BIPOLE III TERRESTRIAL ECOSYSTEMS AND VEGETATION ENVIRONMENTAL MONITORING ANNUAL TECHNICAL REPORT – YEAR V

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SUMMARY

Vegetation and terrestrial ecosystems were assessed for Year V environmental monitoring. Surveys were completed for native grassland prairie, terrestrial vegetation (forested areas), wetlands, plants/communities important to aboriginal people, invasive and non-native species and species of conservation concern, each with botanical summaries presented. The accuracy of effect predictions and the effectiveness of mitigation are discussed.

A single grassland/prairie (PRA) site was surveyed for continued monitoring in 2018. The total species cover in 2018 of this prairie site has decreased from 2017 values to 53.2% (previously 74.4%), with 26 species observed in the survey plot. Vegetation cover is evenly split between grasses (19.4%) and broad-leaved herbs (18.8%). Grasses are dominated by kentucky blue grass (*Poa pratensis*), big blue stem (*Andropogon gerardii*), and sand grass (*Calamovilfa longifolia*). Forbs with the greatest cover include smooth wild strawberry (*Fragaria virginiana*) and prairie sage (*Artemisia ludoviciana*). The effect predictions for prairie vegetation were determined to be accurate.

Twenty-six sites were revisited to sample terrestrial (TER) vegetation in Sections N1, N2, N3, N4 and along the northern AC collector lines and construction power line. Total species cover and richness were significantly different ($p<0.001$ and $p=0.008$, respectively) between surveys on and off the RoW. These sites continued to show lower average values for total vegetation cover and number of species present on the RoW, compared to off-RoW. However, when comparing the mean values, a steady increase in both species cover and species richness is noted from 2014 to 2018, in sites on the RoW. There were no significant differences detected for diversity, however the evenness of species distribution between surveys on and off the RoW was significantly different ($p=0.003$). Four community types were identified and broadly divided into regenerating hardwood or softwood types. The effect predictions for terrestrial vegetation were determined to be accurate.

Seven environmentally sensitive sites (patterned fens) were revisited in Sections N3 and N4 to sample wetland vegetation (WET). There continues to be a trend of lower mean species cover and richness in sites on the RoW, when compared to off-Row sites. Despite lower richness values, the number of species on the RoW has tended to increase in successive years of sampling, while the diversity index and species evenness continue to have similar values across all years and between paired surveys on and off RoW. Two community types were identified, distinguished by moss cover and composition, vegetation structure and surface water present. No noxious, invasive or non-native species have yet been found in WET sites in any year of sampling. The effect predictions were determined to be accurate.

Ten sites were revisited to sample vegetation in the Cowan Blueberry Resource Area (ATK). Two species of blueberry plants were observed during surveys and include velvetleaf blueberry (*Vaccinium myrtilloides*) and low sweet blueberry (*Vaccinium angustifolium*). Blueberry plants have been recorded at sample sites since initial clearing with varying presence. Low sweet blueberry continues to be recorded in five sites, and is generally the more prominent blueberry, with an average cover of 12.5% (ranging from 0.8 to 39.0%). Velvetleaf blueberry, found in three sites in 2018, averaged 3.2% cover, (ranging from 0.4 to 5.6%). Total blueberry cover for sites supporting blueberries on the RoW (2018) averaged 14.4%, an increase since initial pre-clearing surveys in 2014 (11.6%). Other berry plants recorded in plots of the Resource Area included smooth wild strawberry (*Fragaria virginiana*), trailing dewberry (*Rubus pubescens*), raspberry (*Rubus idaeus*), Saskatoon (*Amelanchier alnifolia*), pin cherry (*Prunus pensylvanica*), and chokecherry (*Prunus virginiana*). Total species cover for vegetation surveys on and off the RoW continued to show significantly lower values on the RoW ($p=0.004$). No other significant differences in species richness, diversity or evenness occurred between paired on and off RoW samples. The effect predictions for ATK vegetation were determined to be accurate.

Forty sites were visited to sample invasive and non-native (INV) vegetation with paired samples conducted at each site, for a total of 80 surveys in Sections N1 to N4, C1, C2 and along the northern AC collector lines and construction power line. In vegetation surveys, all species measures showed significant differences between samples on and off the RoW, except for species richness ($p=0.516$). Thirty-four additional roadside sites were visited along the RoW in Sections S1 and S2. A total of 65 noxious, invasive or non-native species were recorded across all vegetation surveys (including rehabilitation sites - RHB). Twenty-six species are listed as noxious weeds (primarily Tier 3, but for four Tier 2 species), while 31 species are considered invasive. Twenty-four species are considered non-native. Project-wide, the most commonly observed noxious, invasive and non-native species were sweet clovers (*Melilotus* spp., 134 records) field sow-thistle (*Sonchus arvensis*, 77 records), lamb's-quarters (*Chenopodium album*, 57 records), common dandelion (*Taraxacum officinale*, 49 records), smooth brome (*Bromus inermis*, 48 records) and Canada thistle (*Cirsium arvense*, 45 records). The greatest frequency of observation records and species was found in the roadside surveys followed by the rehabilitation surveys, and quantitative INV surveys. These areas were identified by the susceptibility to increased spread of invasive and non-native species, due to each site's location, sensitivity or proximity to existing patches. The remainder of surveys (ATK, PRA, TER, SCC) had far more modest records of non-native species occurrences at sites. The effect predictions for invasive and non-native vegetation were determined to be accurate.

Sixty-one species of conservation concern (ranking S1 through S3S5) were recorded during surveys and sampling in 2018. Eighteen species are ranked Very Rare to Rare, (S1 through S2S4), with the remaining 43 species ranked Uncommon (S3 though S3S5). The most frequent number of observations (59), and the greatest number of species of conservation concern (22) were recorded in the SCC surveys in S1, near the Assiniboine River crossing. Silky prairie-clover (*Dalea villosa*), is listed as Threatened under *The Endangered Species and Ecosystems Act* – Manitoba and the *Species at Risk Act*, and Special Concern under the Committee on the Status of Endangered Wildlife in Canada. Silky prairie-clover was first observed in 2010 during rare plant surveys for the Bipole III environmental assessment and has been observed each year at the same locations during monitoring (2014 through 2018). The effect prediction for species of conservation concern was determined to be accurate.

In 2018, 196 additional monitoring areas were visited to evaluate disturbances along the RoW for potential rehabilitation or management. It was determined that 81 sites were revegetating naturally and do not require rehabilitation at this time. Weed management was identified for 67 sites, while 60 other sites could use some form of rehabilitation for disturbance, including topsoil addition, grading, seeding, or erosion control blankets.

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1.0 INTRODUCTION

On August 14, 2013, Manitoba Conservation and Water Stewardship granted an Environment Act Licence to Manitoba Hydro for the construction, operation, and maintenance of the Bipole III Transmission Project. Clearing and construction for the Project began in 2014 and was completed during the winter of 2017-2018 (2018 in-service date). In the summer of 2018, vegetation and terrestrial ecosystems were assessed for Year V environmental monitoring (post-construction), within the Manitoba Hydro Bipole III Transmission Project area (Map 1-1, Appendix II).

Bipole III is a new high voltage direct current (HVDC) transmission project required to improve overall system reliability and dependability. The Bipole III transmission project involved the construction of a 500 kilovolt (kV) HVDC (high voltage direct current) transmission line that links the northern power generating complex on the Lower Nelson River with the conversion and delivery system in southern Manitoba. The project also involved construction of two converter stations (Keewatinohk in northern Manitoba and Riel east of Winnipeg), two ground electrodes, and additional 230 kV transmission line interconnections in the north to tie the new converter station into the existing northern AC (alternating current) system.

The Bipole III Transmission Project occurs over eight ecoregions. From the Hudson Bay Lowlands in the northeast part of the province, the transmission project crosses boreal forest and wetland habitat. In the west central region of the province, the vegetation transitions from boreal forest to mixed woods. The most southerly portion of the transmission line contains forests, wetlands, prairies and agricultural lands.

Over the five-year duration, this study involved pre-construction surveys along uncleared portions of the transmission project as well as environmental monitoring along cleared project areas. Potential environmental effects as a result of the project are listed in Appendix III, which were identified in the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011) and the project Environmental Impact Statement (Manitoba Hydro 2011). Project commitments for environmental monitoring of terrestrial ecosystems and vegetation are identified in Appendix IV. The specific objectives established for this study, based on The Environment Act Licence conditions, the report on Public Hearing recommendations, and Environmental Impact Statement commitments, were as follows:

- Pre-construction surveys and environmental monitoring of prairie sites;
- Environmental monitoring of terrestrial and wetland sites;
- Pre-construction surveys and environmental monitoring of the Cowan blueberry resource area;
- Environmental monitoring for invasive and non-native species;

- Pre-construction surveys and environmental monitoring for species of conservation concern; and
- Site visits for areas potentially requiring vegetation rehabilitation.

The following hypotheses were developed for environmental monitoring of terrestrial ecosystems and vegetation:

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 clearing and construction activities along the right-of-way*.

Hypothesis 3: *There is a relationship between species abundance of blueberry plants along the transmission line right-of-way and clearing activities, in the Cowan resource area*.

2.0 BACKGROUND

The following section discusses the environmental monitoring background for native grassland prairie, terrestrial vegetation (forested areas), wetlands, plants/communities important to aboriginal people, invasive and non-native species, species of conservation concern, and rehabilitation monitoring.

2.1 Native Grassland/Prairie

There is potential for native grassland/prairie areas located in the southern portion of the Project within the HVDC transmission line right-of-way (RoW) to be disrupted by construction activities (e.g., heavy equipment use and grubbing activities).

Approximately 755 ha of the grassland cover type (considered agricultural pastureland) have the potential to be affected by construction activities. Less than 10 ha of dry upland prairie, which are part of grasslands and have been identified as environmentally sensitive sites, may be affected (Szwaluk Environmental Consulting et al. 2011). Another potential effect of the loss of native grassland/prairie areas is the loss of species of conservation concern, such as those listed by the federal Species at Risk Act (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), The Endangered Species and Ecosystems Act – Manitoba (ESEA), or the Manitoba Conservation Data Centre (MBCDC) as very rare to uncommon, within the HVDC transmission line RoW from construction activities.

Sparsely treed areas, which in some locations span the entire width of the HVDC transmission line RoW, were found in dry upland prairie areas during field assessments. Construction activities can result in the clearing of these treed areas. Native grasslands may potentially be disrupted during HVDC maintenance activities within the transmission line RoW.

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.
- Use existing access roads and trails to the extent possible.
- Remove trees by low-disturbance methods.
- Confine vehicle traffic to established trails to the extent possible.
- Stabilize sites immediately after construction and re-vegetate disturbed areas in accordance with the site Rehabilitation Plan.

Monitoring activities for native grassland/prairie areas are identified in Table 2-1.

Table 2-1. Monitoring activities for native grassland/prairie areas.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Pre-construction	Ground surveys to collect baseline data	NA	Prairie ESS	One-time	Once	Summer	Species composition and abundance
Construction /Post-construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Prairie area change	Prairie ESS	During construction and 3 years post construction	Annual	Summer	Area affected (ha); species composition and abundance

2.2 Terrestrial Vegetation (Forested Areas)

The Bipole III Transmission Project will result in the loss of native forest vegetation during clearing and construction activities. It is estimated that 3,355 ha of upland forest vegetation will be affected from clearing of the 500 kV transmission line RoW (Szwaluk Environmental Consulting et al. 2011). Removal and long-term loss of forest cover as a result of RoW clearing as well as potential damage to adjacent forest vegetation during clearing and construction has been identified as an effect of transmission line development.

Many environmental effect predictions incorporate effects on the terrestrial vegetation. For these reasons, terrestrial vegetation monitoring provides an effective means for identifying both anticipated and unexpected effects on the terrestrial environment.

Mitigation Measures Identified in the Environmental Impact Statement

- Clearing and construction activities will be carried out during the winter months to minimize the effect on understory species and to minimize surface damage, rutting and erosion.
- Grubbing will be minimized within the RoW to reduce root damage except at foundation sites.
- Tree removal will be confined within the limits of the RoW, with the exception of danger trees located outside the RoW that can affect transmission lines.
- Trees will be felled into the RoW so as not to damage existing vegetation along RoW boundaries.

Monitoring activities for terrestrial vegetation are identified in Table 2-2.

Table 2-2. Monitoring activities for terrestrial vegetation.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Construction	Ground surveys to identify terrestrial changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Project Footprint	During construction	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify terrestrial changes not discernible from habitat mapping	Species occurrence	Project Footprint	2 yrs	Annual	Summer	Species composition and abundance

2.3 Wetlands

Bog, fen and marsh wetlands identified along the transmission line RoW cover approximately 1,456 ha (Szwaluk Environmental Consulting et al. 2011). Only bog and fen wetlands were identified for other Project components. Main effects include the potential disruption, alteration or loss of wetlands from Project activities for the transmission line RoW and other project components. Project activities may also affect species of concern that may be present in these areas; cause soil compaction; or change water flow, which may affect plant populations.

Environmentally sensitive areas identified along the transmission line RoW included patterned fen wetlands (Bipole III Environmental Protection Plan). Approximately 535 ha of patterned fen wetlands occur within the transmission line RoW. Main effects to these environmentally sensitive sites include potential site disturbance or loss of plants from construction, maintenance and decommissioning activities.

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.

- Use existing access roads and trails to the extent possible.
- Provide 30 m vegetated (shrub and herbaceous) buffer around site.
- Remove trees by low disturbance methods.
- Confine vehicle traffic to established trails to extent possible.
- Install erosion protection and sediment control measures in accordance with Erosion/Sediment Control Plan.

Monitoring activities for wetlands are identified in Table 2-3.

Table 2-3. Monitoring activities for wetlands.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Construction	Ground surveys to identify wetland changes not discernible from habitat mapping and to monitor wetland protection measures	Areas and locations of wetlands affected by the Project	Applicable Project Component Footprint and wetland ESS	During construction	Annual	Summer	Area affected (ha); species composition and abundance
Post-construction	Ground surveys to identify wetland changes not discernible from habitat mapping	Areas and locations of wetlands affected by the Project	Applicable Project Component Footprint and wetland ESS	2 yrs	Annual	Summer	Area affected (ha); species composition and abundance

2.4 Plants/Communities Important to Aboriginal People

A number of plants and plant communities have been identified as being particularly important to Aboriginal people (e.g., Cowan blueberry area, Assiniboine River). These areas are valued for their provision of resources used by Aboriginals including gathering of food and medicines and harvesting plants and trees.

Clearing and construction of transmission line RoW as well as the creation of new access roads/trails for the Project can allow increased access by non-community members to sensitive areas that have been identified by local Aboriginal communities and can result in the potential loss of important vegetation resources found at these sites.

Although non-Aboriginal people also have long-established traditional uses related to botanical resources, several locations along the preferred route have been identified that support plants that are used by Aboriginal people, including areas for berry picking, medicine gathering, and harvesting plants and trees for cultural purposes. The harvesting and profiting from non-timber resources by non-community members is a concern for Aboriginal people.

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.
- Minimize surface disturbance around the site to the extent possible.
- Remove trees by low disturbance methods.
- No herbicide to be applied during construction.
- Confine vehicle traffic to established trails to extent possible.

Monitoring activities for Plants/Communities Important to Aboriginal People areas are identified in Table 2-4.

Table 2-4. Monitoring activities for plants/communities important to Aboriginal people.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Pre-construction	Ground surveys to collect baseline data	NA	Vegetation ESS	One -time	Once	Summer	Species composition and abundance
Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Vegetation ESS	During construction	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify changes not discernible from habitat mapping	Species occurrence	Vegetation ESS	2yrs	Annual	Summer	Species composition and abundance

2.5 Invasive and Non-Native Species

The abundance of non-native or invasive plant 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.

Construction equipment and vehicles can introduce non-native plants such as white sweetclover (*Melilotus albus*), a herbaceous perennial. During the field assessments in 2010, 27 non-native species were observed throughout the Project Study Area, five of which were invasive plants (Szwaluk Environmental Consulting et al. 2011).

Non-native species are problematic for one or a number of the following reasons: introduced plants are capable of growing under a wide range of climatic and soil conditions; they produce abundant seeds that are easily disseminated; their seeds are long lived or can remain dormant through the winter season; they persist even after the removal of vegetative portions of the plant; and they often have vigorous growth and produce seeds under conditions adverse for other plants. All or any of these factors can lead non-native and invasive species to outcompete native species, shifting the vegetation composition and community where they occur.

Mitigation Measures Identified in the Environmental Impact Statement

- Carry out construction activities during the winter months.
- Wash and inspect all construction equipment prior to working in new sites to reduce the spread of introduced species.
- Ensure that construction materials (i.e., gravel) will be taken from clean sources and ground cover materials will be weed free prior to use.

Monitoring activities for invasive and non-native species are identified in Table 2-5.

Table 2-5. Monitoring activities for invasive and non-native species.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	Project footprint	During construction	Annual	Summer	Species composition and abundance
Post-construction	Ground surveys to identify changes not discernible from habitat mapping	Species occurrence	Project footprint	2yrs	Annual	Summer	Species composition and abundance

2.6 Species of Conservation Concern

Species of conservation concern include species of plants that are protected under ESEA, SARA, COSEWIC, or that are listed as very rare to uncommon by the MBCDC. While these species generally exist in low numbers and/or have limited distributions, they play a role in helping to preserve species diversity (e.g., songbirds, invertebrates).

Fifteen locations for plant species of conservation concern were previously known to occur along the transmission RoW and project components (MBCDC records). Field assessments in 2010 identified species of concern along the transmission line RoW local study area (26 locations) and project components (three locations). In 2012, pre-construction botanical surveys conducted for the northern project components identified 42 locations for species of concern.

Construction activities that can negatively affect plant species of conservation concern include the removal of tree cover, the use of heavy equipment (crushing plants), and clearing and grubbing (removal of roots) of vegetation. Another potential effect is herbicide use (during maintenance activities), which not only inhibits the growth of undesirable species, but can also negatively affect desirable species.

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 5 m vegetated (shrub and herbaceous) buffer around site.
- Remove trees by low disturbance methods.
- Confine vehicle traffic to established trails to extent possible.
- Use existing access roads and trails to the extent possible.
- Stabilize sites immediately after construction and re-vegetate disturbed areas in accordance with Site Rehabilitation Plan.

Monitoring activities for species of conservation concern are identified in Table 2-6.

2.7 Rehabilitation Monitoring

Rehabilitation can provide mitigation of adverse Project effects, by providing erosion control and invasive plant spread control, while restoring wildlife habitat and aesthetics. Disturbed habitat will be rehabilitated in all areas not required, and in some areas that are required, for Project operation. Monitoring is required to verify the implementation and effectiveness of rehabilitation measures, the locations and nature of which are presently unknown, but may include staging areas, construction camps and borrow sites.

Monitoring activities for sites rehabilitated are identified in Table 2-7.

Table 2-6. Monitoring activities for species of conservation concern.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Pre-construction	Ground surveys in areas that may support plant species of conservation concern	NA	Various sites within Project footprint	One-time	Once	Summer	NA
Construction/ Post Construction	Ground surveys to identify changes not discernible from habitat mapping and to monitor protection measures	Species occurrence	ESS sites	During construction and 1yr post construction	Annual	Summer	Presence/ absence

Table 2-7. Monitoring activities for rehabilitation sites.

Phase	Task Description	Environmental Indicator	Site Location	Duration	Frequency	Timing	Measurable Parameter
Post-construction	Ground surveys will be used to identify the degree of implementation and the effectiveness of rehabilitation efforts	Areas affected by the Project requiring rehabilitation	Rehabilitation area	2 yrs	Annual	Summer	Area (ha) meeting rehabilitation targets

3.0 METHODS

The methods used to assess terrestrial ecosystems and vegetation can be divided into five general groups, those used for: i) project review and site selection; ii) pre-construction surveys; iii) environmental monitoring; iv) rehabilitation surveys; and v) data preparation and statistical analyses. The following sections summarize the specific techniques used in each of these five groups.

3.1 Project Review and Sample Site Selection

Previously collected information, from the Terrestrial Ecosystems and Vegetation Assessment for the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011) and the project Environmental Impact Statement (Manitoba Hydro 2011), was reviewed to identify predictions made in the assessment and recommended future fieldwork. Applicable regulatory documents were reviewed to determine environmental monitoring requirements for vegetation including: Manitoba Hydro – Bipole III Transmission Project, The Environment Act Licence (Manitoba Conservation and Water Stewardship 2013); and Bipole III Transmission Project, Report on Public Hearing (Manitoba Clean Environment Commission 2013).

Vegetation sites previously selected in 2014 and 2015 and new sites in 2018 were visited to collect environmental monitoring information in Year V. These included sites selected to monitor prairie and forest habitats, wetlands, invasive species, botanical resource areas, and potential rehabilitation sites along Sections N1, N2, N3, N4, C1, C2, S1, S2 and northern project components. Sites where species of conservation concern were observed in previous seasons were monitored again in 2018 for presence/ absence of species. Available progress of project construction activities from Manitoba Hydro were reviewed.

To select potential sample sites for pre-construction surveys and environmental monitoring, Manitoba Hydro's Environmental Protection Information Management System (EPIMS) Map Viewer was used to view project footprint imagery (pre- and post-clearing digital ortho-rectified imagery). EPIMS Map Viewer imagery includes information on previously identified environmentally sensitive sites, former vegetation information collected, and vegetation cover from the biophysical land classification. The land classification used is a national landcover spatial database developed by the federal government. Twenty-three classes of native vegetation are identified. Broad classes include coniferous, deciduous, mixed forest, wetlands and grasslands. Each forest class is separated into dense (crown closure >60%), open (crown closure 26 to 60%), and sparse (crown closure 10 to 25%). Other information sources that were reviewed prior to fieldwork included the terrestrial ecosystems and vegetation technical report prepared for the project (Szwaluk Environmental Consulting et al. 2011), Manitoba

Hydro post-clearing geo-referenced digital video/photo products (low altitude) of the project RoW, and Google Earth imagery, which was used to produce fieldwork navigational maps.

Vegetation type and environmentally sensitive sites were considered potential sampling locations however, suitable sites were also selected based on accessibility, disturbance, sites where invasive and non-native species may establish and proliferate, and landowner permission. Sites selected on private lands were submitted to Manitoba Hydro to determine property ownership and contact information. Landowners were contacted by telephone to request permission for access to their properties. Manitoba Hydro provided detailed field maps books of the Construction Environmental Protection Plan (Manitoba Hydro 2014a and 2014b).

Components of the biophysical environment to sample and monitor for the Bipole III Transmission Project were anticipated to include forest and prairie habitats, wetlands, botanical resource areas identified from Aboriginal Traditional Knowledge (ATK), species of conservation concern, invasive and non-native species, and rehabilitation sites. These components are considered to be important based on scientific interest, public concern, and aboriginal values.

3.2 Pre-construction Surveys

Previous pre-construction surveys occurred on uncleared portions of the transmission line RoW. Pre-construction surveys were conducted in areas that were identified important through the environmental assessment process (i.e., prairies, Assiniboine River crossing, and Cowan blueberry resource area). Surveys in 2014 and 2015 also focused on areas not previously sampled as a result of landowner permissions in Section S1 and adjustments to the Final Preferred Route at the Assiniboine River area and Moose Meadows. Pre-construction surveys involved native vegetation surveys (quantitative) and rare plant surveys (non-quantitative) in selected habitats along the transmission line RoW. Pre-construction surveys also involved roadside assessments for invasive and non-native species, where roads intersected the RoW primarily adjacent to agricultural land.

3.2.1 Native Vegetation Surveys

Sites previously selected for native vegetation surveys had plots established for future vegetation monitoring. The following method was used for the prairie and blueberry resource area surveys (i.e., pre-construction). 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 2.5 m by 2.5 m quadrats with a 1 m by 1 m nested quadrat spaced at 5 m increments along a 30 m transect for shrubs 1 - 2.5 m tall and herbs and low shrubs ≤1 m tall, respectively. Transects were located on sites considered representative of the stand being sampled. The first quadrat was placed at the 5 m mark. The composition of tree 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 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 plastic conduit pipe driven into the ground with a pin flag inserted. Reference sites were established adjacent to the RoW.

3.2.2 Rare Plant Surveys

Species of conservation concern includes species that are rare, disjunct, or at risk throughout their range or in Manitoba. Species of conservation concern encompasses plants ranked very rare to uncommon by the MBCDC, and those listed under ESEA (Manitoba), SARA (federal) and COSEWIC (federal).

The global (G) and sub-national (S) rarity ranking of species used by the MBCDC, according to a standardized procedure used by all Conservation Data Centres and Natural Heritage Programs is as follows:

1: Very rare throughout its range or in the province (5 or fewer occurrences, or very few remaining individuals). May be especially vulnerable to extirpation.

2: Rare throughout its range or in the province (6 to 20 occurrences). May be vulnerable to extirpation.

3: Uncommon throughout its range or in the province (21 to 100 occurrences).

4: Widespread, abundant, and apparently secure throughout its range or in the province, with many occurrences, but the element is of long-term concern (> 100 occurrences).

5: Demonstrably widespread, abundant, and secure throughout its range or in the province, and essentially impossible to eradicate under present conditions.

The conservation status categories for ESEA, SARA and COSEWIC are as follows:

SPECIAL CONCERN: A species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

THREATENED: A species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

ENDANGERED: A species facing imminent extirpation or extinction.

EXTIRPATED: A species no longer existing in the wild in Canada but exists elsewhere.

EXTINCT: A species that no longer exists.

Species of conservation concern previously observed for the project were reviewed (e.g., Terrestrial Ecosystems and Vegetation Technical Report 2011, and Year I and II Annual Technical Reports 2015 and 2016). Flowering times and preferred habitat for species of conservation concern known to occur in the Project area were also reviewed. Areas with high potential to support species of conservation concern were identified for surveys.

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 such as prairies, while meander searches were conducted in areas of difficult terrain, unique habitats, and where unusual landscape features occur. Where rare plants were observed, the following information was recorded: GPS coordinates, associated plants and habitat, and photographs were taken.

3.3 Environmental Monitoring

Environmental monitoring occurred on cleared portions of the RoW and cleared Project components. Surveys in 2018 focused on the transmission line RoW in Sections N1, N2, N3, N4, C1 C2, S1 and S2, and the northern project components that include the northern AC collector lines (CL), construction power line (CP) and ground electrode line (GEL). Only the GEL was cleared prior to 2014, and re-cleared during the winter of 2016/2017. In 2018, environmental monitoring included sites for prairie (PRA), terrestrial (TER), wetlands (WET), blueberry resource area (ATK), invasive and non-native species (INV), and species of conservation concern (SCC). Environmental monitoring involved vegetation monitoring (quantitative) and rare plant monitoring (non-quantitative) to evaluate Project effects. Roadside surveys in Sections S1 and S2 were conducted to record information on invasive and non-native species for the RoW at road allowances intersecting the RoW. Observations were also collected on presence of invasives around towers visible from the roadside. Surveys were conducted mainly in agricultural areas where invasive species composition was assessed.

3.3.1 Vegetation Monitoring

Sampling involved the methods described above under native vegetation survey. The vegetation survey consisted of establishing sample plots on relatively homogenous sites on the cleared RoW. The following method was used for prairie, terrestrial habitat, wetland, blueberry resource area, and invasive and non-native species sampling (i.e., monitoring). Transects were permanently located along the transmission line RoW,

longitudinally, and approximately in the centre of the RoW, but generally off the equipment path. Reference sites that shared similar natural conditions were established adjacent to the RoW, approximately parallel to the RoW sample plot, and plots began approximately 5 m from the RoW edge (i.e., 15 m from RoW edge to the longitudinal transect), using identical quantitative sampling methods. Incidental species observations were recorded both on and off the transmission line RoW. Relative population densities and extent were recorded for incidental invasive species observed. Plot locations were marked at the beginning of each transect with GPS coordinates, and staked with a 30 cm section of plastic conduit pipe, with a pin flag inserted. Photographs were taken at each monitoring site.

For invasive and non-native off RoW sites revisited in 2015, 2016, 2017 and 2018, a belt transect was used to scan for species, without estimating species cover in quadrats. The belt transect overlaid the original 30 m transect established, with a swath of 2.5 m scanned on either side of the transect for invasive and non-native species (150 m^2). Observations included locations along transect and abundance of species from stem counts or estimates.

