneberry	S5
<i>Anemone canadensis</i>	Canada Anemone	S5
<i>Anemone cylindrica</i>	Thimbleweed	S5
<i>Anemone</i> sp.	An Anemone	
<i>Aquilegia canadensis</i>	Wild Columbine	S5

<i>Aquilegia</i> sp.	A Columbine	
<i>Caltha palustris</i>	Marsh Marigold	S5
<i>Clematis</i> sp.	A Clematis	
<i>Ranunculus sceleratus</i>	Cursed Crowfoot	S5
<i>Ranunculus</i> sp.	A Buttercup	
<i>Thalictrum dasycarpum</i>	Hairy Meadowrue	S5
<i>Thalictrum venulosum</i>	Veiny Meadowrue	S5
RHAMNACEAE	BUCKTHORN FAMILY	
<i>Rhamnus alnifolia</i>	Alder-leaved Buckthorn	S5
ROSACEAE	ROSE FAMILY	
<i>Amelanchier alnifolia</i>	Saskatoon	S5
<i>Comarum palustre</i>	Marsh Cinquefoil	S5
<i>Dasiphora fruticosa</i>	Shrubby cinquefoil	S5
<i>Fragaria virginiana</i>	Smooth Wild Strawberry	S5
<i>Geum aleppicum</i>	Yellow Avens	S5
<i>Geum macrophyllum</i>	Large-leaved Avens	S4S5
<i>Potentilla anserina</i> ssp. <i>anserina</i>	Silverweed	S5
<i>Potentilla norvegica</i>	Rough Cinquefoil	S5
<i>Prunus pensylvanica</i>	Pin Cherry	S5
<i>Prunus virginiana</i>	Chokecherry	S5
<i>Rosa acicularis</i>	Prickly Rose	S5
<i>Rosa</i> sp.	A Rose	
<i>Rubus arcticus</i> sep. <i>acaulis</i>	Stemless Raspberry	S5
<i>Rubus idaeus</i>	Raspberry	S5
<i>Rubus pubescens</i>	Trailing Dewberry	S5
<i>Spiraea alba</i>	Meadowsweet	S5
RUBIACEAE	MADDER FAMILY	
<i>Galium boreale</i>	Northern Bedstraw	S5
<i>Galium labradoricum</i>	Northern Bog Bedstraw	S4S5
<i>Galium trifidum</i>	Three-petal Bedstraw	S5
<i>Galium triflorum</i>	Sweet-scented Bedstraw	S5
SALICACEAE	WILLOW FAMILY	
<i>Populus balsamifera</i>	Balsam Poplar	S5
<i>Populus tremuloides</i>	Trembling Aspen	S5
<i>Salix amygdaloides</i>	Peach-leaved Willow	S4
<i>Salix bebbiana</i>	Bebb's Willow	S5
<i>Salix candida</i>	Hoary Willow	S5
<i>Salix discolor</i>	Pussy Willow	S5
<i>Salix famelica</i>	Starved Willow	S4

<i>Salix interior</i>	Sandbar Willow	S5
<i>Salix lucida</i>	Shining Willow	S5
<i>Salix maccalliana</i>	Velvet-fruited Willow	S4
<i>Salix pedicellaris</i>	Bog Willow	S5
<i>Salix pellita</i>	Satin Willow	S3S4
<i>Salix petiolaris</i>	Basket Willow	S4S5
<i>Salix planifolia</i>	Flat-leaved Willow	S5
<i>Salix pseudomonticola</i>	False Mountain Willow	S4S5
<i>Salix</i> spp.	A Willow	
SANTALACEAE	SANDALWOOD FAMILY	
<i>Comandra umbellata</i>	Bastard Toadflax	S5
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
<i>Mitella nuda</i>	Mitrewort	S5
SCROPHULARIACEAE	FIGWORT FAMILY	
<i>Agalinis tenuifolia</i>	Narrow-leaved Agalinis	S3
<i>Chelone glabra</i>	White Turtlehead	S2
<i>Linaria vulgaris</i>	Butter-and-eggs	SNA
<i>Mimulus ringens</i>	Blue Monkeyflower	S4
<i>Odontites vulgaris</i>	Red Bartsia	SNA
<i>Pedicularis lanceolata</i>	Swamp Lousewort	S3S4
<i>Verbascum thapsus</i>	Common Mullein	SNA
SOLANACEAE	POTATO FAMILY	
<i>Solanum triflorum</i>	Wild Tomato	SNA
ULMACEAE	ELM FAMILY	
<i>Ulmus americana</i>	American Elm	S4S5
URTICACEAE	NETTLE FAMILY	
<i>Urtica dioica</i>	Stinging Nettle	S5
VIOLACEAE	VIOLET FAMILY	
<i>Viola canadensis</i>	Canada Violet	S5
<i>Viola</i> spp.	A Violet	