3.3.2 Rare Plant Monitoring

Rare plant monitoring for species of conservation concern initially involved the review of species previously observed along cleared portions of the RoW and northern project components (i.e., AC collector lines and construction power line). Monitoring occurred at selected sites to investigate their presence/ absence of species after RoW clearing activities. Species of concern re-assessed in the field had their GPS coordinates verified, abundance and extent estimated, and photographs were taken.

3.4 Rehabilitation Surveys

Part of Manitoba Hydro's commitment to environmental protection includes the development of an Environmental Protection Program. Aspects of this program include vegetation rehabilitation and management.

In 2018, a list of potential rehabilitation sites was identified by Manitoba Hydro for further site evaluation. The RoW was flown by Manitoba Hydro during April and May of the current year, prior to the growing season. Field surveys were conducted from June to August.

The degree of disturbance was assessed at sites (identified by Manitoba Hydro) using parameters such as size of disturbance, soil disturbance (i.e., rutting, erosion) and vegetation composition. A site visit helped to determine whether natural re-vegetation would be feasible or if rehabilitation is required. Consideration was given to factors such

as topography, slope, moisture, time of year, and post disturbance conditions. Photographs were taken at several sites visited. Rehabilitation activities will be guided by the Rehabilitation and Invasive Species Management Plan (Manitoba Hydro 2018).

Where rehabilitation occurs, monitoring will verify the implementation and effectiveness of rehabilitation measures. Post-construction rehabilitation surveys will record changes in vegetation composition and structure.

3.5 Data Preparation and Statistical Analyses

After field sampling was completed, the data was digitized and verified for accuracy. For each plot with quantitative sampling, mean values for vegetation percent cover were calculated for plots with a tall shrub stratum, herb and low shrub stratum, non-vascular stratum, as well as inanimate ground cover. All sites were stratified by vegetation type.

Species richness was determined for each plot. Species diversity was calculated using the Shannon diversity index which combines species richness with relative abundance. Equitability was calculated to determine the evenness of species in their distribution within the site.

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

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

where s = the number of species

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

ln = log base$_n$

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

where s = the number of species

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

ln = log base$_n$

Although recent research suggests that H' is becoming an expected standard for assessing biological diversity, Strong (2016) suggests that this measure be accompanied

by independent analyses of richness and evenness to ensure proper representation of abundance data in ecology.

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

Sites were described by classifying community types based on plant species composition and abundances 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.

Statistical analyses were performed using R 3.1.1. (R Core Team 2016). Diversity and evenness measures were calculated in Excel.

4.0 RESULTS

The following section discusses the results for all site types as follows: native grassland prairie (PRA), terrestrial vegetation (TER), wetlands (WET), blueberry resource area (ATK), invasive and non-native species (INV), species of conservation concern (SCC), and rehabilitation monitoring (RHB). Included within the botanical summary for each site are values for: total species cover (cumulative % plant cover), species richness (actual number of species present), species diversity index, and species evenness, for all species recorded in plots. The accuracy of effect predictions and the effectiveness of mitigation for site types are also presented.

4.1 Native Grassland/Prairie

A single grassland prairie (PRA) site was surveyed for continued monitoring in 2018 (Map 4-1, Appendix II) (Field Activity ID BPIII_CON_FA403). This PRA site, located in the southern portion of the Bipole III RoW Section S1, was visited on July 21. A search for incidental species of conservation concern was also undertaken. No off-site survey was established as this patch was originally too small to allow a paired survey adjacent to the RoW, within the same habitat.

This site is a dry sandy prairie, with trembling aspen (*Populus tremuloides*) and bur oak (*Quercus macrocarpa*) adjacent to the RoW, and currently present as a regenerating layer within the RoW (Photograph 4-1a). Eight rare or uncommon species were found in or incidental to plots (Sand grass –*Calamovilfa longifolia* S3S5; Schweinitz's flatsedge –*Cyperus schweinitzii* S2; silky prairie-clover –*Dalea villosa* S2S3; sand millet –*Dichanthelium wilcoxianum* S2?; beautiful sunflower –*Helianthus pauciflorus* ssp. *subrhomboideus* S3S4; linear-leaved puccoon –*Lithospermum incisum* S3; skeletonweed –*Lygodesmia juncea* S3S4; and sand dropseed –*Sporobolus cryptandrus* S3S5).

Photograph 4-1a. Aspen regeneration and encroachment on the RoW.

Species of conservation concern are discussed in Section 4.6. Prairie spike-moss (*Selaginella densa,* S3), has not been observed since clearing, and was last recorded at this site in 2015.

4.1.1 Data Analysis of Grassland/Prairie Areas

A single native vegetation survey was conducted in a grassland/prairie area, site S1-PRA-900. Species cover, richness, diversity and evenness of the understory vegetation is provided for all years in Table 4-1a.

Table 4-1a. Grassland/prairie vegetation measures on RoW, 2015 to 2018.

	Pre-Con	Construction		
	2015	**2016**	**2017**	**2018**
Species Cover (%)	62.8	52.8	74.4	53.2
Species Richness	38	30	33	26
Diversity	2.65	2.54	2.27	2.65
Evenness	0.73	0.75	0.65	0.81
Number of Surveys	1	1	1	1

The total species cover in 2018 for this prairie site was 53.2%, with 26 species observed within the survey plot. Vegetation cover is evenly split between grasses (19.4%) and broad-leaved herbs (18.8%). Grasses are dominated by kentucky blue grass (*Poa pratensis*, 8.4%), big blue stem (*Andropogon gerardii*, 4.2%), and sand grass (3%). Forbs are dominated by smooth wild strawberry (*Fragaria virginiana*, 3.8%), prairie sage (*Artemisia ludoviciana*, 3.4%), Canada anemone and leafy spurge (*Anemone canadensis* and *Euphorbia esula*, 2.6%), and hairy-golden aster (*Heterotheca villosa*, 2.2%). Species diversity and evenness values have risen slightly from the previous year. Regeneration of aspen (<2m primarily) and occasional oak are encroaching into the original prairie opening. Regeneration is intermittently thick at this previously open site, with aspen saplings dominating cover in some plots (mean of 11.4%).

When original pre-construction vegetation measures (2015) are compared to the current year, there appears to be a shift in the vegetation structure in this prairie opening. In 2015, the vegetation structure was dominated by grass cover (39%), very little low shrub cover (<1%), and no tree or shrub seedlings. There was a very sparse tree canopy (6%), and few tall shrubs (<1%). However, the changes seen in 2018 at this site are decreased grass cover (19%), increased low shrub and tree seedlings (<4%), increased tall shrub cover (11%), and an increase in bare ground, Table 4-1b.

Table 4-1b. Changes to native prairie vegetation structure and cover (%) from pre-construction (2015) to post-construction (2018), on RoW.		
	2015	**2018**
Grass/Sedges	39.2	19.4
Broadleaved herbs	17.6	18.8
Low shrubs, woody seedlings	0.4	3.6
Tall Shrubs	0.4	11.4
Trees	6.0	-
Cumulative vegetation cover	63.2	53.2
Soil	1.0	8.0
Litter	84.0	91.4
Woody debris	0.4	0.6

While the number of noxious/invasives species is similar over time at this site, during pre-construction the grasses were equally co-dominated by the native big blue stem (13.4%) and the non-native kentucky blue grass (13.0%). In 2018, along with the overall reduction in grass coverage, the cover of big blue stem (4.2%) is also much reduced compared to the dominant kentucky blue grass (8.4%).

4.1.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project area assessed in Section S1, the effect predictions from Appendix III for native grassland/prairie area were accurate for the following:

- Potential loss of plants of conservation concern
- Environmentally sensitive sites may be affected
- Loss of native forest vegetation

Mitigation measures identified in the Project Environmental Impact Statement (Manitoba Hydro 2011), the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011), and Annual Technical Reports (2015 and 2016) were initially assessed, after clearing (Table 4-1c). No new PRA sites were sampled in 2018. Observations recorded in the field from 2018 are provided below.

Table 4-1c. Mitigation measures assessed at a site monitored for native grassland/prairie vegetation on the RoW.
Mitigation Measure
Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion.
Use existing access roads and trails to the extent possible.
Remove trees by low-disturbance methods.
Confine vehicle traffic to established trails to the extent possible.
Stabilize sites immediately after construction and re-vegetate disturbed areas in accordance with the site Rehabilitation Plan.

From fieldwork conducted, it was determined that the recommended mitigation was implemented for native grassland/prairie vegetation. In the absence of mitigation, site disturbance likely would have increased. Activities appeared to occur on dry ground to minimize surface damage, rutting and erosion. Existing access roads and trails appeared to be used. Tree clearing occurred in previous years and within the RoW.

Although mitigation was implemented at the prairie monitoring site (S1-PRA-900), vegetation ground cover showed some disturbance from construction activities. A tower placement is located close to site S1-PRA-900. Machinery used here to establish anchor points has resulted in loss of vegetation cover in and around the tower footprint. The area is extremely sandy, and the ground vegetation is easily disturbed. Abundant bare ground was observed in and around the tower footing area, where outbreaks of several invasive species were also noted this year. ATV tracks elsewhere on the property (both on RoW and off site) have produced bare ground (i.e., sand) with very little vegetation in vehicle tracks. Photograph 4-1b shows sandy soils on the RoW. Noxious and invasive species observed in S1-PRA-900 are discussed in Section 4.5.1. Species of conservation concern - prairie spike-moss (*Selaginella densa,* S3) has not been relocated at sites in this area since 2015, prior to clearing.

Photograph 4-1b. Sandy soils on the RoW.

4.2 Terrestrial Vegetation (Forested Areas)

Twenty-six sites were revisited to sample terrestrial (TER) vegetation from July 6 to August 2 (Field Activity ID BPIII_CON_FA399, 400 and 401) (Map 4-1, Appendix II). No other re-visiting of off-RoW sites was required, resulting in a total of 26 surveys completed for terrestrial vegetation in 2018. Five sites are located in each of Sections N4, N3 and N2, six sites in Section N1, and five sites are located along the northern AC collector lines (CL) and construction power line (CP).

4.2.1 Data Analysis of Terrestrial Vegetation

Twenty-six surveys were conducted for terrestrial vegetation. Results of a paired-sample Wilcoxon test for terrestrial vegetation surveys on (2018) and off the RoW (all years) show continued significantly lower values for total vegetation percent cover ($p<0.001$) on the RoW, as well as for total number of species present ($p=0.008$). There were no significant differences detected for diversity ($p=0.585$), while evenness was slightly higher ($p=0.003$) in surveys on the RoW (2018). Vegetation description measures for paired on- and off- RoW surveys are shown below for species cover, species richness (total number of species), species diversity and evenness in Table 4-2a. Mean values of all vegetation measures for all years of sampling are shown in Table 4-2b.

Table 4-2a. Terrestrial vegetation measures: on-RoW 2018, and off-RoW.

	Species Cover (%)		Species Richness		Diversity		Evenness	
Site	**RoW[1]**	**off RoW**	**RoW[2]**	**off RoW**	**RoW[3]**	**off RoW**	**RoW[4]**	**off RoW**
N4TER10	37.6	126.0	28	34	2.4	2.3	0.7	0.7
N4TER20	56.8	138.6	20	27	2.1	2.1	0.7	0.6
N4TER30	104.8	96.8	22	21	1.7	1.6	0.5	0.5
N4TER40	84.8	68.0	44	31	2.9	2.4	0.8	0.7
N4TER50	82.8	158.4	34	28	2.4	2.0	0.7	0.6
N3TER10	67.4	127.2	37	38	3.0	2.9	0.8	0.8
N3TER20	34	115.0	23	34	2.4	2.7	0.8	0.8
N3TER30	41	145.0	31	31	2.6	2.3	0.8	0.7
N3TER40	110.6	151.8	29	27	2.3	2.1	0.7	0.6
N3TER50	124.4	111.0	23	18	1.8	2.1	0.6	0.7
N2TER10	71.2	140.6	18	22	2.2	1.9	0.8	0.6
N2TER20	115.8	105.0	33	28	2.3	2.1	0.7	0.6
N2TER30	160.4	114.8	24	21	2.7	2.0	0.9	0.7
N2TER40	52	129.6	16	18	1.9	1.4	0.7	0.5
N2TER50	2.8	124.2	6	15	1.7	1.2	1.0	0.4
N1TER10	53.8	118.0	27	28	2.6	2.1	0.8	0.6
N1TER20	10.4	154.2	12	23	2.1	1.9	0.8	0.6
N1TER30	8.2	157.6	21	32	2.8	1.9	0.9	0.5
N1TER40	33.4	99.4	16	31	1.8	2.7	0.6	0.8
N1TER50	30	120.0	21	37	2.4	2.7	0.8	0.7
N1TER60	21.8	157.8	13	44	1.9	2.7	0.7	0.7
CLTER10	11	120.4	9	16	1.6	2.2	0.7	0.8
CLTER20	9	129.6	7	14	1.6	1.9	0.8	0.7
CLTER30	35.4	127.0	11	16	1.9	2.1	0.8	0.8
CPTER10	9	120.2	7	18	1.5	2.0	0.8	0.7
CPTER20	5.4	127.0	9	16	1.9	2.2	0.9	0.8
Mean	**52.8**	**126.3**	**20.8**	**25.7**	**2.2**	**2.1**	**0.8**	**0.7**

[1] Total species cover (%) on (2018) and off RoW is significantly different, $p<0.001$.
[2] Species richness on (2018) and off RoW is significantly different, $p=0.008$.
[3] No significant differences in diversity index on (2018) and off RoW, $p=0.585$.
[4] Species evenness on (2018) and off RoW is significantly different, $p=0.003$.

Table 4-2b. Terrestrial vegetation measures, mean site values 2014 to 2018.						
	On RoW					Off
	2014	2015	2016	2017	2018	RoW
Species Cover (%)	23.3	21.4	24.0	46.2	52.8	126.3
Species Richness	12.3	13.1	16.3	19.3	20.8	25.7
Diversity	1.8	1.9	2.1	2.1	2.2	2.1
Evenness	0.7	0.8	0.8	0.7	0.8	0.7
Number of Surveys	15	22	26	26	26	26

Vegetation cover is likely to remain far lower on the RoW in TER sites, due to the elimination or reduction of original tall canopies. However, when comparing the mean values for vegetation measures of TER surveys, a steady and marked rise in both species cover and species richness is noted from 2014 to 2018, in sites on the RoW. Species diversity also shows a trend of slight increase on the RoW, since initial sampling in 2014.

No active or recent forest fires were observed in the vicinity of TER sampling this season. Two distant fires were observed south of the Nelson River, when sampling the northern project components (August 1). Species of conservation concern observed in TER plots will be discussed in Section 4.6.

4.2.1.1 Cluster Analysis and Community Typing

A total of 173 plant species were observed in plots within sampling of the 26 terrestrial vegetation surveys. The tree stratum is absent in TER sites sampled on the RoW, although regenerating woody species were found as saplings in eight sites, and tree seedlings were found across almost every site (21 sites).

Hierarchical cluster analyses were performed for surveys on the RoW, based on vegetation composition present in sites on the RoW. Cluster analysis resulted in four community types, broadly divided into regenerating hardwood, or softwood groups, Table 4-2c, below.

Table 4-2c. Community types for terrestrial vegetation surveys on the RoW, 2018.		
Community Types	**Surveys**	**Species**
Mixed hardwood saplings/ Herb, Grass and Sedge Rich	7	106
Trembling Aspen saplings/ Grass and Sedge Poor	8	80
Black Spruce seedling- Labrador Tea – Cloudberry- Herb, Sedge Rich/ Mosses	5	78
Black Spruce seedling - Labrador Tea – Herb, Graminoid poor	6	24

The first community type is characterized by regenerating balsam poplar and trembling aspen saplings, and green alder in the tall shrub layer, with occasional paper birch or green ash. The well-developed ground vegetation layer is richly co-dominated by herbs and low shrubs, with a diversity of grasses/sedges and aspen seedlings, with occasional jack pine or black spruce seedlings. Litter cover is high, with a moderate cover of woody debris, and very little bare ground.

The second community group has similar species composition as the first group, although these sites generally have fewer species. Tall shrubs are primarily trembling aspen, and sites are grass/sedge poor. Inanimate ground cover is moderate and generally split between litter, woody debris and bare ground.

The third community type has no tall shrubs, with a moderately well-developed herb and low shrub layer dominated by herbs and gramminoids including Labrador tea, cloudberry, sedges, grasses and mosses. Regenerating seedlings include black spruce and occasional tamarack or hardwoods. There is a moderate cover of litter and surface water in sites, and very little bare ground.

In the fourth community type tall shrubs are absent, and the sparse poorly-developed herb and low shrub layer is dominated by Labrador tea and cloudberry, with regenerating black spruce seedlings. The cover of bare ground is high.

4.2.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project areas cleared previously, the effect predictions from Appendix III for terrestrial vegetation were accurate for the following:

- Loss of native forest vegetation
- Fragmentation of vegetation communities will occur
- Vegetation diversity will be temporarily reduced on the Project site

Mitigation measures identified in the Project Environmental Impact Statement (Manitoba Hydro 2011), the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011), and Annual Technical Reports (2015 and 2016) were initially assessed, after clearing. Table 4-2d identifies the mitigation measures assessed at each site. In 2018, no new TER sites were sampled. Observations recorded in the field from 2018 are provided below.

Table 4-2d. Mitigation measures assessed at sites monitored for terrestrial vegetation on the RoW.

Mitigation Measure
Carry out construction activities during winter months to minimize the effect on understory species.
Tree removal will be confined within the limits of the RoW, with the exception of danger trees located outside the RoW that can affect transmission lines.
Trees will be felled into the RoW and other project component sites so as not to damage existing vegetation along the RoW.
Grubbing will be minimized within the RoW to reduce root damage except at foundation sites.

From fieldwork conducted, it was determined that the recommended mitigation was implemented and effective for terrestrial vegetation which minimized the disturbance

from construction activities. In the absence of mitigation, site disturbance likely would have increased.

Construction activities appeared to be carried out mostly during winter months (or dry ground conditions) to minimize effects on understory species and reduce ground disturbance (e.g., rutting). Tree removal occurred in previous years, during project clearing activities. Grubbing occurred only at foundation sites.

In 2018, all towers were erected and conductor stringing was completed. At monitoring sites, rutting and soil disturbance from construction activities were infrequently observed during ground surveys. However, at plots N1-TER-300 and N2-TER-500 (Photograph 4-2a), construction activity from the previous winter season resulted in ground disturbance and reduced cover of vegetation. At other monitoring sites, construction activity appeared to be confined mostly to the centerline equipment path and tower foundations.

Photograph 4-2a. Ground disturbance on RoW at Plot N2-TER-500.

This season, several berry plants were observed again with abundant fruit in portions of the RoW, along Sections N1, N2 and N3. Sites where fruit of smooth wild strawberry (*Fragaria virginiana*) was noted included N1-TER-100, N1-TER-500, N2-TER-100 and N3-TER-300; trailing dewberry (*Rubus pubescens*) was observed at N2-TER-200 and N2-TER-300.

Windthrow or blowdown (uprooted trees) was commonly observed north of The Pas, along the Wuskwatim transmission line (Photograph 4-2b). Both forest edges of the Bipole RoW (east and west) had areas of windthrow. In some sections, the narrow buffer between the two RoW's no longer exists.

Photograph 4-2b. Windthrow observed along the RoW boundary.

During aerial inspection of the transmission RoW, vegetation regeneration of herbaceous plants and young shrubs was observed to be occurring throughout the RoW. Regeneration of trees south of the Burntwood River have saplings achieving heights of 2 to 3 m. Here, tree regeneration is occurring in areas adjacent to upland conifer and deciduous forests. Disturbances off the equipment path appeared to occur mainly in areas of increased construction activity, such as at snub sites. The equipment path showed areas of construction travel but rutting observed was often minor and occasional. Vegetation cover was generally less abundant at these locations.

On the AC collector lines/construction power line RoW, vegetation regeneration is occurring in many areas (Photograph 4-2c). Sphagnum moss is beginning to recover in moist places and increased ground cover of herbaceous material was observed on the RoW (i.e., greener appearance this season).

Photograph 4-2c. Vegetation regeneration along the collector lines.

Scraped areas are still present with minimal to no vegetation in some areas. This portion of the RoW appears to have drier site conditions this season. Areas of ground disturbance will be discussed under Recommendations, Section 5.0.

4.3 Environmentally Sensitive Wetlands

Seven environmentally sensitive sites were visited on July 14 to 16 to sample wetland (WET) vegetation in Sections N3 and N4, north and south of The Pas, respectively (Field Activity ID BPIII_CON_FA400) (Map 4-1, Appendix II). The sensitive sites are patterned fen wetlands, identified during the terrestrial ecosystems and vegetation assessment conducted for the Bipole III Transmission Project in 2010 and 2011. A search for incidental species of conservation concern was undertaken at all sites.

Patterned fen wetland sites on the RoW in Section N3 included N3-WET-100 (identified as N3-ECO-102 in the Construction Environmental Protection Plan), and N3-WET-200 and N3-WET-300 (both identified as N3-ECO-100). In Section N4, patterned fens included N4-WET-100 (identified as N4-ECO-103 in the Construction Environmental Protection Plan), N4-WET-200 (identified as N4-ECO-102), N4-WET-300 (identified as N4-ECO-101) and N4-WET-400 (identified as N4-ECO-100).

Of the seven sites surveyed, four are paired sites, while three remain unpaired (RoW only) due to minor disturbance to ground vegetation on the RoW and unsafe sampling conditions (floating vegetation), determined during original sampling of WET sites. In total, seven surveys were completed for the monitoring of environmentally sensitive patterned fen wetlands on the RoW. Species of conservation concern observed in WET sites will be discussed in Section 4.6.

4.3.1 Data Analysis of Environmentally Sensitive Wetlands

Seven surveys were conducted for environmentally sensitive wetlands on the RoW. Vegetation descriptions are provided for species cover, richness, diversity and evenness in Table 4-3a., mean values for all years on- and off-RoW are shown in Table 4-3b.

Table 4-3a. Environmentally sensitive wetland vegetation measures: on-RoW 2018, and off-RoW.

	Species Cover (%)		Species Richness		Diversity		Evenness	
Site	**RoW**	**off RoW**	**RoW**	**off RoW**	**RoW**	**off RoW**	**RoW**	**off RoW**
N4WET10	88.6	81.6	27	24	1.86	2.1	0.56	0.7
N4WET20	52.2	70.0	30	32	2.45	2.2	0.72	0.6
N4WET30	38.6	-	27	-	2.27	-	0.69	-
N4WET40	19.6	-	12	-	1.77	-	0.71	-
N3WET10	88.2	-	31	-	2.17	-	0.63	-
N3WET20	25.2	119.8	22	24	2.39	1.9	0.77	0.6
N3WET30	57.4	147.4	30	35	2.81	2.2	0.83	0.6
Mean	52.8	104.7	25.6	28.8	2.2	2.1	0.7	0.6

Table 4-3b. Environmentally sensitive wetland vegetation measures, mean site values 2014 to 2018.						
	On RoW					Off RoW
	2014	2015	2016	2017	2018	
Species Cover (%)	62.7	50.8	43.3	72.0	52.8	104.7
Species Richness	21	22.5	22.8	24.8	25.6	28.8
Diversity	1.9	2.0	2.2	2.1	2.2	2.1
Evenness	0.6	0.6	0.7	0.7	0.7	0.6
Number of Surveys	3	7	7	7	7	4

The number of paired surveys (four) is too small to reliably test for significant differences for environmentally sensitive wetland sites. However, since initial clearing there continues to be a trend of lower mean species cover and richness in sites on-RoW, when compared to off-Row sites. This may be due to the removal of sparse tree and shrub cover, and other low growing woody species on the RoW. On the RoW, the average species cover can be variable in any given year, possibly due to water levels. Despite lower richness values, the number of species on the RoW has tended to increase in successive years of sampling, while the diversity index and species evenness continue to have similar values across all years and between paired surveys on and off RoW.

4.3.1.1 Cluster Analysis and Community Typing

Patterned fen wetland community types were identified on the RoW based on regenerating vegetation cover and composition. A total of 65 plant species were observed in plots within sampling of the environmentally sensitive wetland surveys. Hierarchical cluster analyses were performed for the seven surveys on the RoW, resulting in the same two community types (Table 4-3c) unchanged from 2017. Though quite similar in species composition, the two communities have remained distinguished by moss cover and composition, vegetation structure (i.e., presence of low shrubs) and surface water present, since initial sampling.

Table 4-3c. Community types for environmentally sensitive wetland surveys on the RoW, 2018.		
Community Types	**Surveys**	**Species**
Bog Bean - Hairy-fruited Sedge / moderate Mosses /Surface water	4	49
Low shrub - Bog Bean - Hairy-fruited Sedge / abundant Sphagnum – Mosses	3	44

4.3.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project areas cleared previously (Sections N3 and N4), the effect predictions from Appendix III for environmentally sensitive wetland vegetation were accurate, and included the following:

- Environmentally sensitive sites may be affected

- Wetlands may be affected

Mitigation measures identified in the Construction Environmental Protection Plan for Section N3 and N4 (Manitoba Hydro 2014a) and supported by the Project Environmental Impact Statement (Manitoba Hydro 2011), the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011) and the Annual Technical Report (2015), were initially assessed (after clearing) at each wetland site visited along the RoW (Table 4-3d). In 2018, no new sites were sampled. Observations recorded in the field from 2018 are provided below.

Table 4-3d. Mitigation measures assessed at sites monitored for environmentally sensitive wetlands on the RoW.

Mitigation Measure
Use existing access roads and trails to the extent possible.
Provide 30 m vegetated (shrub, herbaceous) buffer around site.
Remove trees by low disturbance methods.
Confine vehicle traffic to established trails to extent possible.
Carry out construction activities on frozen/dry ground to minimize surface damage, rutting and erosion.
Install erosion protection/sediment control measures in accordance with Erosion/ Sediment control plan.

In 2018, all towers were erected and conductor stringing was completed in wetlands sampled. During ground surveys, the wetlands (Sections N3 and N4) showed relatively low disturbance from the recent construction activities. All trees have been previously removed and recent vehicle traffic appeared to utilize mainly existing trails under frozen ground conditions. In several areas, the equipment path showed evidence of travel, but natural revegetation will occur in these areas. Site N3-WET-100 is shown below with low wetland disturbance (Photograph 4-3a).

Photograph 4-3a. Site N3-WET-100 with low wetland disturbance.

Water levels in many areas of the RoW were observed to be higher than in previous years, possibly a result of increased winter snow melt or greater precipitation during the spring and early summer season. Several sampled wetlands were observed with high water levels (e.g., N3-WET-200 - 90%; N3-WET-300 - 100%; N4-WET-400 - 100%). High water levels were recorded in previous years in some wetlands sampled (e.g., N4-WET-400). Photograph 4-3b shows wetland N4-WET-400, with high water levels, where the equipment path deviated from the RoW centreline path. This was a result of avoiding the tower foundation and construction activities.

Photograph 4-3b. Wetland showing equipment path off centreline.

Wetland disturbance was also documented during aerial inspection of Sections N1, N2, N3 and N4. Except for initial clearing in 2014 where disturbance and tree removal were reported, wetland disturbance on the RoW was low overall in 2018 from construction activities. The equipment path and tower foundations showed evidence of recent construction activity and travel (Photograph 4-3c), but disturbance beyond these areas was generally low.

Few areas were observed along the RoW where notable disturbances or issues occurred beyond the equipment path and tower foundations. Near Towers 3190 and 3016, access roads were observed to be flooded, extending perpendicular from the RoW.

Minor disturbances were occasionally observed near transmission towers, beyond foundations (e.g., Towers 2014, 2015 and 3026). These areas had equipment impressions remain in the wetland of the RoW, with four lines of open water radiating out from the towers. It is anticipated that these sites will recover naturally, similar to the equipment paths within the RoW.

Photograph 4-3c. Patterned fen wetland with low disturbance.

4.4 Plants/Communities Important to Aboriginal People

Ten ATK sites in C1 were visited on July 5 to sample the vegetation on the RoW in the Cowan Blueberry Resource Area after clearing (Field Activity ID BPIII_CON_FA399) (Map 4-1, Appendix II). Vegetation composition, abundance and structure were recorded at all sites, while paired sites adjacent to the RoW were not re-sampled. A search for incidental species of conservation concern was undertaken at all sites. This season, local community members were not present for the surveys with the vegetation team.

Two species of blueberries (low sweet blueberry - *Vaccinium angustifolium,* and velvetleaf blueberry - *Vaccinium myrtilloides*) were observed at five sites on the RoW in 2018 (C1-ATK-300, 400, 500, 600 and 950). Blueberry plants have been recorded at sample sites since initial clearing with varying presence. In 2017, blueberry plants were recorded on the RoW at seven sites, five in 2016, two in 2015 and six in 2014 (Table 4-4a). Neither blueberry has yet been recorded in either of sites C1-ATK-100, -700, or -900.

Low sweet blueberry continues to be recorded in five sites, and is generally the more prominent blueberry species, with an average cover of 12.5%, ranging from 0.8 to 39.0% in sites. Total average cover in 2018 exceeded baseline cover from 2014, in both on-site (11.3%) and off RoW (11.6%) samples. In 2018, low sweet blueberry was observed in the same sites as the previous year, although cover appears to be variable. Plant cover remained unchanged at one site (C1-ATK-300), increased in one site (C1-ATK-500) and decreased in three plots (C1-ATK-400, 600 and 950). No new occurrences of low sweet blueberries were found.

Table 4-4a. Resource Area species cover (%) for two blueberry species.												
Site	Low Sweet Blueberry *V. angustifolium* Average Cover (%)						Velvetleaf Blueberry *V. myrtilloides* Average Cover (%)					
	RoW					off RoW	RoW					off RoW
	2014	2015	2016	2017	2018		2014	2015	2016	2017	2018	
C1-ATK-20	0.4	-	-	-	-	16.6	-	-	-	0.2	-	8.8
C1-ATK-30	-	0.4	3.0	3.0	3.0	5.6	5.0	0.6	2.0	4.6	3.6	-
C1-ATK-40	32.4	NS	43.0	66.0	39.0	35.4	8.0	NS	1.2	-	-	-
C1-ATK-50	11.8	NS	1.0	3.4	18.0	8.0	-	NS	0.2	-	0.4	1.2
C1-ATK-60	4.6	-	-	2.8	0.8	1.6	0.4	2.0	8.6	3.2	5.6	11.4
C1-ATK-80	-	-	-	-	-	-	-	-	-	0.2	-	-
C1-ATK-95	7.2	-	1.4	2.8	1.6	2.6	-	-	3.2	2.0	-	1.8
Mean	11.3	0.4	12.1	15.6	12.5	11.6	4.5	1.3	3.0	2.0	3.2	5.8

Note: NS = no sampling due to clearing activities (2015).

Velvetleaf blueberry was observed in three sites in 2018, with an average cover of 3.2% among sites, ranging from 0.4 to 5.6%. Species cover of velvetleaf blueberry was variable across sites, as in previous years. Increased cover was seen in two sites (C1-ATK-500, 600), slight decreased cover was seen in one site (C1-ATK-300), and no cover was found in four sites where velvetleaf blueberry cover was recorded in previous years. The total average cover of velvetleaf blueberry in 2018 has higher cover (3.2%) when compared to previous years sampling, except for 2014 values (baseline), where on-site was 4.5% and off RoW was 5.8%. Photograph 4-4a shows blueberry plants in the Cowan Blueberry Resource Area.

Total blueberry cover for sites supporting blueberries (both low sweet blueberry and velvetleaf blueberry) on the RoW (2018) averaged 14.4%, an increase since initial RoW pre-clearing surveys in 2014 (11.6%).

Photograph 4-4a. Blueberry plants in the Cowan Resource Area.

Other berry plants recorded in plots of the Resource Area in order of greatest cover include smooth wild strawberry (*Fragaria virginiana*), trailing dewberry (*Rubus pubescens*), raspberry (*Rubus idaeus*), Saskatoon (*Amelanchier alnifolia*), pin cherry (*Prunus pensylvanica*), and chokecherry (*Prunus virginiana*).

Surrounding vegetation in the Resource Area includes stands of jack pine (*Pinus banksiana*) and deciduous forest (e.g., *Populus tremuloides, P. balsamifera*). The RoW is very sandy with exposed soils in some areas. Originally sparsely treed with conifers, areas of open grassland remain with some vegetation characteristic of native prairie. Species of conservation concern observed are discussed in Section 4.6.

4.4.1 Data Analysis of the Cowan Blueberry Resource Area

Ten surveys were conducted in the Cowan Blueberry Resource Area. Resulting vegetation descriptions are provided for species cover, richness, species diversity and evenness in Table 4-4b. Mean values of all vegetation measures for all years of sampling on and off-RoW are shown in Table 4-4c.

Table 4-4b. Blueberry resource area vegetation measures: on-RoW 2018, and off-RoW.

	Species Cover (%)		Species Richness		Diversity		Evenness	
Site	**RoW[1]**	**off RoW**	**RoW[2]**	**off RoW**	**RoW[3]**	**off RoW**	**RoW[4]**	**off RoW**
C1ATK10	27.2	39.2	28	19	2.77	2.22	0.83	0.76
C1ATK20	78	99.8	43	26	2.50	2.26	0.67	0.69
C1ATK30	32.6	75.6	15	19	1.81	1.81	0.67	0.62
C1ATK40	73	116.6	22	17	1.82	1.79	0.59	0.63
C1ATK50	68.2	59.4	28	33	2.39	2.68	0.72	0.77
C1ATK60	72.8	151.8	23	23	2.58	2.0	0.82	0.64
C1ATK70	47	69	28	27	2.24	2.5	0.67	0.76
C1ATK80	53	65.8	39	24	2.75	2.3	0.75	0.72
C1ATK90	36.6	53.4	27	29	2.78	2.72	0.84	0.81
C1ATK95	108.2	132.8	29	36	2.76	2.56	0.82	0.71
Mean	**59.7**	**86.3**	**28.2**	**25.3**	**2.44**	**2.28**	**0.74**	**0.71**

[1] Total species cover (%) on (2018) and off RoW is significantly different, p=0.004.
[2] No significant differences in species richness on (2018) and off RoW, p=0.441.
[3] No significant differences in diversity index on (2018) and off RoW, p=0.193.
[4] No significant differences in species evenness on (2018) and off RoW, p=0.386.

Table 4-4c. Blueberry resource area vegetation measures, mean site values, 2014 to 2018.

	On RoW					Off RoW
	2014	**2015**	**2016**	**2017**	**2018**	
Species Cover (%)	89.3	21.1	34.3	50.3	59.7	86.3
Species Richness	23.6	22.0	22.9	26.6	28.2	25.3
Diversity	2.15	2.61	2.43	2.55	2.44	2.28
Evenness	0.69	0.85	0.78	0.78	0.74	0.71
Number of Surveys	10	8	10	10	10	10

Results of a paired-sample Wilcoxon test for ATK vegetation surveys on (2018) and off the RoW show continued significantly lower values for total species cover (p=0.004) on the RoW. Also consistent with previous years, no other significant differences were detected in species richness (p=0.441), diversity (p=0.193) nor evenness (p=0.386), between paired surveys on (2018) and off the RoW.

4.4.1.1 Cluster Analysis and Community Typing

A total of 114 plant species were recorded across 10 surveys within the Blueberry Resource Area in 2018. The tree stratum was generally absent in all ATK sites on the RoW (but for the presence of aspen and jack pine in C1-ATK-400). However, most sites had regenerating woody species, most commonly found as tall shrub seedlings (nine sites) and tree seedlings (seven sites). Saplings of both tall shrub and tree species were present in six sites.

Cluster analysis of 10 surveys on the RoW resulted in three community type groupings, based on the vegetation composition and structure regenerating at each site, see Table 4-4d. The first community type is made up of sites with a moderate herbaceous cover dominated by little blue stem and other native prairie grasses, with low herbs and shrubs. There are no tall shrubs or tree saplings present. Cover of bare ground and woody debris are low, while litter cover is high.

Table 4-4d. Community types for blueberry resource area surveys on the RoW, 2018.

2018	Surveys	Species
Bearberry – Little Blue Stem Grassland/ Reindeer lichen	4	56
Alder - Aspen Tall Shrub/ Low Sweet Blueberry	4	54
Alder - Willow –Aspen saplings/ Strawberry –dewberry –aspen seedling –marsh reed grass–rose	2	55

The second type is characterized by a moderate cover of regenerating trembling aspen saplings and green alder. This group has a well-developed herb and low shrub layer, with woody and herbaceous species co-dominating. Low sweet blueberry occurs as one of the frequent or dominant species. Bare ground cover is very low, woody debris and litter cover are high.

The third community type is characterized by regenerating trembling aspen saplings and seedlings, green alder and Bebb's willow. This group has a well-developed herb and low shrub layer with herbaceous species dominating, both open and shade tolerant grasses are present. Bare ground cover is very low, woody debris has moderate cover, while litter cover is high.

4.4.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project areas cleared previously, the effect predictions from Appendix III for the environmentally sensitive blueberry resource area were accurate for the following:

- Environmentally sensitive sites may be affected
- Potential loss of habitat and plants used by Aboriginal people as identified through the ATK process
- Loss of native forest vegetation

Mitigation measures identified in the Construction Environmental Protection Plan for Section C1 (Manitoba Hydro 2014a) and supported by the Project Environmental Impact Statement (Manitoba Hydro 2011), the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011), and Annual Technical Reports (2015 and 2016) were initially assessed (after clearing) at each site visited along the RoW (Table 4-4e). In 2018, no new ATK sites were sampled. Observations recorded in the field from 2018 are provided below.

Table 4-4e. Mitigation measures assessed at sites monitored for ATK vegetation on the RoW.

Mitigation Measure
Carry out construction activities on frozen or dry ground to minimize surface damage, rutting and erosion.
Minimize surface disturbance around the site to the extent possible.
Remove trees by low disturbance methods.
No herbicide to be applied during construction.
Confine vehicle traffic to established trails to extent possible.

Through fieldwork, it was determined that the recommended mitigation was implemented and effective for ATK vegetation (Resource Area) which minimized the disturbance from construction activities. Construction activities appeared to occur on frozen or dry ground conditions to minimize surface damage, rutting and erosion. Existing roads and trails appeared to be used, and traffic was mainly confined to the equipment path. Tree clearing occurred in previous years. In the absence of mitigation, surface disturbance (i.e., rutting, exposed soils) likely would have increased. This season, tower erection and stringing of conductors were completed.

Low ground disturbance from construction activities was observed in the Cowan Resource Area, except at foundation sites where soils were generally exposed. Vegetation cover along the equipment path was noted as sparse in areas from equipment travel. In a localized area, near monitoring plots C1-ATK-300 and C1-ATK-400, exposed sandy soils were again observed along the equipment path (Photograph 4-4b). Exposed soils were previously observed at this site, and false heather (*Hudsonia tomentosa*, S3) was recorded in this sensitive area. Vegetation in these habitats is easily disturbed from heavy equipment travel and construction activities. Similar sandy areas adjacent to the

equipment path support typical jack pine (*Pinus banksiana*) upland vegetation with an understory of common bearberry (*Arctostaphylos uva-ursi*), Canada May flower (*Maianthemum canadense*) and various lichens. It is anticipated that this area will naturally revegetate and colonize with native species of shrubs, herbs and non-vascular plants.

Photograph 4-4b. Exposed sandy soils along the equipment path.

In other parts of the RoW, open areas supported dominantly native grasses and forbs. Little regeneration was observed at some sites where ground cover was mostly litter (e.g., C1-ATK-100, C1-ATK-700). Elsewhere, tall shrub cover (>1m height) is dominating the RoW with species of trembling aspen (*Populus tremuloides*) and green alder (*Alnus viridis*). Bebb's willow (*Salix bebbiana*), pin cherry (*Prunus pensylvanica*) and Saskatoon (*Amelanchier alnifolia*) were also observed as tall shrubs on the RoW. Photograph 4-4c shows the regeneration of tall shrub vegetation on the RoW.

Photograph 4-4c. Regeneration of tall shrub vegetation.

No problem areas were identified for invasive and non-native species in plots, but common dandelion (*Taraxacum officinale*) was recorded at two sites (C1-ATK-100, C1-ATK-200) and narrow-leaved hawks-beard (*Crepis tectorum*) at one site (C1-ATK-700). It is assumed that construction equipment was cleaned and inspected prior to tower erecting and conductor stringing. An aerial assessment of the Resource Area was completed and vegetation appears to be regenerating with low disturbance identified.

Future vegetation management activities in the Cowan Resource Area should use low disturbance methods, and be confined to the equipment path, where possible. Productive blueberry habitat and other berry plant growth was observed in 2018. Several species of conservation concern are also present in this area.

4.5 Invasive and Non-Native Species

Forty sites were visited to sample invasive and non-native (INV) vegetation from July 4 to August 2 (Field Activity ID BPIII_CON_FA399, 400 and 401) (Map 4-1, Appendix II). A total of 80 surveys were completed: 40 on-RoW samples, paired with 40 belt-transect surveys off-RoW to scan for invasive species. Six sites are located in each Section N1 and N3, eight sites in N2, five in each of N4, C1, C2, and five additional sites are located along the northern AC collector lines (CL sites) and construction power line (CP sites). Sites surveyed included roads (e.g., provincial, forestry and access), rail lines and creek and river crossing that intersected the RoW.

Thirty-four additional roadside sites were visited along the RoW from July 21 to 24, to record information on invasive and non-native species (Field Activity ID BPIII_CON_FA402 and 403). Of these, 22 were new roadside sites surveyed in Section S1 and 12 roadside sites were revisited in Section S2 (Map 4-1, Appendix II). Roadside surveys were conducted by vehicle mainly in agricultural areas; species composition was recorded and problem areas were noted (e.g., presence of invasives around towers visible from the roadside).

4.5.1 Data Analysis of Invasive and Non-Native Vegetation

Forty quantitative surveys were conducted for invasive and non-native vegetation on the RoW. As with last year, the results of a paired-sample Wilcoxon test show significantly lower values for total vegetation cover ($p<0.001$), yet with similar species richness among surveys on the RoW (2018) when compared to those sampled pre-construction off-RoW. Diversity ($p=0.001$) and evenness ($p<0.001$) remain significantly higher on the RoW again in 2018, compared to surveys off the RoW.

Vegetation descriptions for paired on- and off- RoW surveys are shown below for total species cover, species richness, species diversity and evenness in Table 4-5a. Mean values for all years on- and off-RoW are found in Table 4-5b.

Table 4-5a. Invasive and non-native vegetation measures: on-RoW 2018, and off-RoW.

	Species Cover (%)		Species Richness		Diversity		Evenness	
Site	**RoW[1]**	**off RoW**	**RoW[2]**	**off RoW**	**RoW[3]**	**off RoW**	**RoW[4]**	**off RoW**
N4INV10	66.0	112.4	38	37	2.93	1.8	0.80	0.5
N4INV20	72.4	146.4	30	22	2.19	1.9	0.64	0.6
N4INV30	66.6	126.0	23	15	1.98	1.7	0.63	0.6
N4INV40	90.8	104.0	35	22	2.49	2.1	0.70	0.7
N4INV50	96.6	119.4	25	28	2.54	2.4	0.79	0.7
N3INV10	69.2	135.8	29	27	2.71	1.9	0.81	0.6
N3INV20	69.6	87.4	35	39	2.66	3.0	0.75	0.8
N3INV30	71.0	112.0	39	34	3.17	2.6	0.87	0.7
N3INV40	32.6	85.2	43	39	3.17	2.5	0.84	0.7
N3INV50	148.4	104.8	44	8	2.75	1.2	0.73	0.6
N3INV60	72.6	153.0	39	24	2.96	1.5	0.81	0.5
N2INV10	21.2	84.8	16	33	2.00	2.7	0.72	0.8
N2INV20	107.2	115.8	32	42	2.70	2.7	0.78	0.7
N2INV30	105.8	94.4	36	28	2.87	2.1	0.80	0.6
N2INV40	9.6	152.6	9	16	1.42	1.3	0.65	0.5
N2INV50	20.4	130.0	18	25	2.35	1.6	0.81	0.5
N2INV60	53.4	99.2	27	22	2.64	1.7	0.80	0.6
N2INV70	64.2	135.4	26	31	2.18	2.1	0.67	0.6
N2INV80	22.8	129.0	20	43	2.44	2.6	0.82	0.7
N1INV10	42.8	136.0	19	24	2.10	2.0	0.71	0.6
N1INV20	84.4	48.6	30	21	2.53	2.3	0.74	0.8
N1INV30	50.0	107.4	34	24	2.94	2.1	0.83	0.7
N1INV40	52.0	41.8	15	15	1.83	2.1	0.67	0.8
N1INV50	38.2	67.8	27	28	2.61	2.7	0.79	0.8
N1INV60	22.4	144.2	16	33	2.11	2.6	0.76	0.7
CLINV10	59.6	130.6	27	31	1.99	1.6	0.60	0.5
CLINV20	38.8	104.0	33	44	2.87	2.6	0.82	0.7
CLINV30	5.2	131.0	10	24	2.02	1.7	0.88	0.5
CPINV10	78.8	108.4	39	43	2.71	2.8	0.74	0.7
CPINV20	80.8	120.2	26	28	2.46	2.1	0.76	0.6
C2INV10	64.4	100.4	41	42	2.97	2.4	0.80	0.7
C2INV20	65.0	60.4	53	50	2.91	3.2	0.73	0.8
C2INV30	72.4	149.8	46	40	2.87	2.5	0.75	0.7
C2INV40	35.4	87.4	26	30	2.33	2.5	0.71	0.7
C2INV50	94.0	69.0	40	43	2.73	2.8	0.74	0.7
C1INV10	126.8	183.8	45	26	2.67	1.8	0.70	0.6
C1INV20	96.4	155.8	31	39	2.53	2.6	0.74	0.7
C1INV30	75.2	157.0	39	47	3.04	2.5	0.83	0.7
C1INV40	94.4	112.4	45	51	3.31	3.1	0.87	0.8
C1INV50	70.0	132.6	34	47	2.73	3.2	0.77	0.8
Mean	**65.2**	**114.4**	**31.0**	**31.6**	**2.56**	**2.3**	**0.76**	**0.67**

[1] Total species cover (%) on (2018) and off RoW is significantly different, $p<0.001$.

[2] No significant difference for species richness on (2018) and off RoW, $p=0.516$.

[3] The diversity value on (2018) and off the RoW is significantly different, $p=0.001$.

[4] Species evenness on (2018) and off RoW is significantly different, $p<0.001$.

Table 4-5b. Invasive and non-native vegetation measures, mean site values 2014-18.						
	On RoW					Off
	2014	2015	2016	2017	2018	RoW
Species Cover (%)	20.3	27.1	41.1	53.7	65.2	114.4
Species Richness	16.4	22.2	25.7	29.7	31.0	31.6
Diversity	2.2	2.4	2.4	2.5	2.6	2.3
Evenness	0.84	0.81	0.75	0.76	0.76	0.67
Number of Surveys	17	38	40	40	40	40

The cumulative cover of vegetation in INV sites in 2018 has increased significantly to 65.2% over last year's values (p=0.008) and shown steady increases since initial sampling in 2014. The number of species recorded in each site on the RoW has also increased consistently since initial clearing and is now comparable to the richness originally recorded off-RoW. However, some of this increase is attributable to an increase in noxious/invasive/ non-native species. Baseline vegetation sampling in each off-RoW site was collected once in either 2014, 2015 or 2016. During that time, quantitative cover values were collected in 40 off-RoW INV sites for 12 noxious/invasive/non-native species. In 2018, quantitative cover values were collected in 40 on-RoW INV sites for 30 noxious/invasive/non-native species.

While species richness has previously increased in INV sites on-RoW over successive years, in 2018 there was no significant rise in number of species between the current year, the previous year or off-RoW. Again, no associated statistical difference was detected between years on-RoW for species diversity or evenness.

Noxious, Invasive, Non-invasive SNA species throughout the RoW

Sixty-five noxious, invasive or non-native species were recorded across all vegetation surveys (Field Activity ID BPIII_CON_FA399, 400, 401, 402, 403, and 416). The noxious, invasive and non-native species recorded include nineteen families; most prominently represented are species from Asteraceae (18), Poaceae (14) and Fabaceae (10).

All noxious, invasive and non-native species encountered throughout all surveys (ATK, INV, PRA, SCC, TER, S1 and S2 roadside-INV, RHB sites) and incidental observations are shown in Table 4-5c. No noxious, invasive or non-native species have yet been found in WET sites in any year of sampling. Additions to this year's list of invasive and non-native species (up from 50 in 2017) were due in part due to increased roadside sampling in S1 (R-INV), as well as in rehabilitation areas (RHB), sites that tend to have a presence or abundance of invasive species.

Table 4-5c. Observations of noxious, invasive and non-native species found in all surveys, project-wide, 2018.

Species	Rank	Noxious Weed	Invasive Status	ATK	INV	PRA	TER	SCC	R-INV	RHB
Agropyron cristatum	SNA		CFIA							1
Agrostis stolonifera	SNA				4					
Amaranthus blitoides	SNA				1				9	
Amaranthus retroflexus	SNA		CFIA		2			2	20	5
Ambrosia artemisiifolia	S5	Tier 3			1				14	1
Ambrosia trifida	S4	Tier 3							2	1
Arctium lappa	SNA	Tier 3								1
Arcticum minus	SNA	Tier 3	ISCM					1		
Artemisia absinthium	SNA	Tier 3	CFIA					1	2	
Asclepias speciosa	S3S5*	Tier 3						3	14	1
Avena sativa	SNA								1	
Bassia scoparia	SNA								6	
Brassica napus	SNA								10	2
Brassica rapa	SNA								5	
Bromus inermis	SNA		CFIA		6			4	34	4
Chenopodium album	SNA	Tier 3	CFIA		5		2	7	22	21
Chenopodium strictum	SNA									6
Cirsium arvense	SNA	Tier 3	CFIA, ISCM		8		2	7	21	7
Cirsium vulgare	SNA	Tier 3	ISCM						2	1
Crepis tectorum	SNA	Tier 3	CFIA	1	2					
Cyclachaena xanthiifolia	SNA	Tier 3						3		
Descurainia sophia	SNA	Tier 3	CFIA						1	3
Digitaria ischaemum	SNA		CFIA					1		
Echinochloa crus-galli	SNA							1	13	1
Elymus repens	SNA		CFIA		5		1		11	3
Erigeron canadensis	S5	Tier 3						3	6	
Euphorbia esula	SNA	Tier 3	CFIA			1		5	4	
Fallopia convolvulus	SNA		CFIA		1					
Galeopsis tetrahit	SNA	Tier 3			1					
Galium aparine	S3*	Tier 3	CIA						3	
Glycine max	SNA							1		
Hordeum jubatum	S5	Tier 3			6				13	8
Lappula squarrosa	SNA		CFIA							1
Leucanthemum vulgare	SNA	Tier 2	CFIA, ISCM		1				1	4
Linaria vulgaris	SNA	Tier 3			1					1
Lotus corniculatus	SNA		CFIA		1				1	2
Matricaria discoidea	SNA				1				3	1
Medicago lupulina	SNA				4			4	4	2
Medicago sativa	SNA		CFIA		1			3	11	4
Melilotus albus	SNA		CFIA		15			4	26	53
Melilotus officinalis	SNA		CFIA		3				17	7

Melilotus spp.	SNA				3			3	3	
Pastinaca sativa	SNA	Tier 3	CFIA						3	
Phacelia campanularia	SNA									2
Phalaris arundinacea	S5		CFIA		2	1	1		3	1
Phleum pratense	SNA				5				1	2
Plantago major	SNA				8		1		5	8
Poa annua	SNA									1
Polygonum aviculare	SU							3	22	
Portulaca oleracea	SNA							1	1	
Ranunculus acris	SNA		CFIA, ISCM		1					6
Rumex crispus	SNA				1				8	2
Senecio vulgaris	SNA									2
Setaria pumila	SNA							3	19	
Setaria viridis	SNA		CFIA					3	14	1
Silene vulgaris	SNA	Tier 2	CFIA						4	
Sonchus arvensis	SNA	Tier 3	CFIA		20		4	4	21	28
Tanacetum vulgare	SNA	Tier 2	ISCM					1		
Taraxacum officinale	SNA	Tier 3		2	21		2	1	13	10
Thlaspi arvense	SNA	Tier 3	CFIA						4	2
Tragopogon dubius	SNA								2	
Trifolium hybridum	SNA				1				5	
Trifolium repens	SNA				4				1	5
Tripleurospermum inodorum	SNA	Tier 2	ISCM							1
Vicia cracca	SNA		ISCM		4		1		1	2
Zea mays	SNA							1		

2018	ATK	INV	PRA	TER	SCC	R-INV	RHB
Noxious species only	2	10	1	4	11	18	15
Total Species: Noxious, invasive and non-native	2	29	2	8	24	44	39
Total Observations: Noxious, invasive, non-native	3	139	2	14	70	406	214

Twenty-six species are listed in the Manitoba Noxious Weed Act (2017) as noxious weeds harmful to livestock or agricultural crops, primarily Tier 3, but for four Tier 2 species: ox-eye daisy (*Leucanthemum vulgare*), bladder campion (*Silene vulgaris*); common tansy (*Tanacetum vulgare*); and scentless false mayweed (*Tripleurospermum inodorum*). Noxious weeds may include species that are invasive, non-invasive, or native species. For example, some native species (e.g. milkweeds) may be harmful to livestock if ingested. Milkweed, one of six native species listed as noxious across 2018 sites, is also an ecologically important food plant of the monarch butterfly larvae, listed federally as Special Concern (SARA) and as Endangered (COSEWIC). Furthermore, the Tier 3 showy milkweed (*Asclepias speciosa*) is also tracked as a species of conservation concern, ranked S3S5.

Tier 3 Noxious species include: common ragweed (*Ambrosia artemisiifolia*), giant ragweed (*Ambrosia trifida*), great burdock (*Arctium lappa*), lesser burdock (*Arcticum minus*), wormwood (*Artemisia absinthium*), showy milkweed (*Asclepias speciosa,* S3S5), lamb's-quarters (*Chenopodium album*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), narrow-leaved hawks-beard (*Crepis tectorum*), marsh-elder (*Cyclachaena xanthiifolia*), flixweed (*Descurainia sophia*), Canada horse-weed (*Erigeron canadensis*), leafy spurge (*Euphorbia esula*), common hemp-nettle (*Galeopsis tetrahit*), cleavers (*Galium aparine,* S3), wild barley (*Hordeum jubatum*), yellow toadflax (*Linaria vulgaris*), wild parsnip (*Pastinaca sativa*), field sow-thistle (*Sonchus arvensis*), common dandelion (*Taraxacum officinale*), field pennycress (*Thlaspi arvense*) (Manitoba Noxious Weed Act 2017).

Thirty-one species are considered invasive due to their tendency to outcompete native species and dominate habitats once introduced (Canadian Food Inspection Agency 2008; Invasive Species Council of Manitoba 2018). Half of these are listed above as noxious, the remaining fifteen invasive species are: crested wheat-grass (*Agropyron cristatum*); redroot pigweed (*Amaranthus retroflexus*)*;* smooth brome *(Bromus inermis)*; smooth crab-grass (*Digitaria ischaemum*); quackgrass *(Elymus repens)*; black bindweed *(Fallopia convolvulus)*; bristly stickseed *(Lappula squarrosa)*; bird's-foot trefoil *(Lotus corniculatus)*; alfalfa *(Medicago sativa)*; sweet clovers (*Melilotus albus, M. officinalis*); reed canarygrass *(Phalaris arundinacea)*; common buttercup *(Ranunculus acris)*; green foxtail *(Setaria viridis)*; and tufted vetch *(Vicia cracca*).

An additional 24 species are considered non-native (SNA), though non-invasive in Manitoba: creeping bent grass *(Agrostis stolonifera)*, prostrate pigweed (*Amaranthus blitoides*), oats *(Avena sativa)*, summer cypress (*Bassia scoparia*), turnip *(Brassica napus)*, bird's rape *(Brassica rapa)*, strict goosefoot *(Chenopodium strictum)*, barnyard grass *(Echinochloa crus-galli)*, soybean (*Glycine max*), pineapple weed *(Matricaria discoidea)*, black medick *(Medicago lupulina)*, scorpionweed (*Phacelia campanularia*), common timothy *(Phleum pratense)*, common plantain *(Plantago major)*, annual bluegrass (*Poa annua*), prostrate knotweed (*Polygonum aviculare*), common purslane (*Portulaca oleracea*), curled dock *(Rumex crispus)*, common groundsel (*Senecio vulgaris*), yellow foxtail *(Setaria pumila)*, goat's-beard *(Tragopogon dubius)*, clovers *(Trifolium hybridum* and *T. repens)*, and corn (*Zea mays*), (Manitoba Conservation Data Center 2017; Scoggan 1957). While not all non-native species are necessarily aggressively invasive in their growth habits, by occupying a place in the plant community, they can effectively reduce or exclude native species in their environments.

Project-wide, the most commonly observed non-native species were sweet clovers (*Melilotus* spp., 134 records) field sow-thistle (*Sonchus arvensis*, 77 records), lamb's-quarters (*Chenopodium album*, 57 records), common dandelion (*Taraxacum officinale*, 49

records), smooth brome (*Bromus inermis*, 48 records) and Canada thistle (*Cirsium arvense*, 45 records). The greatest frequency of observation records and species was found in the roadside surveys (R-INV) in S1 and S2 (406 observations of 44 species) followed by the rehabilitation surveys, and INV surveys. These sites were identified as areas susceptible to increased spread of invasive and non-native species, due to each site's location, sensitivity, and proximity to existing patches. The remainder of surveys (ATK, PRA, TER, SCC) had far more modest records of non-native species occurrences at sites. As with previous years, there is a notable absence of noxious, invasive and non-native species from environmentally sensitive wetlands (WET), see Table 4-5c.

Re-visiting sites provides an opportunity to compare abundance and frequency of invasive and non-native species on the RoW over time. Cover values were collected for invasive species in nearly half of all quantitative sites on -RoW project wide (40 sites). Where species have repeat observations, there are variable trends. An extreme example was the explosion of cover values for invasive sweet clovers (*Melilotus* spp.) in certain sites, after clearing. For example, in N3-INV-100 sweet clover cover was recorded pre-construction (2%), increased in 2015 (62%) and again in 2016 (73%). In 2017, cover values were much reduced to 3%, a similar value as pre-construction, and in 2018 sweet clover cover in this site increased to 9%. Most sites this year also had low distribution of sweet clovers. The highest sweet clover cover values (13%) were found in N4-INV-100 and C1-INV-400. However, in both sites this cover is generally due to the presence of sweet clover seedlings. It is apparent that the composition and domination of invasive species can be highly changeable from season to season.

Project-wide, mean cover values for all noxious/invasive/non-native species remain low, 2.3%. Cover values higher than 10% remain uncommon, occurring in 11 INV sites, and for seven species: common dandelion (*Taraxacum officinale*), field sow-thistle (*Sonchus arvensis*), common hemp-nettle (*Galeopsis tetrahit*), sweet clovers (*Melilotus* spp.), smooth brome (*Bromus inermis),* creeping bent grass (*Agrostis stolonifera*), and black medick (*Medicago lupulina*). Aside from common hemp-nettle, which was extremely abundant in one quadrat of a single site, the high cover plants also generally occur on the RoW with elevated frequency.

The following tables show mean cover values for noxious weeds (Table 4-5d), invasive (Table 4-5e) and non-native (Table 4-5f) species recorded in 2018, and their occurrence on the RoW in previous years where recorded. Incidentally occurring species are marked (i). In the 11 instances where cover exceeds 10%, most values represent cover increases, except for two cases of field sow-thistle which decreased from 2017 values (marked + or –).

Table 4-5d. Mean cover (%) of Tier 2 and 3 noxious species 2018, and their occurrence in sites on the RoW, 2014 to 2018.

Site	*Taraxacum officinale*	*Sonchus arvensis*[1]	*Cirsium arvense*[1]	*Chenopodium album*[1]	*Hordeum jubatum*[2]	*Crepis tectorum*[1]	*Ambrosia artemisiifolia*	*Euphorbia esula*[1]	*Galeopsis tetrahit*	*Leucanthemum vulgare*[1]
CPINV100	0.4									
N1INV300	4.0				0.6					
N1TER200	0.2			0.2						
N2INV100	0.8			5.8	1.2					
N2INV400	0.2	0.2		0.2						
N2INV500	0.8	0.2			1.4					
N2INV600		2.4			0.2					
N2INV700	0.2									
N3INV100		11.6-		5.6	3.4	0.2	1.6			
N3INV300		0.6	0.2							
N3INV400		0.8			0.2					0.8
N3INV500	0.2	12.4+	4.0							
N3INV600	0.2									
N3TER100		1.6								
N4INV100	1.6	6.2				0.6				
N4INV200		0.2								
N4INV300		2.0		0.4						
N4INV400	0.4									
N4INV500	0.4	13.8+	0.8	2.2					13.4+	
N4TER300		7.2	1.4	1.4						
N4TER400	0.6	1.0	0.8							
N4TER500		2.0								
C1ATK100	0.2									
C1ATK200	0.2									
C1ATK700						0.2				
C1INV100	0.4	0.4								
C1INV200	0.2	2.2	6.4							
C1INV300	0.4									
C1INV400	0.8	2.2	4.6							
C1INV500	2.2	10.2-	0.4							
C2INV100	0.2									
C2INV200	0.2	1.8								
C2INV300	0.8	0.2	0.2							
C2INV400	0.2	0.2	0.2							
C2INV500	11.0+	0.2								

S1PRA900								2.6		
Occurs on RoW 2018	25	23	10	7	6	3	1	1	1	1
2017	22	18	12	10	3			1		
2016	18	14	7	12				1		
2015	16	10	7	4				1		
2014	6	3	2							

[1] Also considered invasive species (CFIA 2008; ISCM 2018); [2] Ranked as native species (MB CDC 2017)

Notes: Two Tier 3 species recorded on the RoW in 2017 only were not observed with cover in 2018: *Artemisia absinthium* and *Cicuta maculata*.

Table 4-5e. Mean cover (%) of other invasive species 2018, and their occurrence in sites on the RoW, 2014 to 2018.

Site	*Melilotus spp*[1]	*Bromus inermis*	*Elymus repens*	*Vicia cracca*	*Phalaris arundinacea*	*Amaranthus retroflexus*	*Fallopia convolvulus*	*Medicago sativa*	*Ranunculus acris*
N1INV300		0.6		0.6					
N1INV500				0.2					
N1TER300	0.4								
N2INV100	i					0.2			
N2INV300	i					0.2			
N2INV400	1.2			0.2					
N2INV500				1.6					
N2INV600	9.2		4.4						1.2
N2INV800	2.0			0.6					
N3INV100	13.0+	i			0.6				
N3INV400			6.0						
N4INV100	9.2	22.4+	2.0				0.2		
N4INV300			0.2		0.2				
N4INV500		2.0	0.2		0.2				
N4TER500		1.8							
C1INV200	13.2+	1.6							
C1INV300	7.4								
C1INV400	0.2								
C1INV500	0.6								
C2INV100	0.4		0.2						
C2INV200	1.4							0.6	
C2INV300					0.8				
C2INV500		0.6		0.6					

S1PRA900				0.2					
Occurs on RoW 2018	16	6	6	5	4	2	1	1	1
2017	16	7	2	2	1		1	2	1
2016	10	7		1			3		
2015	6	2						2	
2014	1	3		2					

[1] *Melilotus albus*, the dominant sweet clover is merged with *M. officinale* and vegetative samples of *Melilotus* spp. for display.

Notes: Two invasive species recorded on the RoW in 2017 only were not observed with cover in 2018: *Setaria viridis* and *Trifolium pratense*.

Table 4-5f. Mean cover (%) of non-native, non-invasive species 2018, and their occurrence in sites on RoW, 2015 to 2018.

Site	*Plantago major*	*Phleum pratense*	*Trifolium* spp.[1]	*Medicago lupulina*	*Agrostis stolonifera*	*Matricaria discoidea*	*Amaranthus blitoides*	*Rumex crispus*
N1INV400					0.2			
N1INV500	0.2				0.8			
N2INV100						0.2	0.2	
N2INV500		1.2	6.4					
N3INV100	0.6			0.6				
N3INV300	0.4							
N3INV400	7.0							
N4INV100	2.6							
N4INV300	0.2							0.6
N4TER500	0.2							
C1INV200					1.0			
C1INV500	0.8	0.8	0.2		12.2+			
C2INV200	0.2	0.6	0.2	0.2				
C2INV300		0.8		0.2				
C2INV500		0.4	1.8	20.2+				
Occurs on RoW 2018	9	5	5	4	4	1	1	1
2017	6	5	5	5	1	4		
2016	3	4	7					
2015	1	1	3	4				

[1] The clovers (*Trifolium hybridum* and *T. repens*) are merged for display.

Notes: Five non-native species recorded on the RoW in 2017 only were not observed with cover in 2018: *Chenopodium strictum, Petasites frigidus* var *vitifolia, Polygonum aviculare, Puccinella distans,* and *Tragopogon dubius.*

On the RoW, there is a continued trend of increased occurrences of high frequency noxious species (common dandelion, field sow-thistle), invasives (sweet clovers, smooth brome) and non-native species (common plantain, timothy grass) in successive years since initial project sampling in 2014 or 2015.

Consistently, invasives and non-native species are occurring with greatest cover and frequency in the INV surveys. These are areas chosen because of a susceptibility to increased spread of invasive and non-native species, due to the site location or proximity to existing patches.

Off-RoW Invasive monitoring

Each of the 40 INV sites are paired with a belt-transect scan off the RoW to track the presence or spread of noxious, invasive or non-native species adjacent to the RoW. This season, such species were recorded from nine off-site belt-transect scans, (12 in 2017, nine in 2016, five in 2015). Ten non-native species were recorded off RoW, of which eight were invasive and/or noxious, Table 4-5g. As with the previous years, abundance was generally sparse for all species observed, with no major outbreaks found off-site. No observations of noxious/invasive species were recorded in three off-RoW sites (N4-INV-101, N4-INV-501, C1-INV-501) despite previous records of common dandelion or field sow-thistle in 2017.

Table 4-5g. Noxious, invasive and non-native species recorded in INV surveys off-RoW, 2018, with total number of site occurrences 2015 to 2018.

SITE	*Taraxacum officinale*	*Medicago lupulina*	*Melilotus albus*	*Trifolium repens*	*Cirsium arvense*	*Cirsium vulgare*	*Leucanthemum vulgare*	*Medicago sativa*	*Sonchus arvensis*	*Vicia cracca*
N2INV801	S									
N3INV401				S			S			S
C1INV201					S					
C1INV301	S									
C1INV401	S									
C2INV101			S							
C2INV201	S	S	S	S					S	
C2INV301	S									
C2INV501	S	S-M	S			SO		S		M
Occurs off- RoW										
2018	6	2	3	2	1	1	1	1	1	2
2017	9	2	2	2	2		1		3	

2016	5	2	2	1	2		1	1	4	
2015	5		2	1				1	1	
Noxious, Tier	T3				T3	T3	T2		T3	
Invasive	x		x		x	x	x	x	x	x

S=sparse, M= moderate, SO=single occurrence.

4.5.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project areas previously cleared, the effect predictions from Appendix III for invasive and non-native species were accurate for the following:

- Abundance of non-native species may increase

Mitigation measures identified in the Project Environmental Impact Statement (Manitoba Hydro 2011) and the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011) were initially assessed (after clearing) at each site visited along the RoW, see Table 4-5h. Observations documented in the field from 2018 are provided below.

Table 4-5h. Mitigation measures assessed at sites monitored for invasive and non-native species on the RoW.

Mitigation Measure
Carry out construction activities during winter months.
All equipment will be thoroughly washed and inspected prior to working in new sites to reduce the spread of introduced species.
Construction materials (i.e., gravel) will be taken from clean sources and ground cover materials will be weed free prior to use.
Maintain a minimum vegetation buffer width of 30 m from the high-water mark of water bodies.
Where a buffer zone will be disrupted, clearing and construction activities will occur during the winter months and activities will be minimized within the buffer zone.
Where clearing activities are necessary in riparian areas, grubbing will not occur.

From fieldwork conducted, it was determined that the recommended mitigation was effective where implemented. In the absence of mitigation, invasive and non-native species cover would likely be greater along the RoW. The majority of clearing and construction activities appeared to be carried out during winter months, where the spread of invasive and non-native species is reduced. It is assumed that all equipment was thoroughly washed and inspected prior to working in the RoW, during construction activities. This season, towers were erected and conductors were strung.

Environmental monitoring in 2018 (Year V) observed a greater presence of invasive and non-native species along the RoW, compared to previous years. These species were often observed at newly constructed tower sites, were exposed soil commonly occurs. An increase in number of sites visited occurred this season (i.e., roadside, rehabilitation).

Specific areas of ground disturbance and invasive species spread are discussed under Recommendations, Section 5.0.

In Sections S1 and S2, numerous invasive and non-native species were observed during roadside surveys, with several species considered noxious. At sites, invasive species presence ranged from few species and sparsely distributed to commonly observed and abundant at the roadside and into the ditch within the RoW. Species here have already been established along the roadways prior to construction activities. Where visible from the roadside, invasive species were generally absent to sparse in distribution into the RoW. Areas on the RoW where invasive plant growth was observed roadside, generally occurred where crops were not sown, areas between crops, or nearby towers with soil disturbance. Areas of invasive species that were observed with a notable presence into the RoW (e.g., S1-INV-045; S2-INV-012) are identified in Section 5.0. Common species observed in areas of infestations included field sow-thistle (*Sonchus arvensis*), lamb's-quarters (*Chenopodium album*) and yellow sweet clover (*Melilotus officinalis*). No rutting was observed at sites from construction activities and exposed soil was infrequently observed from the roadside.

In SCC survey locations (Assiniboine River vicinity), abundant invasive species were found generally at each tower footing, along with bare ground, often sandy soil. In several areas, invasive species had a near continuous distribution, or were abundant in patches along the centerline between towers. Leafy spurge (*Euphorbia esula*), while present on the RoW last year, has increased its distribution and abundance. Leafy spurge and other Tier II noxious weeds (ox-eye daisy - *Leucanthemum vulgare*, bladder campion - *Silene vulgaris*), were observed in several other S1 and S2 sites.

In Sections C1, C2, and N4 (south of the Red Deer River), non-native and invasive species were observed during ground surveys in monitoring plots. Management should occur to reduce their potential spread. Invasive outbreaks of field sow-thistle were observed at C1-INV-500 and N4-INV-500; Canada thistle (*Cirsium arvense*) at C1-INV-200; and sweet clover (*Melilotus* spp.) at C1-INV-400 and N4-INV-500. Ox-eye daisy was observed again near plot C1-INV-300, throughout the ditch (Photograph 4-5a). This species has the ability to spread rapidly in favorable habitats. No major rutting issues or soil disturbances from the previous year of construction activities were observed during ground surveys at monitoring sites. Construction activity appeared to be confined to the centerline equipment path and tower foundations.

Photograph 4-5a. Ox-eye daisy observed at C1-INV-300 along the RoW.

In Sections N1 to N4, North of the Red Deer River to the Split Lake area (west of Hunting River), low ground disturbance was observed at monitoring plots. Areas of disturbance are identified below. At N4-INV-200, rutting was observed again near the water crossing, adjacent to the equipment path but the area has naturally revegetated with native species. Construction activity from the previous winter season has resulted in ground disturbance and reduced cover of vegetation in monitoring plot N2-INV-800. In the vicinity of N3-INV-300, a dugout used for borrow material during construction was colonized by common cat-tail (*Typha latifolia*). Other dugouts along the RoW were also observed with common cat-tail. These areas are susceptible to invasive species outbreaks but could also provide habitat for fauna species. On several occasions, bird species were observed in these wet depressions on the RoW.

Invasive and non-native species were observed during several INV surveys along the RoW in Sections N1 to N4. These species are established at many roads and rail lines that intersect the RoW. Plot locations where species should be managed include N4-INV-300, N3-INV-400, N3-INV-600, N2-INV-200, N2-INV-500, and N2-INV-600. These areas support species such as white sweet clover (*Melilotus albus*), field sow-thistle, ox-eye daisy, butter-and-eggs (*Linaria vulgaris*) tufted vetch (*Vicia cracca*) and scentless false mayweed (*Tripleurospermum inodorum*). Several tower foundations with exposed soil were observed to support invasive and non-native species, and are identified in Section 5.0.

Few non-native and invasive species were observed during plot surveys in Section N1, east of Hunting River and along the northern AC collector lines and construction power line. Invasive species were not problematic in this area of the Project in 2018. Field sow-thistle and white sweet clover were observed along the centerline equipment path at the Limestone River, near N1-INV-500 (Photograph 4-5b).

Photograph 4-5b. Invasive species observed near N1-INV-500.

Bladder campion and white sweet clover were observed in the vicinity of plot CL-INV-200. Access trails in Section N1 were assessed from the air to identify disturbance (between plots N1-TER-500 and N1-INV-500). No issues of rutting or invasive outbreaks were observed along trails inspected. Most areas were vegetated with little to no exposed soil.

Monitoring in 2019 will provide an opportunity to re-assess species distribution and cover along the RoW. Invasive plants are capable of growing under a wide range of climatic and soil conditions, and produce abundant seeds that are easily disseminated. Recommendations for invasive and non-native species observed in Year V are identified in Section 5.0.

4.6 Species of Conservation Concern

4.6.1 Monitoring for Species of Conservation Concern

During sampling in 2018, 61 species of conservation concern (ranking S1 through S3S5) were recorded in almost every type of survey (Field Activity ID BPIII_CON_ FA399, 400, 401, 402, 403 and 416) and in each section of the RoW. The most frequent number of observations (59), and the greatest number of species of conservation concern (22) were recorded in the SCC surveys in S1, near the Assiniboine River crossing. Table 4-6a.

Among these 61 species of conservation concern 18 are ranked Very Rare to Rare, (S1 through S2S4), Table 4-6b, while the remaining 43 species are ranked Uncommon (S3 through S3S5), Table 4-6c, (MB Conservation Data Centre 2017). Locations of rare plant surveys (SCC) are shown in Map 4-1 (Appendix II).

Table 4-6a. Species of conservation concern: counts of species and total observations by project section, 2018.

	S1	S2	C1	C2	N1	N2	N3	N4	CL	CP	GE	RHB
Very Rare – Rare: S1-S2S4	9	-	3	-	2	-	3	2	1	1	3	-
Uncommon: S3-S3S5	13	2	7	2	4	1	9	7	4	1	3	3
Total # species	22	2	10	2	6	1	12	9	5	2	6	3
Total # observations	59	5	21	2	15	1	16	13	16	3	6	3

Table 4-6b. Species of conservation concern: Very Rare to Rare Species (S1-S2S4), recorded during Bipole III monitoring, 2018.

Species	Common Name	Rank
Agrimonia gryposepala	Common Agrimony	S1S2
Arabidopsis lyrata	Lyre-leaved Rock Cress	S1S2
Astragalus americanus	American Milkvetch	S2S3
Caltha natans	Floating Marsh-marigold	S2S4
Carex inops ssp. heliophila	Sun Sedge	S1?
Circaea canadensis spp. *canadensis*	Large Enchanter's Nightshade	S2
Cryptotaenia canadensis	Honewort	S1
Cyperus schweinitzii	Schweinitz's Flatsedge	S2
Dalea villosa	Silky Prairie-clover	S2S3
Desmodium canadense	Beggar's-lice	S2
Dichanthelium wilcoxianum	Sand Millet	S2?
Drosera linearis	Slender-leaved Sundew	S2?
Eriophorum scheuchzeri	Scheuchzeri's Cotton-grass	S2?
Impatiens noli-tangere	Western Jewelweed	S1
Osmorhiza claytonii	Hairy Sweet Cicely	S2?
Pedicularis macrodonta	Muskeg Lousewort	S2S3
Salix arbusculoides	Little-tree Willow	S2S3
Sanguinaria canadensis	Blood-root	S2

Table 4-6c. Species of conservation concern: Uncommon Species (S3-S3S5), recorded during Bipole III monitoring, 2018.

Species	Common Name	Rank
Amorpha canescens	Leadplant	S3S4
Amphicarpaea bracteata	Hog-peanut	S3S5
Arctous alpina	Alpine Bearberry	S3S4
Asclepias speciosa	Showy Milkweed	S3S5
Botrychium lunaria	Common Moonwort	S3S4

Calamovilfa longifolia	Sand Grass	S3S5
Carex prairea	Prairie Sedge	S3S4
Chenopodium pratericola	Goosefoot	S3
Corispermum americanum	American Bugseed	S3
Cynoglossum virginianum var. *boreale*	Northern Wild Comfrey	S3S4
Dichanthelium leibergii	Leiberg's Panic-grass	S3S4
Drosera anglica	Oblong-leaved Sundew	S3S4
Galium aparine	Cleavers	S3
Geum rivale	Water or Purple Avens	S3S4
Helianthus pauciflorus ssp. *subrhomboideus*	Beautiful Sunflower	S3S4
Houstonia longifolia	Long-leaved Bluets	S3S5
Hudsonia tomentosa	False Heather	S3
Liparis loeselii	Yellow Twayblade	S3S4
Lithospermum incisum	Linear-leaved puccoon	S3
Lithospermum occidentale	Marble-seed	S3S4
Lonicera involucrata	Black Twinberry	S3S4
Lonicera oblongifolia	Swamp-fly-honeysuckle	S3S5
Lygodesmia juncea	Skeletonweed	S3S4
Melampyrum lineare	Cow-wheat	S3S5
Pedicularis labradorica	Labrador Lousewort	S3S4
Phryma leptostachya	Lopseed	S3
Pinguicula villosa	Hairy Butterwort	S3S4
Platanthera dilatata	Bog Candle	S3S4
Platanthera orbiculata	Round-leaved Bog Orchid	S3
Rhododendron tomentosum	Dwarf Labrador-tea	S3S5
Rhynchospora alba	White Beakrush	S3
Rudbeckia laciniata	Tall Coneflower	S3S4
Salix vestita	Rock Willow	S3
Scheuchzeria palustris	Podgrass	S3S4
Schizachyrium scoparium	Little Bluestem	S3S4
Selaginella densa	Prairie Spike-moss	S3
Selaginella selaginoides	Northern Spike-moss	S3S4
Solidago mollis	Velvety Goldenrod	S3
Sporobolus cryptandrus	Sand Dropseed	S3S5
Streptopus lanceolatus	Rosy Twisted-stalk	S3?
Tofieldia pusilla	Bog Asphodel	S3S5
Utricularia minor	Lesser Bladderwort	S3
Vaccinium caespitosum	Dwarf Bilberry	S3

Southern Segments: S1 Assiniboine Crossing and S1, S2 surveys

In Section S1 near the Assiniboine River crossing (Field Activity ID BPIII_CON_FA403), eight monitoring surveys for species of conservation concern (SCC) were completed from July 21 to 23, with all populations of previously recorded species re-visited. The route both north and south of the Assiniboine River, passes through mature deciduous forest with canopies of bur oak (*Quercus macrocarpa*), black ash (*Fraxinus nigra*), and trembling aspen (*Populus tremuloides*), with some younger open trembling aspen forests found in the north. Some steep sloped areas occur both north and south of the Assiniboine River crossing, although most sites on the south side of and adjacent to the river are nearly level, with corn/ bean/ potato crops surrounded by mature deciduous forest (black ash, bur oak, trembling aspen). The areas of mature bur oak and black ash forest are exceptional areas, as their locations, slopes and soils, have generally prevented any previous clearing, cultivation or development. During agricultural settlement of this region, these mature forests remained refuges for diverse species assemblages that today include species of conservation concern.

On the RoW, species of conservation concern were observed under open conditions, as well as more favourable shady conditions, e.g., at the cleared edge, or under the cover of other broadleaved herbs and regenerating woody species. This season, frequent observations of species of conservation concern were again found along the cleared route. Observation points had single stems, multiple stems or large patches of each species present.

A total of 22 species of conservation concern were recorded in eight SCC surveys, near the Assiniboine crossing. Nine species ranked Very Rare to Rare (S1 to S2S4) are common agrimony (*Agrimonia gryposepala*, S1S2), large enchanter's-nightshade (*Circaea canadensis* spp*. canadensis*, S2), honewort (*Cryptotaenia canadensis*, S1), Schweinitz's flatsedge (*Cyperus schweinitzii*, S2), silky prairie-clover (*Dalea villosa*, S2S3), beggar’s-lice (*Desmodium canadense*, S2), western jewelweed (*Impatiens noli-tangere*, S1), hairy sweet cicely (*Osmorhiza claytonia*, S2?), and blood-root (*Sanguinaria canadensis*, S2). Thirteen additional species ranked Uncommon (S3 to S3S5) are leadplant (*Amorpha canescens*, S3S4), hog-peanut (*Amphicarpaea bracteata*, S3S5), showy milkweed (*Asclepias speciosa*, S3S5), sand grass (*Calamovilfa longifolia*, S3S5), goosefoot (*Chenopodium pratericola*, S3), American bugseed (*Corispermum americanum*, S3), beautiful sunflower (*Helianthus pauciflorus* ssp. *subrhomboideus*, S3S4), linear-leaved puccoon (*Lithospermum incisum*, S3), skeletonweed (*Lygodesmia juncea*, S3S4), marble-seed (*Lithospermum occidentale,* S3S4), lopseed (*Phryma leptostachya*, S3), tall coneflower (*Rudbeckia laciniata,* S3S4) and sand dropseed (*Sporobolus cryptandrus,* S3S5).

At the single prairie monitoring site (S1-PRA-900), eight species of conservation concern were relocated in and incidental to plots, including sand grass, Schweinitz's flatsedge, silky prairie-clover, beautiful sunflower, linear-leaved puccoon, skeletonweed, sand millet, and sand dropseed. Prairie spike-moss (*Selaginella densa*) has not been observed in S1-PRA-900 nor the near-by S1-SCC-700, since 2015.

Silky prairie-clover, is listed as Threatened under The Endangered Species and Ecosystems Act – Manitoba and the Species at Risk Act, and Special Concern under the Committee on the Status of Endangered Wildlife in Canada. Silky prairie-clover was first observed in 2010 during rare plant surveys for the Bipole III environmental assessment and has been observed each year at the same locations during monitoring (2014 through 2018).

In roadside surveys showy milkweed (*Asclepias speciosa*, S3S5), was recorded in S1 (12 surveys) and S2 (two surveys), on July 21 to 24 (Field Activity ID BPIII_CON_FA402 and 403). Showy milkweed is also listed in the Noxious Weed Act (Tier 3), due to its toxicity to livestock. Cleavers (*Galium aparine*, S3) was also recorded in S2 (three surveys) on July 23-24 (Field Activity ID BPIII_CON_FA402). Cleavers is also listed in the Noxious Weed Act (Tier 3), a serious contaminant of canola seed due to its extreme competitivity.

Central: C1 Blueberry Resource Area and C2

In the Cowan Resource Area (Section C1), surveys were conducted July 7 to monitor species of conservation concern previously observed (Field Activity ID BPIII_CON_FA399). Twelve Rare and Uncommon species were recorded. Three Rare species include lyre-leaved rock cress (*Arabidopsis lyrata*, S1S2), sun sedge (*Carex inops* ssp. *heliophila*, S1?) and sand millet (*Dichanthelium wilcoxianum*, S2?). The rock cress populations were in full flower and readily observed, though sparsely distributed, throughout four sites. When vegetative, this plant is very inconspicuous, so may be underrepresented if sites are not visited during flowering times. Nine Uncommon species were also recorded, including sand grass (*Calamovilfa longifolia*, S3S5), Leiberg's panic-grass (*Dichanthelium leibergii*, S3S4), long-leaved bluets (*Houstonia longifolia*, S3S5), false heather (*Hudsonia tomentosa,* S3), cow-wheat (*Melampyrum lineare*, S3S5), little bluestem (*Schizachyrium scoparium*, S3S4) prairie spike-moss (*Selaginella densa*, S3), velvety goldenrod (*Solidago mollis*, S3) and black twinberry (*Lonicera involucrata*, S3S4). Photograph 4-6a shows cow-wheat observed at C1-ATK-300.

All previously observed species were again recorded this year, with the addition of the newly recorded sun sedge at one site (C1-ATK-100). Off-site, and immediately adjacent to the RoW, lyre-leaved rock cress and false heather were relocated again in 2018, at two locations each, at four sites.

Photograph 4-6a. Cow-wheat observed at C1-ATK-300.

Northern Segments: N1 through N4

From the Thompson area south to Swan River in Sections N1 to N4, 24 species of conservation concern ranked Rare (S2? to S2S4) to Uncommon (S3 to S3S5) were recorded during surveys from July 5 to August 2 (Field Activity ID BPIII_CON_FA399, 400, 401). Five Rare species include American milkvetch (*Astragalus americanus*, S2S3), floating marsh-marigold (*Caltha natans*, S2S4), slender-leaved sundew (*Drosera linearis*, S2?), Scheuchzeri's cotton-grass (*Eriophorum scheuchzeri*, S2?), and little-tree willow (*Salix arbusculoides,* S2S3). An additional 19 species ranked Uncommon (S3 to S3S5) were also recorded, including alpine bearberry (*Arctous alpina*, S3S4), prairie sedge (*Carex prairea,* S3S4), northern wild comfrey (*Cynoglossum virginianum* var. *boreale*, S3S4), oblong-leaved sundew (*Drosera anglica*, S3S4), water or purple avens (*Geum rivale*, S3S4), yellow twayblade (*Liparis loeselii*, S3S4), black twinberry (*Lonicera involucrata*, S3S4), swamp-fly-honeysuckle (*Lonicera oblongifolia*, S3S5), Labrador lousewort (*Pedicularis labradorica*, S3S4), small butterwort (*Pinguicula villosa*, S3S4), bog candle (*Platanthera dilatata*, S3S4), round-leaved bog orchid (*Platanthera orbiculata*, S3), white beakrush (*Rhynchospora alba*, S3), rock willow (*Salix vestita*, S3), podgrass (*Scheuchzeria palustris*, S3S4), low spike-moss (*Selaginella selaginoides*, S3S4), rosy twisted-stalk (*Streptopus lanceolatus*, S3?), lesser bladderwort (*Utricularia minor*, S3), and dwarf bilberry (*Vaccinium caespitosum*, S3). Photograph 4-6b shows oblong-leaved sundew observed in a monitored wetland at N4-WET-400.

Photograph 4-6b. Oblong-leaved sundew observed at N4-WET-400.

Adjacent to the RoW, ten species were relocated in five monitored sites (four INV sites in N1, N2 and N3, as well as one WET site in N4), including two Rare species and eight Uncommon species, each also found in sites on the RoW (mentioned above). A single species, teaberry (*Gaultheria procumbens*, S3S4), has not been re-located since 2015, when it was recorded adjacent to the RoW (N3-TER-201). Cow-wheat (*Melampyrum lineare*, S3S5) was not observed in 2018.

Northern Components: AC Collector Lines, Construction Power Line and Ground Electrode Line

In the northeastern portion of the Project, monitoring surveys were conducted on August 1 and 2 for species of conservation concern located along the northern AC collector lines (14 sites), construction power line (six sites), and northern ground electrode line (two sites) (Field Activity ID BPIII_CON_FA401). A total of 22 monitoring surveys were conducted along the northern project components (INV, TER, SCC), with five sites (INV) monitored off RoW.

Eleven species of conservation concern were observed, ranked Rare (S2S3) to Uncommon/Widespread (S3-S3S5). Three species are Rare: American milkvetch (*Astragalus americanus*, S2S3); muskeg lousewort (*Pedicularis macrodonta*, S2S3); and little-tree willow (*Salix arbusculoides*, S2S3). Eight species are Uncommon: alpine bearberry (*Arctous alpina*, S3S4), common moonwort (*Botrychium lunaria*, S3S4), oblong-leaved sundew (*Drosera anglica*, S3S4), hairy butterwort (*Pinguicula villosa*, S3S4), dwarf Labrador-tea (*Rhododendron tomentosum*, S3S5), white beakrush (*Rhynchospora alba*, S3), rock willow (*Salix vestita*, S3) and bog asphodel (*Tofieldia pusilla*, S3S5). All species of concern previously observed in the CL, CP and GEL sites

were re-located. Two new plants observed in these sites 2018 are alpine bearberry and bog asphodel. Photograph 4-6c shows muskeg lousewort observed at GEL-SCC-100.

Photograph 4-6c. Muskeg lousewort observed at GEL-SCC-100.

Rehabilitation Sites, 2018

In 2018, nearly 200 rehabilitation sites were visited. Three Uncommon species of concern were recorded from two sites, alpine bearberry (*Arctous alpina*, S3S4) and rock willow (*Salix vestita*, S3) found in RHB-87; and showy milkweed (*Asclepias speciosa*, S3S5) found in RHB-4278.

4.6.2 Accuracy of Effect Predictions and Effectiveness of Mitigation

For the Project areas previously cleared, the effect predictions from Appendix III for species of conservation concern were accurate for the following:

- Potential loss of plants of conservation concern

Mitigation measures identified in the Construction Environmental Protection Plan (Manitoba Hydro 2014a) and supported by the Project Environmental Impact Statement (Manitoba Hydro 2011), the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011), and Annual Technical Reports (2015 and 2016) were initially assessed, after clearing along the RoW. Table 4-6d identifies the mitigation measures assessed at each site.

This season, no new clearing occurred where species of conservation concern were previously observed. The RoW had towers erected and stringing of conductors were completed.

Table 4-6d. Mitigation measures assessed at sites monitored for species of conservation concern on the RoW.
Mitigation Measure
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 5 m vegetated (shrub and herbaceous) buffer around site.
Remove trees by low disturbance methods.
Confine vehicle traffic to established trails to extent possible.
Use existing access roads and trails to the extent possible.
Stabilize sites immediately after construction and re-vegetate disturbed areas.

It was determined that recommended mitigation was implemented in areas of species of conservation concern, where possible. Construction activities appeared to be carried out on frozen or dry ground to minimize surface damage and rutting. Buffers were maintained where previously observed, and construction equipment was largely confined to established centerline trails and equipment paths. Mitigation was assessed annually at SCC sites, during clearing and construction activities. Mitigation was determined to be effective where implemented. In the absence of mitigation during construction activities, increased disturbance or loss to species of conservation concern may have resulted. Nearly all known locations for species of conservation concern (pre-clearing) were observed again after construction activities. Sites off the RoW were not monitored for mitigation.

In surveys near the Assiniboine River where several species of conservation concern were previously observed, abundant invasive species were found generally at each tower location. In several areas, invasive species had a near continuous distribution, or were abundant in patches along the centerline between towers. Many of the species of conservation concern observed are considered shade requiring species (e.g., common Agrimony - *Agrimonia gryposepala,* large enchanter's nighshade - *Circaea canadensis* spp*. canadensis,* honewort - *Cryptotaenia canadensis,* marble-seed - *Lithospermum occidentale,* hairy sweet cicely - *Osmorhiza claytonii, lopseed - Phryma leptostachya,* and blood-root - *Sanguinaria canadensis*). In some cases, their persistence is noted in the RoW preferentially under shade provided by regenerating woody species (e.g., trembling aspen, hazelnut), or other tall broadleaved herbs. Woody tree species are regenerating to a height of <3 m in places, generally off the equipment path. Woody regeneration tends to be patchy in areas where mulch remains.

In wetland monitoring sites, species of conservation concern were observed to persist after construction activities. Low disturbance occurred in these areas and all species previously recorded were observed again this season. Newly located species included yellow twayblade (*Liparis loeselii*) whitebeakrush (*Rhynchospora alba*).

Along the northern ground electrode RoW, where recent project activities (2017) resulted in the loss of two shrub species, rock willow (*Salix vestita*) was observed back on the RoW at GEL-SCC-200. Muskeg lousewort (*Pedicularis macrodonta*) and oblong-leaved sundew (*Drosera anglica*) were both observed again on the RoW at GEL-SCC-100. The ground electrode RoW showed an increase in shrub and graminoid cover in 2018, compared to the previous season.

North of Keewatinohk converter station, the vegetation has shown good recovery where several occurrences of white beakrush (*Rhynchospora alba*) were previously known to occur. In this area of the RoW, many moist depressions occur, where white beakrush was annually observed and located again this season. The population of white beakrush appears stable on the RoW and conditions have not dried out at this location. Common species along this portion of the AC collector line RoW include black spruce (*Picea mariana*), ecicaeous species such as Labrador tea (*Rhododendron groenlandicum*), leatherleaf (*Chamaedaphne calyculata*) and bog-rosemary (*Andromeda polifolia*), as well as cloudberry (*Rubus chamaemorus*), pitcher plant (*Sarracenia purpurea*), cotton grass (*Eriophorum* spp.), peat moss (*Sphagnum* sp.) and various lichens (*Cladonia* spp.).

4.7 Rehabilitation Monitoring

In 2018, additional monitoring areas were visited to evaluate disturbances along the Bipole III RoW for potential rehabilitation or management (Field Activity ID BPIII_CON_FA399, 400, 401, 402, 403 and 416). Sites assessed included tower foundations, snub sites and centerline disturbances. A total of 196 sites were visited, where vegetation species information was collected at 132 sites. Initially, a list of potential rehabilitation sites was identified by Manitoba Hydro for site evaluation (101 sites). All other sites were identified in the field during vegetation surveys, where disturbances were observed and recorded along the RoW.

From fieldwork conducted, it was determined that 81 sites were currently revegetating naturally. At this time, these sites do not require rehabilitation. Weed management was identified for 67 sites. Species with the greatest frequency among sites requiring management included sweet clover (*Melilotus* spp.), lamb's-quarters (*Chenopodium album*) and field sow-thistle (*Sonchus arvensis*), with 50, 18 and 13 occurrences, respectively. Two Tier II noxious species were observed including ox-eye daisy (*Leucanthemum vulgare*, four occurrences) and scentless false mayweed (*Tripleurospermum inodorum*, one occurrence).

Sixty sites visited could use rehabilitation for disturbance from either exposed soil, rutting, spoil piles, or dugouts as borrow sources. Of these, weed management was identified for eight sites. Disturbances generally occurred at tower sites or at snub sites, between towers from construction activities. Rehabilitation that could be implemented

includes topsoil additions, grading, seeding, and erosion control blankets. Of the 60 sites recognized for rehabilitation, seven of these were identified for natural revegetation but could use an upland seed mixture to increase revegetation. These sites all occur in areas of sloping terrain with sensitive sandy soils. Table 4-7 shows the evaluation of sites visited along the RoW. Specific sites visited along the RoW that require weed management and/or rehabilitation are identified in Section 5.0.

Table 4-7. Sites visited along the RoW to evaluate disturbance.

Evaluation	Field Observation	Number of Sites
Natural Revegetation	Light disturbance (e.g., exposed soil, rutting, surface water).	81
Weed Management	Weed infestations.	67
Rehabilitation	Increased disturbance or need for rehabilitation (e.g., exposed soil, rutting, slope erosion, dugout).	60

In 2015, two water crossings were observed with established erosion control measures. Follow-up monitoring occurred again in 2018, to evaluate erosion control and rehabilitation success. At the Mitishto River (479170 E and 6050339 N) in Section N3, an aerial evaluation could only be conducted. The helicopter (Bell 207) was unable to access the site as a result of tall trees adjacent to the RoW and increased shrub cover on the RoW, limiting access with the conductors strung. Fibre blankets were formerly installed at this site to maintain the river bank from exposed soil. No disturbance or erosion were visible and river banks were vegetated with shrub and graminoid cover (Photograph 4-7a). The water level of the Mitishto River was high this season.

Photograph 4-7a. Mitishto River with vegetated river banks.

At the Hunting River (670030 E, 6248581 N) in Section N1, a previously installed fibre blanket was not visible during ground inspection and has now disintegrated. Soil erosion was not observed at the site. The equipment path at the crossing was vegetated dominantly with graminoid species including fowl bluegrass (*Poa palustris*), marsh reed grass (*Calamagrostis canadensis*) and water sedge (*Carex aquatilis*). Other species included wood horsetail (*Equisetum sylvaticum*), water-parsnip (*Sium suave*), common mint (*Mentha arvensis*), Macoun's buttercup (*Ranunculus macounii*) and willows (*Salix* sp.). This site now appears stable and is located in the immediate vicinity of Plot N1-INV-100.

In early spring of 2017, construction activities resulted in disturbance of vegetation and ground conditions at Slug Site (404388 E, 5751244 N) in Section C1. Ground disturbance included heavy rutting and a trench that was excavated to divert water flow during construction. Rehabilitation recommendations were identified to include stabilizing the watercourse, grading material during suitable ground conditions and to allow for natural revegetation. In 2018, the site was revisited but was assessed from the air as a result of unsafe landing conditions at the site (Photograph 4-7b). The trench was still visible at the site and rehabilitation at this time would not be possible as a result of wet ground conditions. The nearest tower immediately to the south provided a landing spot to assess the site at ground level. The vegetation was naturally regenerating with increased cover of shrubs and marsh vegetation (e.g., common cat-tail - *Typha latifolia*) as compared to last season. This site should be re-assessed in 2019.

Photograph 4-7b. Vegetation recovery at Slug Site.

Several sites were assessed for slope erosion, at or near foundation sites along the RoW, mainly in Section N1. At RHB-466 (also Tower 466), erosion control blankets were inspected and were in position on a strong slope (16-30%). Natural revegetation is occurring at this site to include wild red raspberry (*Rubus idaeus*), fowl bluegrass (*Poa*

palustris), fireweed (*Chamerion angustifolium*), balsam poplar (*Populus balsamifera*), marsh reed grass (*Calamagrostis canadensis*) and hay sedge (*Carex foenea*).

At RHB-516 and RHB-517, erosion control blankets were also installed on moderate (10-15%) and strong slopes respectively but sparse vegetation cover was observed at the sites. Rills causing erosion occurred on surface slopes at RHB-491 and RHB-510, both without erosion control. Other sites without erosion control and sparse vegetation on slopes (moderate to strong) include RHB-70 (Photograph 4-7c) and RHB-81.

Photograph 4-7c. Exposed soil on sloping terrain at RHB-70.

4.8 Hypothesis Testing

Three hypotheses were proposed for environmental monitoring of terrestrial ecosystems and vegetation. Their intent was 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 V monitoring. In 2018, the single prairie (PRA) monitoring site showed a decrease in species richness (number of species) from the previous season. The prairie site originally was dominated by grass cover with few tall shrubs. Terrestrial sites (TER) showed an increase in mean species richness between Year IV and Year V environmental monitoring, on the RoW. Mean species richness remains lower in these sites when compared to the off-RoW value. Similarly, wetland (WET) and invasive (INV) monitoring sites showed the same trend in species richness as TER sites, both on and off the RoW. Monitoring sites in the Resource Area (ATK) increased in mean species richness both on the RoW (from previous growing season) and off-RoW.

Hypothesis 2 (*Invasive and non-native species abundance is related to transmission clearing and construction activities along the right-of-way*) proved to be true in Year V monitoring. Surveys in 2018 revealed that cover values were collected for invasive species in nearly half of all quantitative sites on the RoW project wide (40 sites). There is a continued trend of increased occurrences of high frequency noxious species, invasives and non-native species in successive years since initial project sampling. Species abundance remains low off-RoW, with no major outbreaks found off-site.

Hypothesis 3 (*There is a relationship between species abundance of blueberry plants along the transmission line right-of-way and clearing activities, in the Cowan resource area*) appears to be true after Year V monitoring. Blueberry plants have been recorded at sample sites since initial clearing with varying presence. Low sweet blueberry mean cover in 2018 exceeded baseline average cover from 2014, in both on-site and off RoW samples. Velvetleaf blueberry remains as the less prominent blueberry at sites. Total blueberry cover for sites only supporting blueberries on the RoW averaged 14.4% in 2018, an increase since initial RoW pre-clearing surveys in 2014 (11.6%).

5.0 RECOMMENDATIONS

Based on the vegetation surveys conducted and observations recorded on the RoW, the following are recommendations for 2018. Site coordinates are provided in Appendix V.

Cowan Blueberry Resource Area

Future vegetation management activities in the Cowan Resource Area should use low disturbance manual or mechanical methods, and be confined to the equipment path, where possible (between Towers 4024 to 4032). This area is known to support blueberry picking and harvesting of other plants. The soils are sandy and the ground cover is easily disturbed. Several species of conservation concern are also present in this area, with low occurrence of invasive species.

Invasive and Non-native Species

It is recommended that invasive species control be implemented at locations, where these species have become established. Species with the highest threat (Tier II) should be managed to reduce further species spread, according to responsibilities under the current Regulation of the Noxious Weeds Act. The risk of spread into adjacent sites or along the RoW may increase with each season. Manual control (hand pulling) is effective for small infestations, while chemical control is effective for larger populations. Where herbicides are used as control, environmentally sensitive sites should be avoided and all regulatory requirements and license commitments should be followed (Conditions 45, 48, 52, 60, 61 and 62).

The following identifies sites recommended for species management at monitoring plots as well as additional monitoring areas visited to evaluate disturbances, see also Table 5-0.

- C1-INV-200 (Canada thistle) 415313 E, 5732754 N. Management 0 to 100 m from roadside.
- C1-INV-300 (ox-eye daisy) 435925 E, 5717173 N. The species was observed on the west side of the road, throughout the ditch. Management 0 to 50 m from roadside.
- C1-INV-400 (sweet clover) 442329 E, 5713130 N. Management 0 to 200 m from roadside.
- C1-INV-500 (field sow-thistle) 456833 E, 5700234 N. Management 0 to 200 m from roadside.
- CL-INV-200 (bladder campion) 429602 E, 6264292 N. Management 10 m^2.

- N1-INV-500 (sweet clover, field sow-thistle) 359811 E, 6272718 N. Centerline trail at Limestone River. Management 0 to 30 m from river.
- N2-INV-200 (sweet clover) 593703 E, 6167484 N. Management 0 to 50 m, on centerline.
- N2-INV-500 (sweet clover, bladder campion) 577535 E, 6145769 N. Management 0 to 50 m from roadside, species mainly in ditch.
- N2-INV-600 (sweet clover, bladder campion) 591352 E, 6157388 N. Management 0 to 100 m, both sides of rail line.
- N3-INV-400 (ox-eye daisy, sweet clover, tufted vetch, yellow toadflax) 451029 E, 6040069 N. This location previously was a staging area for construction equipment and materials. Management 0 to 800 m from Wekusko Road.
- N3-INV-600 (sweet clover, ox-eye daisy, scentless false mayweed) 491652 E, 6056251 N. Management 0 to 800 m from Hwy 6, down equipment path.
- N4-INV-300 (sweet clover, field sow-thistle, ox-eye daisy) 360550 E, 5897888 N. In ditch spreading to RoW. Management 0 to 100 m from roadside.
- N4-INV-500 (smooth brome, sweet clover, field sow-thistle) 360325 E, 5849418 N. Management 0 to 100 m from roadside.
- S1-INV-042 (bladder campion) 538854 E, 5506474 N. Management north side of road.
- S1-INV-043 (ox-eye daisy) 539835 E, 5498282 N. Management north side of road.
- S1-INV-045 (field sow-thistle, smooth brome) 548841 E, 5497536 N. Management east side of road and RoW 0 to 100m.
- S1-INV-046 (leafy spurge) 550477 E, 5497549 N. Management east side of road and RoW 0 to 100m.
- S1-INV-047 (marsh-elder) 552187 E, 5496743 N. Management north side of road.
- S1-INV-048 (sweet clover, field sow-thistle) 553768 E, 5496639 N. Management west side of road.
- S1-INV-048 (bladder campion) 553768 E, 5496639 N. Management east side of road.
- S1-INV-051 (leafy spurge) 559223 E, 5496685 N. Management north side of road.
- S1-INV-054 (leafy spurge) 568551 E, 5497755 N. Management east side of road.
- S1-INV-056 (leafy spurge) 560302 E, 5497551 N. Management west side of road.
- S2-INV-003 (bladder campion) 606346 E, 5496717 N. Management west side of road.
- S2-INV-007 (Canada thistle) 652722 E, 5491514 N. Management west side of road.
- S2-INV-008 (field sow-thistle) 659535 E, 5493813 N. Management north and south sides of road.

- S2-INV-009 (field sow-thistle, lamb's-quarters) 659451 E, 5497052 N. Management south side of road.
- S2-INV-011 (field sow-thistle) 667597 E, 5513715 N. Management south side of road and RoW 0 to 50m.
- S2-INV-012 (Canada thistle, field sow-thistle) 655011 E, 5525091 N. Management west side of road and RoW 0 to 50m.
- S1-PRA-900, S1-SCC-300, S1-SCC-310, S1-SCC-400, S1-SCC-530, S1-SCC-600 (leafy spurge). Selectively spray visible patches during growing season because of rare plants throughout area. In the vicinity of the Assiniboine River, abundant invasive species were found generally at each tower footing. In several areas, invasive species had a near continuous distribution, or were abundant in patches along the centerline between towers.

Ground Disturbance

Additional monitoring areas in 2018 were visited to evaluate disturbances on the RoW, see Table 5-0. Some of the disturbance areas investigated show evidence of exposed soil or erosion. Areas with steep slopes on mineral soil should be managed for erosion control. These areas were observed to occur in drier upland sites. No infestation of invasive species was recorded in these areas at this time. It is recommended that further erosion control (fibre blankets) be installed at these sites (e.g., RHB-70, 81, 491, 510, 516, 517 and 3293).

Available soil from excavated material placement areas could be spread over the disturbance areas of the slopes to provide additional soil, where required. These sites could be seeded with a native upland seed mix to further assist vegetation establishment, but risk the introduction of non-native and invasive species, in these northern environments. The diversity of invasive species is low in these areas. Recommended baseline native seed mixes from the Rehabilitation and Invasive Species Management Plan can be used for rehabilitation, or similar native species mixes from local suppliers. Alternatively, native seed could be manually collected from surrounding vegetation at local sites, and dispersed over the soil at the appropriate season, if required. Transplanting of local shrubs (e.g., willows) could also occur to help stabilize slopes. Where rehabilitation occurs, ensure that any imported soil used is weed free and equipment has been cleaned and is free of weed species, where possible. Table 5-0 identifies sites visited along the RoW that require further weed management and/or rehabilitation. The RoW should be re-evaluated in 2019 to assess natural revegetation cover.

Table 5-0. Sites visited along the RoW that require weed management and/or rehabilitation.

Site/Tower (RHB-)	Field Observation	Rehabilitation Recommendation
2118-2119	Weed infestation from Wekusko Road	Weed management
2023-2024	Weed infestation from Hwy 6	Weed management
1096	Weed infestation, ~900m^2	Weed management
1097	Weed infestation, ~900m^2	Weed management
1098	Weed infestation, ~900m^2	Weed management
1100	Weed infestation, ~900m^2	Weed management
1102	Weed infestation, ~900m^2	Weed management
1140	Weed infestation, ~900m^2	Weed management
1149	Weed infestation, ~900m^2	Weed management
1150	Weed infestation, ~900m^2	Weed management
1151	Weed infestation, and access road ditch	Weed management
1162	Weed infestation, ~900m^2	Weed management
1192	Weed infestation, ~900m^2	Weed management
1193	Weed infestation, ~900m^2	Weed management
1205	Weed infestation, ~900m^2	Weed management
1210	Weed infestation, ~900m^2	Weed management
1213	Weed infestation, ~900m^2	Weed management
1217	Weed infestation, and access road ditch	Weed management
1218	Weed infestation, ~900m^2	Weed management
1219	Weed infestation, ~900m^2	Weed management
1220	Weed infestation, ~900m^2	Weed management
1221	Weed infestation, ~900m^2	Weed management
1222	Weed infestation, ~900m^2	Weed management
1226	Weed infestation, and access road ditch	Weed management
1228	Weed infestation, ~900m^2	Weed management
1234	Weed infestation, ~900m^2	Weed management
1236	Weed infestation, ~900m^2	Weed management
1237	Weed infestation, and access road ditch	Weed management
1241	Weed infestation, and rail line	Weed management
1242	Weed infestation, ~900m^2	Weed management
1243	Weed infestation, ~900m^2	Weed management
1244	Weed infestation, ~900m^2	Weed management
1266	Weed infestation, ~900m^2	Weed management
1283	Weed infestation, ~900m^2	Weed management
1298	Weed infestation, ~900m^2	Weed management
1310	Weed infestation, ~900m^2	Weed management
1317	Weed infestation, ~900m^2	Weed management
1318	Weed infestation, ~900m^2	Weed management
1327	Weed infestation	Weed management
1336	Weed infestation	Weed management
1375	Exposed soil, weed infestation, ~3000m^2	Weed management
4206	Tower, weed infestation, ~500m^2	Weed management
4252-4253	Exposed soil, rutting, weed infestation, ~1500m^2	Weed management
5211	Dugout, weed infestation, ~500m^2	Weed management
7087	Weed infestation	Weed management
7088	Weed infestation	Weed management
7093	Weed infestation	Weed management
7094	Weed infestation	Weed management
7095	Weed infestation	Weed management
7135	Weed infestation	Weed management
7188	Weed infestation	Weed management
7189	Weed infestation	Weed management

7241	Weed infestation	Weed management
7276	Weed infestation	Weed management
1148	Weed infestation	Weed management
1233	Weed infestation	Weed management
1245	Weed infestation	Weed management
1265	Weed infestation	Weed management
1267	Weed infestation	Weed management
3098	Exposed soil, dugouts, weed infestation, ~1200m^2	Grade, seed upland mix, weed management
3100	Exposed soil, dugouts, weed infestation, ~1600m^2	Grade, seed upland mix, weed management
3290	Tower, exposed soil, weed infestation, ~3600m^2	Seed upland mix, weed management
4212	Exposed soil, rutting, weed infestation ~1200m^2	Seed upland mix, weed management
4238	Snub site, exposed soil, weed infestation, ~2500m^2	Add topsoil, seed upland mix, weed management
5019	Exposed soil, weed infestation, ~1500m^2	Add topsoil, seed lowland mix, weed management
5141	Tower, exposed soil, weed infestation, ~3600m^2	Add topsoil, seed upland mix, weed management
5238	Snub site, exposed soil, weed infestation, ~1500m^2	Add topsoil, seed upland mix, weed management
70	Exposed soil, slope erosion, ~3000m^2	Erosion control blankets, natural revegetation (seed upland mix?)
81	Exposed soil, slope erosion, ~800m^2	Erosion control blankets, natural revegetation (seed upland mix?)
88	Exposed soil, ~200m^2	Grade, seed upland mix
94	Exposed soil, ~200m^2	Grade, seed upland mix
108	Exposed soil, ~400m^2	Grade, seed upland mix
112	Exposed soil, ~800m^2	Grade, seed upland mix
491	Exposed soil, slope erosion	Erosion control blankets, natural revegetation (seed upland mix?)
510	Exposed soil, slope erosion	Erosion control blankets, natural revegetation (seed upland mix?)
516	Exposed soil, slope erosion	Additional erosion control blankets, natural revegetation (seed upland mix?)
517	Exposed soil, slope erosion	Additional erosion control blankets, natural revegetation (seed upland mix?)
3278	Exposed soil, ~2500m^2	Seed upland mix
3288	Tower, exposed soil, ~2500m^2	Seed upland mix
3293	Exposed soil, slope erosion, ~300m^2	Erosion control blankets, natural revegetation (seed upland mix?)
3313	Tower, exposed soil, ~2500m^2	Seed upland mix
3336	Tower, exposed soil, ~3600m^2	Seed upland mix
3370	Tower, exposed soil, ~3600m^2	Seed upland mix
3371	Tower, exposed soil, ~5000m^2	Seed upland mix
3375	Tower, exposed soil, ~2500m^2	Seed upland mix
3388	Tower, exposed soil, ~3600m^2	Seed upland mix
3389	Tower, exposed soil, ~3600m^2	Seed upland mix
3390	Tower, exposed soil, ~3600m^2	Seed upland mix
3409	Snub site, exposed soil, rutting, ~600m^2	Add topsoil, seed lowland mix
4119	Exposed soil, ~5000m^2	Add topsoil, seed upland mix
4130	Snub site, exposed soil, ~600m^2	Add topsoil, seed upland mix
4142	Exposed soil, ~600m^2	Add topsoil, seed upland mix
4156	Tower, exposed soil, ~1600m^2	Add topsoil, seed upland mix
4169	Snub site, exposed soil, rutting, ~1800m^2	Add topsoil, grade, seed upland mix
4187	Exposed soil, ~200m^2	Add topsoil, seed upland mix
4193	Snub site, exposed soil, rutting, ~900m^2	Add topsoil, grade, seed upland mix
4197	Tower, exposed soil, ~1500m^2	Seed lowland mix

4223	Snub site, surface water	Seed lowland mix
4273	Exposed soil, ~3000m^2	Add topsoil, seed upland mix
4278	Exposed soil, rutting, ~1500m^2	Add topsoil, seed upland mix
4279	Exposed soil	Add topsoil, seed upland mix
5056	Snub site, exposed soil, ~1500m^2	Add topsoil, seed upland mix
5070	Snub site, exposed soil, rutting, ~1500m^2	Add topsoil, grade, seed upland mix
5103	Exposed soil roadside	Add topsoil, seed upland mix
5116	Snub site, tower with exposed soil, ~2000m^2	Add topsoil, seed upland mix
5120	Tower and dugout, exposed soil, ~2500m^2	Add topsoil, grade, seed upland mix
5129	Snub site, exposed soil, ~1500m^2	Add topsoil, grade, seed upland mix
5132	Exposed soil, ~2500m^2	Add topsoil, seed upland mix
5133	Tower, exposed soil, mounds, ~3600m^2	Add topsoil, grade, seed lowland mix
5157	Snub site, exposed soil, rutting, ~400m^2	Add topsoil, grade, seed upland mix
5171	Snub site, exposed soil and mounds, ~1500m^2	Add topsoil, grade, seed upland mix
5175	Dugout, ~1000m^2	Add topsoil, grade, seed lowland mix
5185	Dugout, ~1000m^2	Add topsoil, grade, seed upland mix
5188	Tower and dugout, ~500m^2	Add topsoil, grade, seed upland mix
5197	Dugout, ~500m^2	Add topsoil, grade, seed upland mix
5198	Dugout	Add topsoil, grade, seed upland mix
5226	Snub site, exposed soil, rutting, ~1500m^2	Add topsoil, grade, seed upland mix
5234	Dugout, ~1000m^2	Add topsoil, grade, seed upland mix
5248	Snub site, exposed soil, rutting, ~1500m^2	Add topsoil, grade, seed upland mix

6.0 REFERENCES

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

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.

Invasive Species Council of Manitoba. URL: 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.

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

Manitoba Clean Environment Commission. 2013. Bipole III Transmission Project, Report on Public Hearing. URL: http://www.cecmanitoba.ca/archives/

Manitoba Conservation Data Centre. 2017. Conservation Status Rank. URL: http://www.gov.mb.ca/conservation/cdc/consranks.html

Manitoba Conservation and Water Stewardship. 2013. Manitoba Hydro – Bipole III Transmission Project, The Environment Act Licence No. 3055. URL: http://www.gov.mb.ca/conservation/eal/registries/5433bipole/3055.pdf

Manitoba Government. 2017. The Noxious Weeds Act. URL: http://web2.gov.mb.ca/laws/statutes/ccsm/n110e.php

Manitoba Hydro. 2006. Environmental Protection Guidelines. Construction, Operation and Decommissioning, Manitoba Hydro Work Sites and Facilities.

Manitoba Hydro. 2011. Bipole III Transmission Project, Environmental Impact Statement. URL: http://www.hydro.mb.ca/projects/bipoleIII/regulatory_filings.shtml

Manitoba Hydro. 2014a. Bipole III Transmission Project Construction Environmental Protection Plan – Sections N1, N2, N3, N4, C1, C2, S1, S2 Mapbooks.

Manitoba Hydro. 2014b. Bipole III Transmission Project Construction Environmental Protection Plan – AC Collector Lines, Construction Power Line and Station.

Manitoba Hydro. 2018. Rehabilitation and Invasive Species Management Plan, Manitoba-Minnesota Transmission Project. Draft. 24 p.

Merriam-Webster. URL: http://www.merriam-webster.com/dictionary/disjunct.

R Core Team. 2016. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: 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.

Scoggan, H.J. 1957. Flora of Manitoba. National Museum of Canada. Department of Northern Affairis and National Resources. Bulletin No. 140. Ottawa, Ontario.

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

Szwaluk Environmental Consulting Ltd., Calyx Consulting and MMM Group Ltd. 2011. Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd. and Calyx Consulting. 2012. Pre-Construction Survey for Species of Conservation Concern for Bipole III Northern Project Components. Prepared for Manitoba Hydro.

Szwaluk Environmental Consulting Ltd., K. Newman and Calyx Consulting. 2015. Bipole III Terrestrial Ecosystems and Vegetation Pre-construction and Environmental Monitoring Annual Technical Report (Year I). Prepared for Manitoba Hydro.

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

Szwaluk Environmental Consulting Ltd. and K. Newman. 2017. Bipole III Terrestrial Ecosystems and Vegetation Environmental Monitoring Annual Technical Report (Year IV). Prepared for Manitoba Hydro.

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

APPENDIX I. Definitions of selected technical terms.

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 (Cauboue et al. 1996).

Activity – Activity in relation to a project means actions carried out for construction, operation and eventual decommissioning; and in relation to human presence, actions carried out for domestic and commercial purposes including hunting, fishing, trapping, forestry, mining etc (Manitoba Hydro 2011).

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 (Cauboue et al. 1996).

Boreal – Pertaining to the north; a climatic and ecological zone that occurs south of the subarctic, but north of the temperate hardwood forests of eastern North America, the parkland of the Great Plains region, and the montane forests of the Canadian cordillera (Cauboue et al. 1996).

Bryophyte – A plant of the group Bryophyta; a liverwort, moss or hornwort (Johnson et al. 1995).

Canopy – The more or less continuous cover of branches and foliage formed by the crowns of trees (Cauboue et al. 1996).

Canopy Closure – The degree of canopy cover relative to openings (Cauboue et al. 1996).

Classification – The systematic grouping and organization of objects, usually in a hierarchical manner (Cauboue et al. 1996).

Closed – see canopy closure.

Cluster Analysis – A multidimentional statistical technique used to group samples according to their degree of similarity (Cauboue et al. 1996).

Community-Type – A group of vegetation stands that share common characteristics, an abstract plant community (Cauboue et al. 1996).

Coniferous – A cone-bearing plant belonging to the taxonomic group Gymnospermae (Cauboue et al. 1996).

Cover – The area of ground covered with plants of one or more species, usually expressed as a percentage (Cauboue et al. 1996).

Deciduous – Refers to perennial plants from which the leaves abscise and fall off at the end of the growing season (Cauboue et al. 1996).

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).

Disjunct – Marked by separation of or from usually contiguous parts or individuals (Merriam-Webster).

Ecoregion – An area characterized by a distinctive regional climate as expressed by vegetation (Cauboue et al. 1996).

Environmental Effect – Any change in biophysical or socio-economic environment caused by a project or its components or activities (Manitoba Hydro 2011).

Ericaceous – Ericaceae family, heather-like (Usher 1996).

Fen – Wetland with a peat substrate, nutrient-rich waters, and primarily vegetated by shrubs and graminoids (Cauboue et al. 1996).

Flora – A list of the plant species present in an area (Cauboue et al. 1996).

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 (Cauboue et al. 1996).

Graminoid – A plant that is grass-like; the term refers to grasses and plant that look like grasses, i.e., only narrow-leaved herbs; in the strictest sense, it includes plants belonging only to the family *Graminaceae* (Cauboue et al. 1996).

Grassland – Vegetation consisting primarily of grass species occurring on sites that are arid or at least well drained (Cauboue et al. 1996).

Grubbing – Removal of roots and other ground vegetation (Manitoba Hydro 2006).

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 (Cauboue et al. 1996).

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).

Mitigation – Often the process or act of minimizing the negative effects of a proposed action (Cauboue et al. 1996).

Mixedwood – Forest stands composed of conifers and angiosperms each representing between 25 and 75% of the cover (Cauboue et al. 1996).

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

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

Plot – A vegetation sampling unit used to delineate a fixed amount of area for the purpose of estimating plant cover, biomass, or density (Cauboue et al. 1996).

Pteriodophyte – A division of the plant kingdom; the sporophyte is vascular and independent of the gametophyte at maturity; generally they have stems, leaves and roots (Usher 1996).

Rare Species – Any indigenous species of flora that, because of its biological characterisitics, 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 (Cauboue et al. 1996).

Riparian – Refers to terrain, vegetation or simply a position adjacent to or associated with a stream, flood plain, or standing body of water (Cauboue et al. 1996).

Shrub – A perennial plant usually with a woody stem, shorter than a tree, often with a multi-stemmed base (Cauboue et al. 1996).

Site – The place or category of places, considered from an environmental perspective, that determines the type and quality of plants that can grow there (Cauboue et al. 1996).

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 (Cauboue et al. 1996).

Stand – A collection of plants having a relatively uniform composition and structure, and age in the case of forests (Cauboue et al. 1996).

Stratum – A distinct layer within a plant community, a component of structure (Cauboue et al. 1996).

Terrestrial – Pertaining to land as opposed to water (Cauboue et al. 1996).

Understory – Vegetation growing beneath taller plants such as trees or tall shrubs (Cauboue et al. 1996).

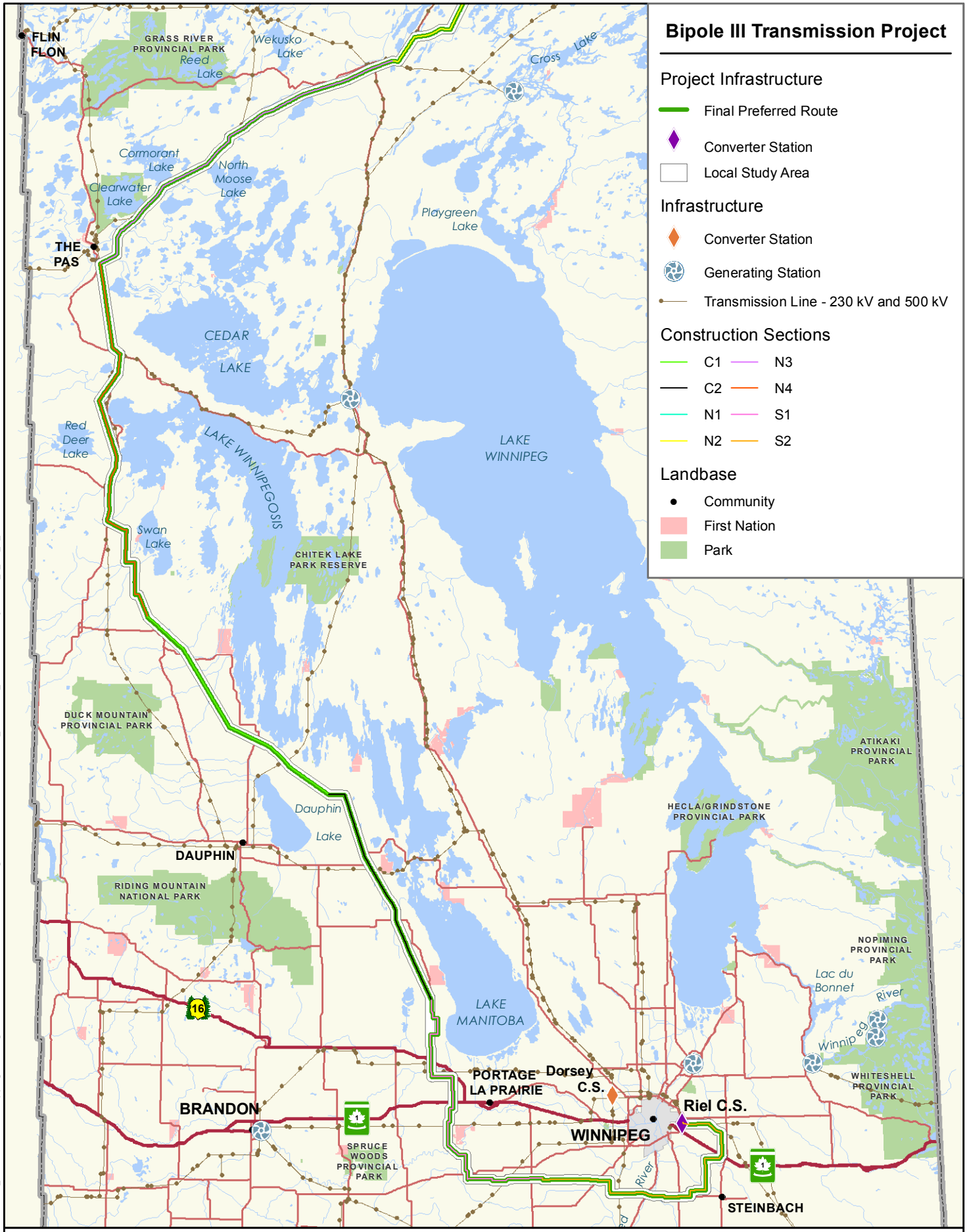
Vascular Plant – A plant having a vascular system (Usher 1996).

Vegetation – The general cover of plants growing on a landscape (Cauboue et al. 1996).

Vegetation Type – In phytosociology, the lowest possible level to be described (Cauboue et al. 1996).

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 acivity that are adapted to wet environments (Cauboue et al. 1996).

APPENDIX II. Report maps.



Manitoba Hydro

Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan
Date Created: October 30, 2018

0 50 100 Kilometres
0 25 50 Miles

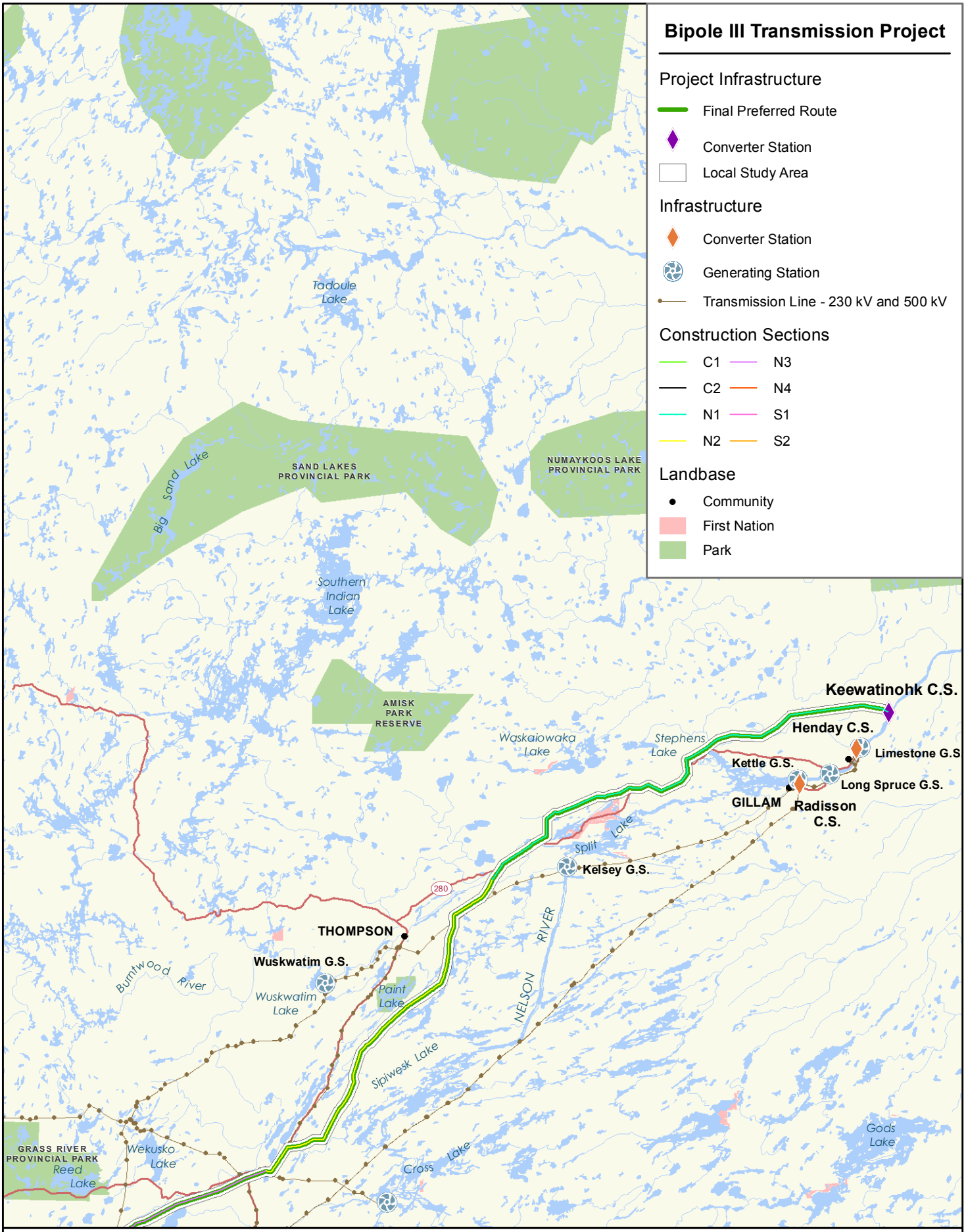
N

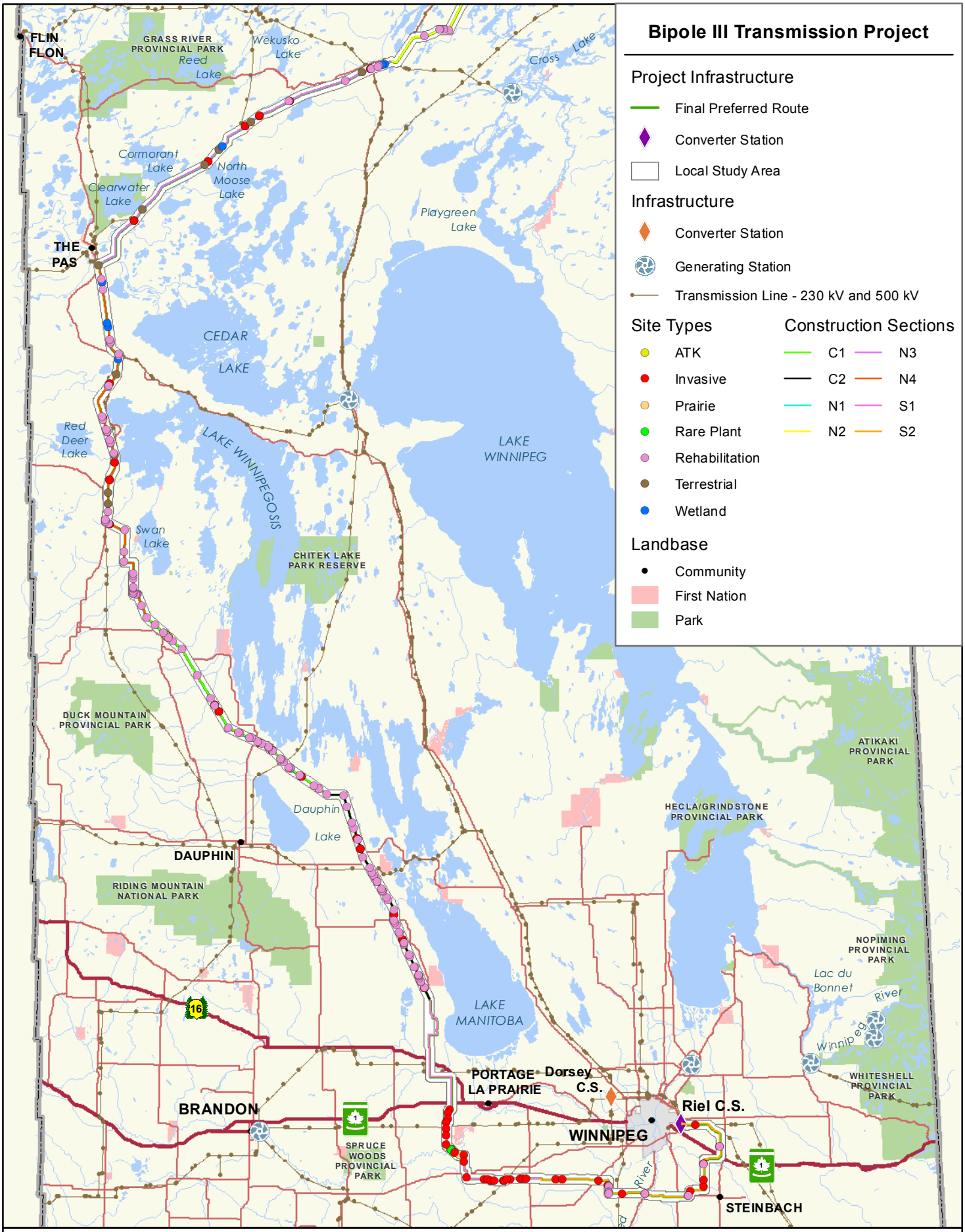
1:2,500,000

Bipole III Transmission Project Area

Map 1-1

File Location: I:\CLIENTS\MANITOBA_HYDRO\1404220\Mapping\MXD\Vegetation\SzwalukEnvironmentalConsulting\KevinSzwaluk\20181030\BPIII_TECHREP_TransmissionProjectArea_2_5m_A_20181030.mxd


Bipole III Transmission Project
Project Infrastructure
Final Preferred Route
Converter Station
Local Study Area
Infrastructure
Converter Station
Generating Station
Transmission Line - 230 kV and 500 kV
Construction Sections
C1
C2
N1
N2
N3
N4
S1
S2
Landbase
Community
First Nation
Park
Tadoule Lake
Big Sand Lake
SAND LAKES PROVINCIAL PARK
NUMAYKOOS LAKE PROVINCIAL PARK
Southern Indian Lake
AMISK PARK RESERVE
Waskaiowaka Lake
Stephens Lake
Keewatinohk C.S.
Henday C.S.
Limestone G.S
Kettle G.S.
Long Spruce G.S.
GILLAM
Radisson C.S.
Split Lake
Kelsey G.S.
280
THOMPSON
Wuskwatim G.S.
Burntwood River
Wuskwatim Lake
Paint Lake
NELSON RIVER
Sipiwesk Lake
Cross Lake
Gods Lake
GRASS RIVER PROVINCIAL PARK
Reed Lake
Wekusko Lake
Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan
Date Created: October 30, 2018
0 50 100 Kilometres
0 25 50 Miles
N
1:2,500,000
Manitoba Hydro
Bipole III Transmission Project Area
Map 1-1
File Location: I:\CLIENTS\MANITOBA_HYDRO\1404220\Mapping\MXD\Vegetation\SzwalukEnvironmentalConsulting\KevinSzwaluk\20181030\BPIII_TECHREP_TransmissionProjectArea_2_5m_A_20181030.mxd



Manitoba Hydro

Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan, SEC
Date Created: October 30, 2018

0 50 100 Kilometres
0 25 50 Miles

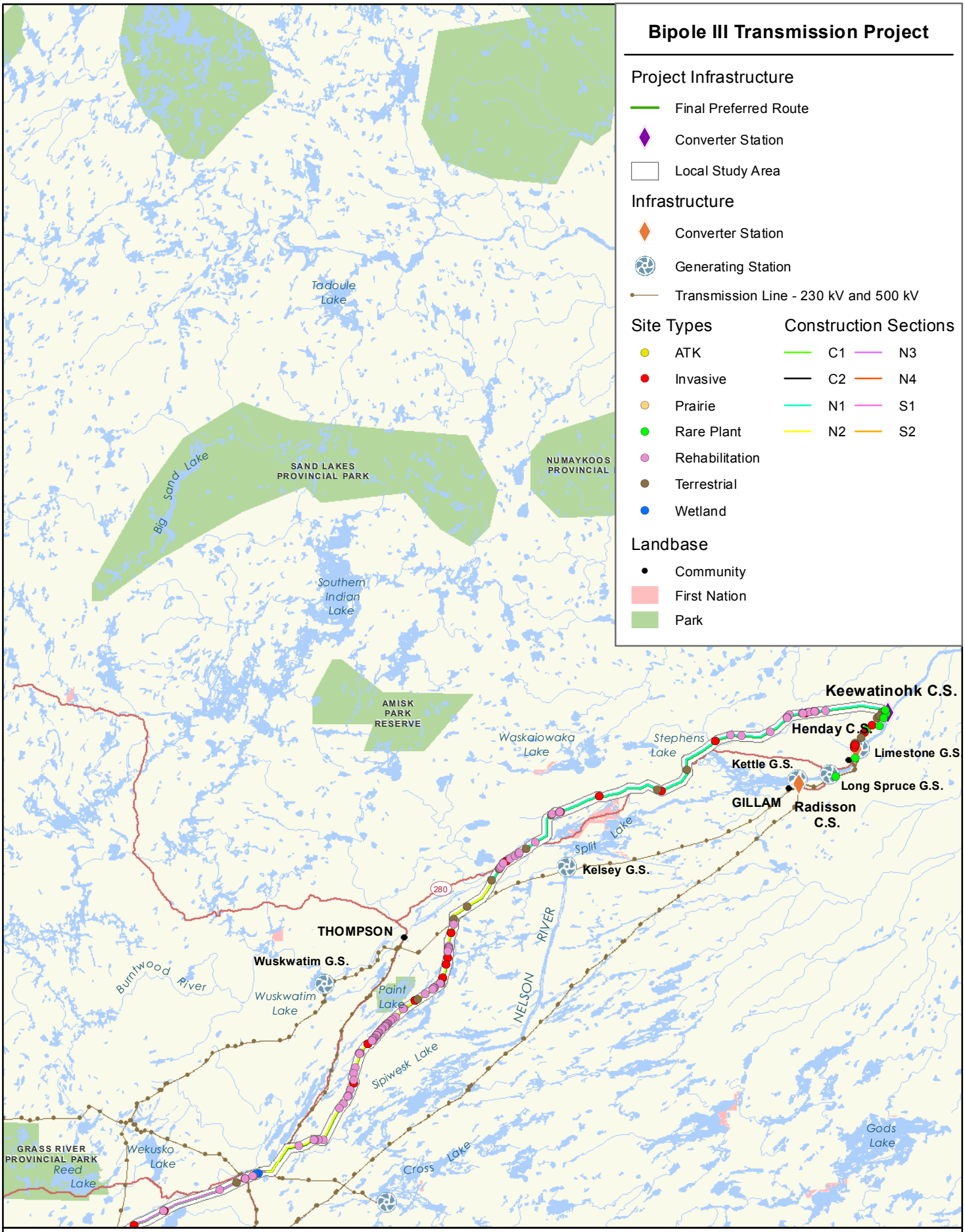
N

1:2,500,000

Distribution of Vegetation Sites

Map 4-1

File Location: I:\CLIENTS\MANITOBA_HYDRO\1404220\Mapping\MXD\Vegetation\SzwalukEnvironmentalConsulting\KevinSzwaluk\20181030BPIII_TECHREP_VegetationDistributionSites_2_5m_A_20181030.mxd


Bipole III Transmission Project
Project Infrastructure
Final Preferred Route
Converter Station
Local Study Area
Infrastructure
Converter Station
Generating Station
Transmission Line - 230 kV and 500 kV
Site Types
ATK
Invasive
Prairie
Rare Plant
Rehabilitation
Terrestrial
Wetland
Construction Sections
C1
C2
N1
N2
N3
N4
S1
S2
Landbase
Community
First Nation
Park
Tadoule Lake
SAND LAKES PROVINCIAL PARK
Big Sand Lake
NUMAYKOOS PROVINCIAL
Southern Indian Lake
AMISK PARK RESERVE
Waskaiowaka Lake
Stephens Lake
Keewatinohk C.S.
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Limestone G.S
Kettle G.S.
Long Spruce G.S.
GILLAM
Radisson C.S.
Split Lake
Kelsey G.S.
280
THOMPSON
Wuskwatim G.S.
Burntwood River
Wuskwatim Lake
Paint Lake
NELSON RIVER
Sipiwesk Lake
GRASS RIVER PROVINCIAL PARK
Reed Lake
Wekusko Lake
Cross Lake
Gods Lake
File Location: I:\CLIENTS\MANITOBA_HYDRO\1404220\Mapping\MXD\Vegetation\SzwalukEnvironmentalConsulting\KevinSzwaluk\20181030BPIII_TECHREP_VegetationDistributionSites_2_5m_A_20181030.mxd
Coordinate System: UTM Zone 14 NAD 83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCan, SEC
Date Created: October 30, 2018
0 50 100 Kilometres
0 25 50 Miles
N
1:2,500,000
Distribution of Vegetation Sites
Map 4-1

APPENDIX III. Potential environmental effects on terrestrial ecosystems and vegetation as a result of the project. Effects were identified in the project Environmental Impact Statement (Manitoba Hydro 2011) and the Terrestrial Ecosystems and Vegetation Technical Report (Szwaluk Environmental Consulting et al. 2011).

Number	Potential Environmental Effect
1	Potential loss of plants of conservation concern
2	Environmentally sensitive sites may be affected
3	Potential loss of habitat and plants used by Aboriginal people as identified through the ATK process
4	Loss of native forest vegetation
5	Riparian areas may be disrupted
6	Vegetation diversity will be temporarily reduced on the Project site
7	Abundance of non-native species may increase
8	Vegetation composition and structure may be modified adjacent to the disturbance zone
9	Fragmentation of vegetation communities will occur
10	Wetlands may be affected
11	Potential effect to vegetation from the release of fuels and hazardous substances
12	Potential effect of dust from project activities on the health of plants
13	Use of herbicides may affect desirable vegetation
14	Increased risk of wildfire
15	Potential for increased access by non-Aboriginal people to vegetation resources used by Aboriginal people as identified through the ATK process

APPENDIX IV. Project commitments for environmental monitoring of terrestrial ecosystems and vegetation. Documents referred to include the Environment Act Licence (Manitoba Conservation and Water Stewardship 2013), the report on Public Hearing (Manitoba Clean Environment Commission 2013), the project Environmental Impact Statement (Manitoba Hydro 2011), and the Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project (Szwaluk Environmental Consulting et al. 2011).

Commitment Document	Page/Section or Clause	Environmental Component	Commitment Description Summary	Objectives to meet intent of Commitment
Licence	Clause 57	Mitigation	The Licencee shall, during construction of the Development, submit annual reports to the Director on the success of the mitigation measures employed during construction, a description of the adaptive management measures undertaken to address issues, and recommendations for improvements of mitigation in future projects. The reports shall include a progressive assessment of the accuracy of predictions made in the EIS and supporting information, including those relating to domestic use of resources.	Submit annual technical report identifying success of mitigation measures, and recommendations for improvements where required.
Licence	Clause 36	Forests	The Licencee shall, in consultation with the Forestry Branch, manage vegetation along the transmission RoW in coniferous dominated forest to retain the coniferous character.	Monitor transmission line RoW in coniferous dominated forest.
Licence	Clause 46	Invasives and non-natives	The Licencee shall, during construction and maintenance of the Development, prevent the introduction and spread of foreign aquatic and terrestrial biota (e.g., weeds, non-native species) to surface waters and in native habitats and prevent invasive species to agricultural lands.	Monitor transmission line RoW for invasives and non-natives.

Licence	Clause 48	Environmental sensitive sites	The Licencee shall, during maintenance of the Development in ESSs identified in the EPP related to traditional plant harvesting: a) clear vegetation using only low impact methods including hand clearing; b) not apply herbicides in the ESSs and within a buffer from the sites, unless a vegetation management agreement stating otherwise is developed with the First Nations, Metis communities and local Aboriginal communities that utilize the specific sites; and c) post signs indicating herbicides have been applied in areas along the transmission line right of-way when and where herbicides have been applied in the vicinity of the ESSs.	Monitor transmission line RoW during maintenance activities.
Licence	Clause 52	Wetlands	To ensure no net loss of wetlands, the Licencee shall, during construction and maintenance of the development, maintain a minimum 30 meter riparian buffer zone immediately adjacent to wetlands and the shoreline of lakes, rivers, creeks, and streams.	Visual observations during monitoring of the transmission line RoW wetlands and river crossings.
Licence	Clause 53	Prairies	The Licencee shall, where native prairie habitat is disturbed during construction of the Development, retain a native prairie re-vegetation specialist to plan and oversee reclamation of these areas.	Monitor transmission line RoW prairies; develop and implement vegetation rehabilitation plan.
Licence	Clause 60	Vegetation control	The Licencee shall, for approval of the Director, submit a vegetation control plan for line maintenance.	Manitoba Hydro to develop and implement vegetation control plan.

EIS	EIS Commitment Table	Native Grasslands/Prairie Areas	Existing access roads and trails will be used to the extent possible; construction activities will be carried out during the winter months; where disturbance has occurred in areas prone to increased erosion, vegetation will be re-established using native species appropriate for the site; trees will be removed by low ground disturbance methods; where trees do not pose a threat to the operations of the transmission line, clearing will be reduced in these areas; where maintenance activities do not occur during winter months, soil and vegetation disturbance will be minimized in the prairie areas.	Monitor transmission line RoW in prairies.
EIS	EIS Commitment Table	Plant Species of Conservation Concern	Existing access roads and trails will be used to the extent possible; locations of species will be marked prior to construction activities; activities will be carried out during the winter months; where activities do not occur over winter months, disturbance to the shrub and herb layers will be minimized where species of concern have been observed; a non-herbicide method will be used to control vegetation, such as hand cutting, mechanical cutting or winter shearing.	Pre-construction surveys and monitor transmission line RoW during construction and maintenance activities.
EIS	EIS Commitment Table	Dust	Construction and maintenance activities for many areas will be carried out during the winter months; water or approved dust suppression agents that will not negatively affect surrounding vegetation will be used for dust abatement where and when necessary.	Visual observations during monitoring of the transmission line RoW.
EIS	EIS Commitment Table	Herbicides	Clearing of the transmission line RoW and other sites, will employ a nonherbicide method such as hand cutting, mechanical cutting or winter shearing; if herbicides are required, all applicable permits and provincial regulations will be followed.	Visual observations during monitoring of the transmission line RoW.

EIS	EIS Commitment Table	Invasives and non-natives	Construction and maintenance activities will be carried out during the winter months where possible.	Monitor transmission line RoW for invasives and non-natives.
EIS	EIS Commitment Table	Modification of vegetation composition	Construction activities will be carried out during the winter months to minimize removal of shrub and understory species; grubbing will be minimized within the RoW to reduce root damage except at foundation sites.	Monitor transmission line RoW for vegetation composition.
EIS	EIS Commitment Table	Non-VEC plants and communities	Existing access roads and trails will be used to the extent possible; tree removal will be confined within the limits of the RoW; trees will be felled into the RoW; clearing and construction activities will be carried out during the winter months; in wetlands, clearing, construction and maintenance activities will be carried out during the winter months; where transmission structures will be sited in areas of increased erosion potential, planting or seeding these areas with native species will occur; during construction, measures will be implemented to manage storm water runoff to reduce the potential for erosion; where activities, do not occur during winter months, soil and vegetation disturbance will be minimized; a minimum vegetation buffer width of 30 m of the high water mark will be maintained for waterbodies such as lakes, ponds and streams.	Visual observations during monitoring of the transmission line RoW.
EIS	EIS Commitment Table	Vegetation diversity	Construction activities will be carried out during the winter months; grubbing will be minimized within the RoW to reduce root damage except at foundation sites; native plant species will be used for revegetation of disturbed areas.	Monitor transmission line RoW for vegetation diversity.

EIS	EIS Commitment Table	Wildfire risks	The removal of slash and other tree maintenance activities will be scheduled to avoid the forest fire season, and burning should occur in the winter months; where practical, slash piles will be located on sites with mineral soils; slash piles will be placed away from the RoW edges to reduce the potential for scorching of standing vegetation.	Visual observations during monitoring of the transmission line RoW.
EIS	Draft EnvPP Appendix H	Species of conservation concern	Pre-clearing surveys for rare plants will be focused in areas of the Project Footprint likely to support species of concern (including the small white lady's slipper) but not previously assessed.	Pre-construction surveys and monitor transmission line RoW during construction and maintenance activities.
EIS	Draft EnvPP Appendix H	Prairies	Monitoring native grassland/prairie areas will occur as part of the overall monitoring program.	Monitor transmission line RoW in prairies; develop and implement vegetation rehabilitation plan.
EIS	Draft EnvPP Appendix H	Plants important to Aboriginal people	In summer construction areas pre-clearing surveys for plants and plant communities identified in the EIS as being important to Aboriginal communities will occur in areas of the Project Footprint not previously assessed; surveys of plants and plant communities identified in the EIS as being important to Aboriginal communities will focus on identifying any changes in plant community composition and productivity (e.g., berries, medicinal plants) due to Project development.	Monitor transmission line RoW for plants important to Aboriginal people.
EIS	Draft EnvPP Appendix H	Invasives and non-natives	Permanently located sampling units located at representative sites will be used to record any changes in vegetation resulting from Project construction (i.e., introduction of non-native and invasive species).	Monitor transmission line RoW for invasives and non-natives.

CEC Report	Page 83	Plants important to Aboriginal people	Conduct vegetation clearing by hand in identified ESS related to traditional plant harvesting; provide a buffer between herbicide application areas and ESS related to traditional plant harvesting; post areas that have been actively herbicided in the vicinity of plant harvesting areas.	Visual observations during monitoring of the transmission line RoW.
CEC Report	Page 122	Herbicides	No herbicide use in bog areas	Visual observations during monitoring of the transmission line RoW.
CEC Report	Page 122	Forests	Manitoba Hydro leave wildlife trees throughout the project RoW where they do not pose a hazard; retain coniferous character by using such techniques as topping conifers.	Visual observations during monitoring of the transmission line RoW.

APPENDIX V. Location of vegetation sample plots and sites visited in 2018.

Site	Section/Component	UTM Zone	Easting	Northing
C1-ATK-100	C1	14 U	388879	5771333
C1-ATK-101	C1	14 U	388845	5771292
C1-ATK-200	C1	14 U	389135	5771103
C1-ATK-300	C1	14 U	390193	5770124
C1-ATK-301	C1	14 U	390232	5770173
C1-ATK-400	C1	14 U	390144	5770173
C1-ATK-500	C1	14 U	389944	5770397
C1-ATK-501	C1	14 U	389958	5770416
C1-ATK-600	C1	14 U	387873	5772269
C1-ATK-700	C1	14 U	388842	5771385
C1-ATK-800	C1	14 U	388809	5771421
C1-ATK-801	C1	14 U	388839	5771429
C1-ATK-900	C1	14 U	388913	5771289
C1-ATK-950	C1	14 U	388956	5771275
C1-INV-100	C1	14 U	413214	5736318
C1-INV-101	C1	14 U	413248	5736326
C1-INV-200	C1	14 U	415313	5732754
C1-INV-201	C1	14 U	415327	5732791
C1-INV-300	C1	14 U	435939	5717157
C1-INV-301	C1	14 U	435943	5717111
C1-INV-400	C1	14 U	442329	5713130
C1-INV-401	C1	14 U	442319	5713178
C1-INV-500	C1	14 U	456833	5700234
C1-INV-501	C1	14 U	456837	5700293
C2-INV-100	C2	14 U	507939	5617871
C2-INV-101	C2	14 U	507896	5617866
C2-INV-200	C2	14 U	485099	5668778
C2-INV-201	C2	14 U	485135	5668777
C2-INV-300	C2	14 U	486683	5663797
C2-INV-301	C2	14 U	486638	5663800
C2-INV-400	C2	14 U	503574	5630853
C2-INV-401	C2	14 U	503610	5630854
C2-INV-500	C2	14 U	518882	5593323
C2-INV-501	C2	14 U	518844	5593324
CL-ECO-300	AC Collector Line	15 U	436473	6271853
CL-ECO-301	AC Collector Line	15 U	429707	6264325
CL-ECO-302	AC Collector Line	15 U	429708	6264317
CL-ECO-303	AC Collector Line	15 U	429721	6264365
CL-ECO-304	AC Collector Line	15 U	429092	6258136
CL-ECO-305	AC Collector Line	15 U	418520	6249769
CL-INV-100	AC Collector Line	15 U	429351	6263150
CL-INV-101	AC Collector Line	15 U	429294	6263142
CL-INV-200	AC Collector Line	15 U	429646	6264309
CL-INV-201	AC Collector Line	15 U	429482	6264289
CL-INV-300	AC Collector Line	15 U	434736	6270314

Site	Section/Component	UTM Zone	Easting	Northing
CL-INV-301	AC Collector Line	15 U	434730	6270356
CL-SCC-100	AC Collector Line	15 U	446264	6279361
CL-SCC-200	AC Collector Line	15 U	446608	6279124
CL-TER-100	AC Collector Line	15 U	444699	6279727
CL-TER-200	AC Collector Line	15 U	441910	6277124
CL-TER-300	AC Collector Line	15 U	430017	6265684
CP-ECO-300	Construction Power Line	15 U	446377	6280992
CP-ECO-301	Construction Power Line	15 U	429862	6264576
CP-INV-100	Construction Power Line	15 U	429927	6264437
CP-INV-101	Construction Power Line	15 U	429888	6264417
CP-INV-200	Construction Power Line	15 U	439016	6274030
CP-INV-201	Construction Power Line	15 U	439078	6274015
CP-TER-100	Construction Power Line	15 U	443457	6278245
CP-TER-200	Construction Power Line	15 U	432907	6268153
GEL-SCC-100, KW-ECO-319	Northern Ground Electrode Line	15 U	445251	6276654
GEL-SCC-200, KW-ECO-325	Northern Ground Electrode Line	15 U	442897	6272941
Mitishto River	N3	14 U	479170	6050339
N1-INV-100	N1	14 U	670081	6248601
N1-INV-101	N1	14 U	670086	6248624
N1-INV-200	N1	14 U	650359	6240892
N1-INV-201	N1	14 U	650391	6240873
N1-INV-300	N1	14 U	623260	6215908
N1-INV-301	N1	14 U	623309	6215912
N1-INV-400	N1	15 U	330724	6250164
N1-INV-401	N1	15 U	330744	6250156
N1-INV-500	N1	15 U	359811	6272718
N1-INV-501	N1	15 U	359818	6272694
N1-INV-600	N1	15 U	406148	6282707
N1-INV-601	N1	15 U	406149	6282681
N1-TER-100	N1	14 U	646024	6239472
N1-TER-200	N1	14 U	633076	6222270
N1-TER-300	N1	14 U	619843	6212151
N1-TER-400	N1	15 U	328929	6250914
N1-TER-500	N1	15 U	344352	6259571
N1-TER-600	N1	15 U	410680	6282956
N2-INV-100	N2	14 U	595548	6180196
N2-INV-101	N2	14 U	595513	6180218
N2-INV-200	N2	14 U	593703	6167484
N2-INV-201	N2	14 U	593745	6167480
N2-INV-300	N2	14 U	593122	6163747
N2-INV-301	N2	14 U	593085	6163776
N2-INV-400	N2	14 U	577340	6145650
N2-INV-401	N2	14 U	577334	6145689
N2-INV-500	N2	14 U	577535	6145769

Site	Section/Component	UTM Zone	Easting	Northing
N2-INV-501	N2	14 U	577473	6145770
N2-INV-600	N2	14 U	591352	6157388
N2-INV-601	N2	14 U	591329	6157449
N2-INV-700	N2	14 U	553573	6124046
N2-INV-701	N2	14 U	553581	6124010
N2-INV-800	N2	14 U	546315	6104417
N2-INV-801	N2	14 U	546276	6104398
N2-TER-100	N2	14 U	615850	6206194
N2-TER-200	N2	14 U	603753	6193292
N2-TER-300	N2	14 U	596633	6186775
N2-TER-400	N2	14 U	578679	6146503
N2-TER-500	N2	14 U	590289	6154658
N3-INV-100	N3	14 U	372809	5979985
N3-INV-101	N3	14 U	372787	5980018
N3-INV-200	N3	14 U	410128	6009548
N3-INV-201	N3	14 U	410195	6009568
N3-INV-300	N3	14 U	435832	6032716
N3-INV-301	N3	14 U	435772	6032727
N3-INV-400	N3	14 U	451029	6040069
N3-INV-401	N3	14 U	451038	6040028
N3-INV-500	N3	14 U	428778	6027547
N3-INV-501	N3	14 U	428844	6027556
N3-INV-600	N3	14 U	491652	6056251
N3-INV-601	N3	14 U	491677	6056230
N3-TER-100	N3	14 U	376909	5985410
N3-TER-200	N3	14 U	408181	6007830
N3-TER-300	N3	14 U	415512	6015685
N3-TER-400	N3	14 U	431478	6029646
N3-TER-500	N3	14 U	487589	6054372
N3-WET-100	N3	14 U	417198	6017184
N3-WET-200	N3	14 U	498745	6058859
N3-WET-300	N3	14 U	497455	6058400
N4-INV-100	N4	14 U	360575	5827359
N4-INV-101	N4	14 U	360593	5827388
N4-INV-200	N4	14 U	357123	5880370
N4-INV-201	N4	14 U	357162	5880374
N4-INV-300	N4	14 U	360550	5897888
N4-INV-301	N4	14 U	360546	5897827
N4-INV-400	N4	14 U	363099	5858125
N4-INV-401	N4	14 U	363122	5858123
N4-INV-500	N4	14 U	360325	5849418
N4-INV-501	N4	14 U	360284	5849383
N4-TER-100	N4	14 U	362886	5861976
N4-TER-200	N4	14 U	354948	5957785
N4-TER-300	N4	14 U	363801	5902453
N4-TER-400	N4	14 U	359454	5837353

Site	Section/Component	UTM Zone	Easting	Northing
N4-TER-500	N4	14 U	359589	5842897
N4-WET-100	N4	14 U	364795	5910113
N4-WET-200	N4	14 U	359710	5926198
N4-WET-300	N4	14 U	359413	5928279
N4-WET-400	N4	14 U	356515	5948514
RHB-1070	N2	14 U	596706	6184163
RHB-108	N1	14 U	765818	6289546
RHB-1096	N2	14 U	594167	6173280
RHB-1097	N2	14 U	594146	6172783
RHB-1098	N2	14 U	594131	6172298
RHB-1100	N2	14 U	594089	6171410
RHB-1102	N2	14 U	594054	6170597
RHB-111	N1	15 U	397384	6281686
RHB-112	N1	14 U	764628	6288412
RHB-113	N1	14 U	764269	6288068
RHB-1140	N2	14 U	590254	6154617
RHB-1148	N2	14 U	587239	6152450
RHB-1149	N2	14 U	586934	6152231
RHB-1150	N2	14 U	586663	6152038
RHB-1151	N2	14 U	586391	6151843
RHB-1162	N2	14 U	582368	6148958
RHB-1192	N2	14 U	571763	6141735
RHB-1193	N2	14 U	571460	6141457
RHB-1205	N2	14 U	567520	6137830
RHB-1210	N2	14 U	565935	6136377
RHB-1213	N2	14 U	564925	6135446
RHB-1217	N2	14 U	563743	6134361
RHB-1218	N2	14 U	563397	6134040
RHB-1219	N2	14 U	563035	6133705
RHB-1220	N2	14 U	562746	6133443
RHB-1221	N2	14 U	562406	6133129
RHB-1222	N2	14 U	562035	6132793
RHB-1226	N2	14 U	560859	6131631
RHB-1228	N2	14 U	560333	6131021
RHB-1233	N2	14 U	559077	6129553
RHB-1234	N2	14 U	558819	6129244
RHB-1236	N2	14 U	558257	6128586
RHB-1237	N2	14 U	557980	6128274
RHB-1241	N2	14 U	556913	6127007
RHB-1242	N2	14 U	556635	6126692
RHB-1243	N2	14 U	556311	6126357
RHB-1244	N2	14 U	556022	6126056
RHB-1245	N2	14 U	555714	6125737
RHB-1265	N2	14 U	549709	6119703
RHB-1266	N2	14 U	549620	6119409
RHB-1267	N2	14 U	549512	6119074

Site	Section/Component	UTM Zone	Easting	Northing
RHB-1283	N2	14 U	547323	6112212
RHB-1290	N2	14 U	546375	6109247
RHB-1298	N2	14 U	546337	6105824
RHB-1310	N2	14 U	544965	6100866
RHB-1317	N2	14 U	543780	6098109
RHB-1318	N2	14 U	543537	6097659
RHB-1327	N2	14 U	541476	6094210
RHB-1336	N2	14 U	539193	6091367
RHB-136	N1	14 U	755919	6281417
RHB-1375	N2	14 U	531097	6075841
RHB-1381	N2	14 U	528496	6075923
RHB-1385	N2	14 U	526820	6075977
RHB-1386	N2	14 U	526403	6075992
RHB-1405-1407	N2	14 U	518923	6072747
RHB-168	N1	14 U	741646	6279164
RHB-179	N1	14 U	736223	6279435
RHB-2014	N3	14 U	495979	6057849
RHB-2015	N3	14 U	495523	6057683
RHB-2023-2024	N3	14 U	491939	6056374
RHB-2118-2119	N3	14 U	450821	6039965
RHB-3016	N4	14 U	356237	5950345
RHB-3026	N4	14 U	356947	5945408
RHB-3078	N4	14 U	360588	5920061
RHB-3081	N4	14 U	360794	5918642
RHB-3082	N4	14 U	360852	5918210
RHB-3098	N4	14 U	365057	5912693
RHB-3100	N4	14 U	365034	5912484
RHB-3135	N4	14 U	359975	5897076
RHB-3137	N4	14 U	359433	5896319
RHB-3172	N4	14 U	356752	5881515
RHB-3176	N4	14 U	357305	5879775
RHB-3187	N4	14 U	358950	5874522
RHB-3189	N4	14 U	359256	5873579
RHB-3190	N4	14 U	359389	5873153
RHB-3198	N4	14 U	360565	5869395
RHB-3200	N4	14 U	360871	5868430
RHB-3201	N4	14 U	361012	5867973
RHB-3212	N4	14 U	362654	5862743
RHB-3278	N4	14 U	359637	5833371
RHB-3288	N4	14 U	358524	5829259
RHB-3290	N4	14 U	358579	5828403
RHB-3293	N4	14 U	359903	5827702
RHB-3313	N4	14 U	368140	5824127
RHB-3336	N4	14 U	367823	5813303
RHB-3347	N4	14 U	367675	5807951
RHB-3370	N4	14 U	372392	5802065

Site	Section/Component	UTM Zone	Easting	Northing
RHB-3371	N4	14 U	372372	5801550
RHB-3375	N4	14 U	372320	5799531
RHB-3383	N4	14 U	372411	5795641
RHB-3384	N4	14 U	372399	5795181
RHB-3385	N4	14 U	372387	5794669
RHB-3388	N4	14 U	372352	5793145
RHB-3389	N4	14 U	372339	5792647
RHB-3390	N4	14 U	372348	5792169
RHB-3394	N4	14 U	373633	5791607
RHB-3395	N4	14 U	374023	5791598
RHB-3396	N4	14 U	374436	5791587
RHB-3409	N4	14 U	376643	5786059
RHB-4000	C1	14 U	378916	5780234
RHB-4012	C1	14 U	383272	5776474
RHB-4024	C1	14 U	387656	5772409
RHB-4032	C1	14 U	390256	5770088
RHB-4037	C1	14 U	392157	5768370
RHB-4051	C1	14 U	396691	5764271
RHB-4088	C1	14 U	404589	5750912
RHB-4119	C1	14 U	411113	5739681
RHB-4130	C1	14 U	413433	5735774
RHB-414	N1	14 U	650073	6240801
RHB-4142	C1	14 U	495071	5647332
RHB-415	N1	14 U	649613	6240620
RHB-4156	C1	14 U	420000	5724784
RHB-4169	C1	14 U	425347	5722240
RHB-4172	C1	14 U	426296	5721776
RHB-4182	C1	14 U	430644	5719723
RHB-4187	C1	14 U	432179	5719723
RHB-4193	C1	14 U	435179	5717530
RHB-4197	C1	14 U	437036	5716662
RHB-4205	C1	14 U	440328	5714881
RHB-4206	C1	14 U	440680	5714657
RHB-4212	C1	14 U	442575	5712938
RHB-4223	C1	14 U	446511	5709153
RHB-4225	C1	14 U	446990	5708602
RHB-4229	C1	14 U	448105	5707351
RHB-4238	C1	14 U	450514	5704706
RHB-4239	C1	14 U	450751	5704515
RHB-4240	C1	14 U	451372	5704271
RHB-4241	C1	14 U	451590	5703948
RHB-425	N1	14 U	646178	6239562
RHB-4252-4253	C1	14 U	456017	5700813
RHB-4273	C1	14 U	463486	5695567
RHB-4278	C1	14 U	465561	5694082
RHB-4279	C1	14 U	465725	5693961

Site	Section/Component	UTM Zone	Easting	Northing
RHB-4290	C1	14 U	469770	5691123
RHB-466	N1	14 U	638078	6225816
RHB-490	N1	14 U	629771	6220107
RHB-491	N1	14 U	629318	6219814
RHB-495	N1	14 U	627667	6218755
RHB-501	N1	14 U	625177	6217153
RHB-5019	C2	14 U	478089	5690481
RHB-5032	C2	14 U	479831	5685064
RHB-5050	C2	14 U	482492	5676835
RHB-5056	C2	14 U	483436	5673960
RHB-5070	C2	14 U	485215	5668371
RHB-5088	C2	14 U	488003	5659719
RHB-510	N1	14 U	621825	6214995
RHB-5103	C2	14 U	491322	5653883
RHB-5108	C2	14 U	492398	5651990
RHB-5112	C2	14 U	493384	5650250
RHB-5116	C2	14 U	494254	5648768
RHB-5120	C2	14 U	495071	5647332
RHB-5129	C2	14 U	497154	5643673
RHB-5132	C2	14 U	497735	5642601
RHB-5133	C2	14 U	497919	5642223
RHB-5141	C2	14 U	499686	5639166
RHB-5145	C2	14 U	500779	5637774
RHB-5157	C2	14 U	503582	5632867
RHB-516	N1	14 U	620609	6213390
RHB-5169	C2	14 U	503571	5627653
RHB-517	N1	14 U	620182	6212692
RHB-5171	C2	14 U	504048	5626611
RHB-5175	C2	14 U	504678	5625181
RHB-5183	C2	14 U	506219	5621731
RHB-5185	C2	14 U	506627	5620824
RHB-5188	C2	14 U	508676	5616259
RHB-5197	C2	14 U	508744	5615999
RHB-5198	C2	14 U	508861	5615649
RHB-5211	C2	14 U	511025	5610357
RHB-5212-5213	C2	14 U	511444	5609461
RHB-5224-5225	C2	14 U	513909	5604115
RHB-5226	C2	14 U	513988	5603900
RHB-5234	C2	14 U	515726	5600180
RHB-5235	C2	14 U	515933	5599724
RHB-5236	C2	14 U	516100	5599513
RHB-5238	C2	14 U	516459	5598630
RHB-5242	C2	14 U	517144	5597106
RHB-5243	C2	14 U	517144	5596655
RHB-5248	C2	14 U	518706	5593727
RHB-70	N1	14 U	783795	6291972

Site	Section/Component	UTM Zone	Easting	Northing
RHB-7087	S2	14 U	611313	5494048
RHB-7088	S2	14 U	611327	5493563
RHB-7093	S2	14 U	611376	5491177
RHB-7094	S2	14 U	611381	5490690
RHB-7095	S2	14 U	611391	5490213
RHB-7135	S2	14 U	629854	5490053
RHB-7188	S2	14 U	651422	5488781
RHB-7189	S2	14 U	651923	5488792
RHB-7241	S2	14 U	659300	5505156
RHB-7276	S2	14 U	667593	5513752
RHB-81	N1	15 U	411191	6282994
RHB-82	N1	14 U	778257	6291226
RHB-82A	N1	15 U	410429	6282933
RHB-87	N1	15 U	408191	6282844
RHB-88	N1	15 U	407828	6282844
RHB-94	N1	14 U	772357	6290431
RHB-95	N1	15 U	404414	6282653
S1-INV-001	S1	14 U	531541	5532716
S1-INV-002	S1	14 U	530735	5531012
S1-INV-003	S1	14 U	530760	5527730
S1-INV-004	S1	14 U	529814	5526129
S1-INV-005	S1	14 U	529829	5522822
S1-INV-006	S1	14 U	529845	5519529
S1-INV-007	S1	14 U	529881	5514598
S1-INV-040	S1	14 U	533953	5510892
S1-INV-041	S1	14 U	538827	5509743
S1-INV-042	S1	14 U	538854	5506474
S1-INV-043	S1	14 U	539835	5498282
S1-INV-045	S1	14 U	548841	5497536
S1-INV-046	S1	14 U	550477	5497549
S1-INV-047	S1	14 U	552187	5496743
S1-INV-048	S1	14 U	553768	5496639
S1-INV-050	S1	14 U	558684	5496599
S1-INV-051	S1	14 U	559223	5496685
S1-INV-052	S1	14 U	561952	5497615
S1-INV-053	S1	14 U	566892	5497729
S1-INV-054	S1	14 U	568551	5497755
S1-INV-055	S1	14 U	570185	5497776
S1-INV-056	S1	14 U	560302	5497551
S1-PRA-900	S1	14 U	536436	5509796
S1-SCC-100	S1	14 U	532512	5512172
S1-SCC-110	S1	14 U	532576	5512138
S1-SCC-200	S1	14 U	534137	5510731
S1-SCC-300	S1	14 U	533861	5510965
S1-SCC-310	S1	14 U	533525	5511291
S1-SCC-400	S1	14 U	533351	5511373

Site	Section/Component	UTM Zone	Easting	Northing
S1-SCC-500	S1	14 U	531997	5512573
S1-SCC-530	S1	14 U	531899	5512696
S1-SCC-600	S1	14 U	532045	5512521
S1-SCC-610	S1	14 U	532179	5512407
S1-SCC-700	S1	14 U	536525	5509798
S2-INV-001	S2	14 U	585016	5497215
S2-INV-002	S2	14 U	588323	5497272
S2-INV-003	S2	14 U	606346	5496717
S2-INV-004	S2	14 U	611301	5494389
S2-INV-005	S2	14 U	618351	5490374
S2-INV-006	S2	14 U	629891	5490023
S2-INV-007	S2	14 U	652722	5491514
S2-INV-008	S2	14 U	659535	5493813
S2-INV-009	S2	14 U	659451	5497052
S2-INV-010	S2	14 U	659294	5505304
S2-INV-011	S2	14 U	667597	5513715
S2-INV-012	S2	14 U	655011	5525091

APPENDIX VI. Species of conservation concern recorded at or near surveys in 2018. - **REDACTED**

APPENDIX VII. Flora recorded from surveys in 2018.

Family/Species	Common Name	MBCDC Rank
VASCULAR SPECIES		
PTERIDOPHYTES	**FERNS AND ALLIES**	
DRYOPTERACEAE	WOOD FERN FAMILY	
Dryopteris carthusiana	Spinulose Wood Fern	S5
Matteuccia struthiopteris	Ostrich Fern	S5
EQUISETACEAE	HORSETAIL FAMILY	
Equisetum arvense	Common Horsetail	S5
Equisetum fluviatile	Swamp Horsetail	S5
Equisetum hyemale	Common Scouring-rush	S5
Equisetum pratense	Meadow Horsetail	S4S5
Equisetum scirpoides	Dwarf Scouring-rush	S4S5
Equisetum sylvaticum	Wood Horsetail	S5
OPHIOGLOSSACEAE	ADDER'S TONGUE FAMILY	
Botrychium lunaria	Common Moonwort	S3S4
Botrypus virginianus	Rattlesnake Fern	S4
SELAGINELLACEAE	SPIKEMOSS FAMILY	
Selaginella densa	Prairie Spike-moss	S3
Selaginella selaginoides	Northern Spike-moss	S3S4
Gymnosperms		
CUPRESSACEAE	CYPRESS FAMILY	
Juniperus communis	Common Juniper	S5
PINACEAE	PINE FAMILY	
Larix laricina	Tamarack	S5

Family/Species	**Common Name**	**MBCDC Rank**
Picea glauca	White Spruce	S5
Picea mariana	Black Spruce	S5
Picea spp.	Spruce	
Pinus banksiana	Jack Pine	S5
Angiosperms - Monocotyledons		
ALISMACEAE	WATER PLANTAIN FAMILY	
Alisma triviale	Common Water Plantain	S5
CYPERACEAE	SEDGE FAMILY	
Carex aquatilis	Water Sedge	S5
Carex atherodes	Awned Sedge	S5
Carex aurea	Golden Sedge	S5
Carex backii	Back's Sedge	S4S5
Carex bebbii	Bebb's Sedge	S5
Carex brunescens	Brownish Sedge	S5
Carex buxbaumii	Brown Sedge	S4S5
Carex canescens	Grey Sedge	S5
Carex capillaris	Hair-like Sedge	S5
Carex chordorrhiza	Prostrate Sedge	S4S5
Carex concinna	Beautiful Sedge	S4S5
Carex deflexa	Bent Sedge	S4S5
Carex deweyana	Dewey’s Sedge	S5
Carex diandra	Two-stamened Sedge	S4S5
Carex disperma	Two-seeded Sedge	S5
Carex foenea	Hay Sedge	S5
Carex granularis	Granular Sedge	S4?
Carex gynocrates	Bog Sedge	S5
Carex houghtoniana	Sand Sedge	S5

Family/Species	Common Name	MBCDC Rank
Carex inops ssp. *heliophila*	Sun Sedge	S1?
Carex interior	Inland Sedge	S4?
Carex lasiocarpa	Woolly Sedge	S5
Carex leptalea	Bristle-stalked Sege	S5
Carex magellanica	Bog Sedge	S5
Carex media	Intermediate Sedge	S4S5
Carex pellita	Wooly Sedge	S5
Carex prairea	Prairie Sedge	S3S4
Carex rostrata	Beaked Sedge	S4
Carex sartwellii	Sartwell's Sedge	S4?
Carex scirpoidea	Rush-like Sedge	S4S5
Carex siccata	Dry-spike Sedge	S4S5
Carex spp.	Sedge	
Carex tenera	Slender Sedge	S4
Carex tenuiflora	Thin-flowered Sedge	S4S5
Carex trisperma	Three-seeded Sedge	S4S5
Carex vaginata	Sheathed Sedge	S5
Cyperus schweinitzii	Schweinitz's Flatsedge	S2
Eleocharis palustris	Creeping Spike-rush	S5
Eleocharis spp.	A Spike-rush	
Eriophorum angustifolium	Tall Cotton-grass	S5
Eriophorum brachyantherum	Short-anther Cotton-grass	S4S5
Eriophorum scheuchzeri	Scheuchzeri's Cotton-grass	S2?
Eriophorum spp.	A Cotton-grass	
Eriophorum vaginatum	Tussock Cotton-grass	S5
Eriophorum viridicarinatum	Thin-leaved Cotton-grass	S4
Rhynchospora alba	White Beakrush	S3
Schoenoplectus tabernaemontani	Soft-stem Bulrush	S5
Scirpus microcorpus	Small-fruited Bulrush	S5

Family/Species	**Common Name**	**MBCDC Rank**
IRIDACEAE	IRIS FAMILY	
Sisyrinchium montanum	Blue-eyed Grass	S5
JUNCACEAE	RUSH FAMILY	
Juncus alpinoarticulatus spp. *americanus*	Alpine Rush	S5
Juncus arcticus var. *balticus*	Baltic Rush	S5
Juncus bufonius	Toad Rush	S5
Juncus nodosus	Knotted Rush	S5
Juncus sp.	A Rush	
Luzula parviflora	Small-flowered Woodrush	S5
Luzula sp.	A Woodrush	
JUNCAGINACEAE	ARROW-GRASS FAMILY	
Triglochin maritima	Seaside Arrow-grass	S5
LILIACEAE	LILY FAMILY	
Anticlea elegans	White Camas	S5
Lilium philadelphicum	Wood Lily	S4
Maianthemum canadense	Canada May Flower	S5
Maianthemum stellatum	Star-flowered Solomon's Seal	S5
Maianthemum trifolium	Three-leaved Solomon's Seal	S5
Smilax lasioneura	Carrion Vine	S4S5
Streptopus lanceolatus	Rosy Twisted-stalk	S3?
Tofieldia pusilla	Bog Asphodel	S3S5
ORCHIDACEAE	ORCHID FAMILY	
Cypripedium parviflorum var.	Large Yellow Lady's-slipper	S5?

Family/Species	Common Name	MBCDC Rank
pubescens		
Cypripedium reginae	Showy Lady's-slipper	S4
Cypripedium sp.	A Lady's-slipper	
Liparis loeselii	Yellow Twayblade	S3S4
Platanthera aquilonis	Tall Northern Green Orchid	S4S5
Platanthera dilatata	Bog Candle	S3S4
Platanthera orbiculata	Round-leaved Bog Orchid	S3
Spiranthes romanzoffiana	Hooded Ladies'-tresses	S5
POACEAE	GRASS FAMILY	
Agropyron cristatum	Crested Wheatgrass	SNA
Agrostis scabra	Ticklegrass	S5
Agrostis spp.	An Agrostis	
Agrostis stolonifera	Creeping Bent	SNA
Andropogon gerardii	Big Bluestem	S5
Avena sativa	Oats	SNA
Beckmannia syzigachne	Slough Grass	S5
Bouteloua gracilis	Blue Gramma	S4
Bromus ciliatus	Fringed Brome	S5
Bromus inermis	Smooth Brome	SNA
Calamagrostis canadensis	Marsh Reed Grass	S5
Calamagrostis sp.	Reed Grass	
Calamagrostis stricta	Northern Reed Grass	S5
Calamovilfa longifolia	Prairie Sandreed	S3S5
Deschampsia cespitosa	Tufted Hairgrass	S4S5
Dichanthelium leibergii	Leiberg's Panic-grass	S3S4
Dichanthelium sp.	A Panic-grass	
Dichanthelium wilcoxianum	Sand Millet	S2?
Digitaria ischaemum	Smooth Crab-grass	SNA

Family/Species	**Common Name**	**MBCDC Rank**
Echinochloa crus-galli	Barnyard Grass	SNA
Elymus canadensis	Canada Wild-rye	S4S5
Elymus repens	Quack-grass	SNA
Elymus spp.	A Wheatgrass	
Elymus trachycaulus	Slender Wheatgrass	S5
Elymus trachycaulus ssp. *subsecundus*	Slender Wheat Grass	S5
Festuca saximontana.	Rocky Mountain Fescue	S4S5
Festuca spp.	Fescue	
Glyceria striata	Fowl Manna Grass	S5
Hordeum jubatum	Wild Barley	S5
Koeleria macrantha	June Grass	S5
Leymus innovatus	Hairy Wild Rye	S5
Muhlenbergia glomerata	Bog Muhly	S4
Muhlenbergia sp.	Muhly	
Oryzopsis asperifolia	White-grained Mountain Rice Grass	S5
Panicum capillare	Witch Grass	S4S5
Phalaris arundinacea	Reed Canarygrass	S5
Phleum pratense	Timothy	SNA
Piptatheropsis pungens	Northern Rice Grass	SS45
Poa annua	Annual Bluegrass	SNA
Poa palustris	Fowl Bluegrass	S5
Poa pratensis	Kentucky Bluegrass	S5
Poa spp.	Bluegrass	
Schizachne purpurascens	Purple Oat Grass	S5
Schizachyrium scoparium	Little Bluestem	S3S4
Setaria pumila	Yellow Foxtail	SNA
Setaria viridis	Green Foxtail	SNA
Spartina gracilis	Alkali Cord Grass	S4

Family/Species	Common Name	MBCDC Rank
Sporobolus cryptandrus	Sand Dropseed	S3S5
Zea mays	Corn	SNA
TYPHACEAE	CAT-TAIL FAMILY	
Typha latifolia	Common Cat-tail	S5
Angiosperms – Dicotyledons		
ACERACEAE	MAPLE FAMILY	
Acer negundo	Manitoba Maple	S5
AMARANTHACEAE	AMARANTH FAMILY	
Amaranthus blitoides	Prostrate Pigweed	SNA
Amaranthus retroflexus	Redroot Pigweed	SNA
ANACARDIACEAE	SUMAC FAMILY	
Toxicodendron rydbergii	Poison Ivy	S5
APIACEAE	CARROT FAMILY	
Cryptotaenia canadensis	Honewort	S1
Heracleum maximum	Cow Psarsnip	S4S5
Osmorrhiza claytonii	Hairy Sweet Cicely	S2?
Pastinaca sativa	Parsnip	SNA
Sanicula marilandica	Seneca Snakeroot	S5
Sium suave	Water Parsnip	S5
Zizia aptera	Heart-leaved Alexanders	S5
Zizia aurea	Golden Alexanders	S4S5
APOCYNACEAE	DOGBANE FAMILY	
Apocynum androsaemifolium	Spreading Dogbane	S5

Family/Species	Common Name	MBCDC Rank
ARALIACEAE	GINSENG FAMILY	
Aralia hispida	Bristly Sarsaparilla	S4S5
Aralia nudicaulis	Wild Sarsaparilla	S5
ASCLEPIADACEAE	MILKWEED FAMILY	
Asclepias ovalifolia	Dwarf Milkweed	S4S5
Asclepias speciosa	Showy Milkweed	S3S5
ASTERACEAE	ASTER FAMILY	
Achillea alpina	Many-flowered Yarrow	S4S5
Achillea millefolium	Yarrow	S5
Ambrosia artemisiifolia	Common Ragweed	S5
Ambrosia trifida	Giant Ragweed	S4
Antennaria sp.	Pussytoes	
Arctium lappa	Great Burdock	SNA
Arcticum minus	Lesser Burdock	SNA
Arnica chamissonis	Leafy Arnica	S4
Artemisia absinthium	Wormwood	SNA
Artemisia campestris	Sage	S4S5
Artemisia ludoviciana	Prairie Sage	S5
Cirsium arvense	Canada Thistle	SNA
Cyclachaena xanthiifolia	Marsh-elder	SNA
Doellingeria umbellata	Flat-topped White Aster	S5
Erigeron canadensis	Canada Horse-weed	S5
Erigeron glabellus	Smooth Fleabane	S5
Erigeron hyssopifolius	Hyssop-leaved Fleabane	S4
Erigeron lonchophyllus	Hirsute Fleabane	S4
Erigeron philadelphicus	Philadelphia Fleabane	S5

Family/Species	**Common Name**	**MBCDC Rank**
Erigeron sp.	A Fleabane	
Helenium autumnale	Common Sneezeweed	S4S5
Helianthus pauciflorus ssp. *subrhomboideus*	Beautiful Sunflower	S3S4
Heterotheca villosa	Hairy Golden-aster	S5
Hieracium umbellatum	Northern Hawkweed	S5
Lactuca sp.	A Lettuce	
Leucanthemum vulgare	Ox-eye Daisy	SNA
Liatris punctata	Dotted Blazing Star	S4
Lygodesmia juncea	Skeletonweed	S3S4
Matricaria discoidea	Pineapple Weed	SNA
Nabalus spp.	Lettuce	
Packera paupercula	Balsam Groundsel	S5
Petasites frigidus var. *palmatus*	Palmate-leaved Coltsfoot	S5
Petasites frigidus var. *sagittatus*	Arrow-leaved Coltsfoot	S5
Rudbeckia hirta	Black-eyed Susan	S5
Rudbeckia laciniata	Tall Coneflower	S3S4
Senecio vulgaris	Common Groundsel	SNA
Solidago canadensis	Canada Goldenrod	S5
Solidago hispida	Hairy Goldenrod	S5
Solidago missouriensis	Missouri Goldenrod	S5
Solidago mollis	Velvety Goldenrod	S3
Solidago multiradiata	Alpine Goldenrod	S4S5
Solidago nemoralis	Showy Goldenrod	S5
Solidago rigida	Stiff Goldenrod	S5
Solidago sp.	Goldenrod	
Sonchus arvensis	Field Sow-thistle	SNA
Symphyotrichum boreale	Northern Bog Aster	S4S5
Symphyotrichum ciliolatum	Lindley's Aster	S5

Family/Species	**Common Name**	**MBCDC Rank**
Symphyotrichum laeve	Smooth Aster	S5
Symphyotrichum puniceum	Purple-stemmed Aster	S5
Symphyotrichum sp.	An Aster	
Tanacetum vulgare	Common Tansy	SNA
Taraxacum officinale	Common Dandelion	SNA
Tragopogon dubius	Goat's-beard	SNA
Triplospermum perforata	Scentless False Mayweed	SNA
Xanthium strumarium	Cocklebur	S4
BALSAMINACEAE	TOUCH-ME-NOT FAMILY	
Impatiens capensis	Jewelweed	S5
Impatiens noli-tangere	Western Jewelweed	S1
BETULACEAE	BIRCH FAMILY	
Alnus incana	Speckled Alder	S5
Alnus viridis	Green Alder	S5
Betula papyrifera	Paper Birch	S5
Betula pumila	Dwarf Birch	S5
Corylus americana	American Hazelnut	S4
Corylus cornuta	Beaked Hazelnut	S5
Corylus sp.	A Hazelnut	
BORAGINACEAE	BORAGE FAMILY	
Cynoglossum virginianum var. *boreale*	Northern Wild Comfrey	S3S4
Lappula squarrosa	Bristly Stickseed	SNA
Lithospermum canescens	Hoary Puccoon	S5
Lithospermum incisum	Linear-leaved Puccoon	S3
Lithospermum occidentale	Marble-seed	S3S4

Family/Species	**Common Name**	**MBCDC Rank**
Mertensia paniculata	Tall Lungwort	S5
BRASSICACEAE	MUSTARD FAMILY	
Arabidopsis lyrata	Lyre-leaved Rock Cress	S1S2
Brassica napus	Turnip	SNA
Brassica rapa	Bird's Rape	SNA
Lepidium densiflorum	Common Pepper-grass	S5
Rorippa palustris	Bog Yellowcress	S4S5
Thlaspi arvense	Field Pennycress	SNA
CAMPANULACEAE	BELLFLOWER FAMILY	
Campanula aparinoides	Marsh Bellflower	S5
Campanula rotundifolia	Harebells	S5
CANNABACEAE	HEMP FAMILY	
Humulus lupulus	Common Hop	S4
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Diervilla lonicera	Bush-honeysuckle	S5
Linnaea borealis	Twinflower	S5
Lonicera dioica	Twining Honeysuckle	S5
Lonicera involucrata	Black Twinberry	S3S4
Lonicera oblongifolia	Swamp-fly Honeysuckle	S3S5
Lonicera villosa	Mountain Fly Honeysuckle	S4S5
Symphoricarpos albus	Snowberry	S5
Symphoricarpos occidentalis	Western Snowberry	S5
Viburnum edule	Mooseberry	S5
Viburnum lentago	Nannyberry	S4
Viburnum opulus	High-bush Cranberry	S5

Family/Species	**Common Name**	**MBCDC Rank**
Viburnum rafinesquianum	Downy Arrowwood	S4S5
CARYOPHYLLACEAE	PINK FAMILY	
Cerastium arvense	Field Chickweed	S5
Moehringia lateriflora	Blunt-leaved Sandwort	S5
Silene latifolia	White Cockle	SNA
Silene vulgaris	Bladder Campion	SNA
Silene spp.	A Silene	
Stellaria longipes	Long-stalked Stitchwort	S5
Stellaria spp.	A Stitchwort	
CHENOPODIACEAE	GOOSEFOOT FAMILY	
Bassia scoparia	Summer Cypress	SNA
Blitum capitatum	Strawberry Blite	S4S5
Chenopodiastrum simplex	Maple-leaved Goosefoot	S5
Chenopodium album	Lamb's-quarters	SNA
Chenopodium leptophyllum	Narrow-leaved Goosefoot	SNA
Chenopodium pratericola	Goosefoot	S3
Chenopodium spp.	Goosefoot	
Chenopodium strictum	Strict Goosefoot	SNA
Corispermum americanum	American Bugseed	S3
Salicornia rubra	Slender Glasswort	S4
Suaeda calceoliformis	Horned Sea-blite	S4S5
CISTACEAE	ROCK ROSE FAMILY	
Hudsonia tomentosa	False Heather	S3
CONVOLVULACEAE	CONVOLVULUS FAMILY	
Calystegia sepium	Hedge Bindweed	S4S5

Family/Species	Common Name	MBCDC Rank
CORNACEAE	DOGWOOD FAMILY	
Cornus canadensis	Bunchberry	S5
Cornus sericea	Red-osier Dogwood	S5
CUCURBITACEAE	GOURD FAMILY	
Echinocystis lobata	Wild Cucumber	S4S5
DROSERACEAE	SUNDEW FAMILY	
Drosera anglica	Oblong-leaved Sundew	S3S4
Drosera linearis	Slender-leaved Sundew	S2?
Drosera rotundifolia	Round-leaved Sundew	S4S5
ELAEAGNACEAE	OLEASTER FAMILY	
Elaeagnus commutata	Silverberry	S4S5
Shepherdia canadensis	Canada Buffaloberry	S5
ERICACEAE	HEATH FAMILY	
Andromeda polifolia	Bog-rosemary	S5
Arctostaphylos uva-ursi	Common Bearberry	S5
Arctous alpina	Alpine Bearberry	S3S4
Chamaedaphne calyculata	Leatherleaf	S5
Gaultheria hispidula	Creeping Snowberry	S4S5
Kalmia polifolia	Pale Laurel	S5
Rhododendron groenlandicum	Labrador Tea	S5
Rhododendron tomentosum	Trapper's Tea	S3S5
Vaccinium angustifolium	Low Sweet Blueberry	S4
Vaccinium caespitosum	Dwarf Bilberry	S3
Vaccinium myrtilloides	Velvetleaf Blueberry	S5

Family/Species	Common Name	MBCDC Rank
Vaccinium oxycoccus	Bog Cranberry	S5
Vaccinium uliginosum	Tall Sweet Blueberry	S5
Vaccinium vitis-idaea	Dry-ground Cranberry	S5
EUPHORBIACEAE	SPURGE FAMILY	
Euphorbia esula	Leafy Spurge	SNA
FABACEAE	PEA FAMILY	
Amorpha canescens	Leadplant	S3S4
Amphicarpaea bracteata	Hog-peanut	S3S5
Astragalus americanus	American Milkvetch	S2S3
Astragalus spp.	A Milkvetch	
Dalea villosa	Hairy Prairie-clover	S2S3
Desmodium canadense	Beggar's-lice	S2
Glycyrrhiza lepidota	Wild Licorice	S4S5
Glycine max	Soybean	SNA
Lathyrus ochroleucus	Cream-coloured Vetchling	S5
Lathyrus palustris	Marsh Vetchling	S5
Lathyrus venosus	Wild Peavine	S5
Lotus corniculatus	Bird's-foot Trefoil	SNA
Medicago lupulina	Black Medic	SNA
Medicago sativa	Alfalfa	SNA
Melilotus albus	White Sweetclover	SNA
Melilotus officinalis	Yellow Sweetclover	SNA
Melilotus sp.	A Sweetclover	
Oxytropis sp.	Locoweed	
Trifolium hybridum	Alsike Clover	SNA
Trifolium repens	White Clover	SNA
Trifolium sp.	A Clover	

Family/Species	**Common Name**	**MBCDC Rank**
Vicia americana	American Vetch	S5
Vicia cracca	Tufted Vetch	SNA
FAGACEAE	BEECH FAMILY	
Quercus macrocarpa	Bur Oak	S5
FUMARIACEAE	FUMITORY FAMILY	
Capnoides sempervirens	Pink Corydalis	S5
Corydalis aurea	Golden Corydalis	S5
Corydalis sp.	A Corydalis	
GENTIANACEAE	GENTIAN FAMILY	
Gentiana spp.	A Gentian	
GERANIACEAE	GERANIUM FAMILY	
Geranium bicknellii	Bicknell's Geranium	S5
GROSSULARIACEAE	CURRANT FAMILY	
Ribes americanum	Wild Black Currant	S5
Ribes glandulosum	Skunk Currant	S5
Ribes hudsonianum	Northern Black Currant	S5
Ribes lacustre	Swamp Gooseberry	S4
Ribes oxyacanthoides	Northern Gooseberry	S5
Ribes sp.	A Currant	
Ribes triste	Swamp Red Currant	S5
HYDROPHYLLACEAE	WATERLEAF FAMILY	
Phacelia campanularia	Scorpionweed	SNA
Phacelia franklinii	Franklin's Scorpionweed	S4S5

Family/Species	**Common Name**	**MBCDC Rank**
LAMIACEAE	MINT FAMILY	
Dracocephalum parviflorum	American Dragon-head	S5
Galeopsis tetrahit	Common Hemp-nettle	SNA
Lycopus americanus	Water Hore-hound	S5
Lycopus uniflorus	Northern Bugleweed	S4S5
Mentha arvensis	Common Mint	S5
Monarda fistulosa	Wild Bergamot	S5
Prunella vulgaris	Heal-all	S4
Scutellaria galericulata	Marsh Skullcap	S5
Stachys palustris	Marsh Hedge-nettle	S5
Stachys pilosa	Woundwort	S5
LENTIBULARIACEAE	BLADDERWORT FAMILY	
Pinguicula villosa	Small Butterwort	S3S4
Utricularia intermedia	Flat-leaved Bladderwort	S4S5
Utricularia minor	Lesser Bladderwort	S3
Utricularia vulgaris ssp. *macrorhiza*	Greater bladderwort	S5
MENYANTHACEAE	BOG BEAN FAMILY	
Menyanthes trifoliata	Bog Bean	S5
OLEACEAE	OLIVE FAMILY	
Fraxinus pennsylvanica	Green Ash	S4S5
ONAGRACEAE	EVENING PRIMROSE FAMILY	
Chamerion angustifolium	Fireweed	S5

Family/Species	**Common Name**	**MBCDC Rank**
Circaea alpina	Small Enchanter's Nightshade	S4S5
Circaea canadensis spp. *canadensis*	Large Enchanter's Nightshade	S2
Epilobium ciliatum ssp. *ciliatum*	Hairy Willowherb	S5
Epilobium ciliatum ssp. *glandulosum*	Northern Willowherb	S5
Epilobium palustre	Marsh Willowherb	S5
Oenothera biennis	Evening-primrose	S5
PAPAVERACEAE	POPPY FAMILY	
Sanguinaria canadensis	Blood-root	S2
PLANTAGINACEAE	PLANTAIN FAMILY	
Plantago major	Common Plantain	SNA
POLEMONIACEAE	PHLOX FAMILY	
Collomia linearis	Narrow-leaved Collomia	S5
POLYGALACEAE	MILKWORT FAMILY	
Polygala senega	Seneca Root	S4
POLYGONACEAE	SMARTWEED FAMILY	
Fallopia convolvulus	Black Bindweed	SNA
Persicaria amphibia	Water Smartweed	S5
Polygonum aviculare	Prostrate Knotweed	SU
Polygonum spp.	Smartweed	
Rumex crispus	Curly Dock	SNA
Rumex fueginus	Golden Dock	S4S5
Rumex occidentalis	Western Dock	S4S5

Family/Species	**Common Name**	**MBCDC Rank**
Rumex spp.	Dock	
PORTULACACEAE	PURSLANE FAMILY	
Portulaca oleracea	Common Purslane	SNA
PRIMULACEAE	PRIMROSE FAMILY	
Androsace septentrionalis	Pygmyflower	S5
Lysimachia ciliata	Fringed Loosestrife	S5
Lysimachia thyrsiflora	Tufted Loosestrife	S5
Trientalis borealis	Northern Starflower	S5
PYROLACEAE	WINTERGREEN FAMILY	
Orthilia secunda	One-sided Wintergreen	S5
Pyrola asarifolia	Pink Wintergreen	S5
Pyrola sp.	Wintergreen	
RANUNCULACEAE	CROWFOOT FAMILY	
Actaea rubra	Red Baneberry	S5
Anemone canadensis	Canada Anemone	S5
Anemone cylindrica	Thimbleweed	S5
Anemone multifida	Cut-leaved Anemone	S5
Anemone parviflora	Small Wood Anemone	S4
Anemone sp.	An Anemone	
Aquilegia brevistyla	Small-flowered Columbine	S4
Aquilegia canadensis	Wild Columbine	S5
Caltha natans	Floating Marsh Marigold	S2S4
Caltha palustris	Marsh Marigold	S5
Coptidium lapponicum	Lapland Buttercup	S4S5
Halerpestes cymbalaria	Seaside Crowfoot	S5

Family/Species	**Common Name**	**MBCDC Rank**
Ranunculus acris	Common Buttercup	SNA
Ranunculus gmelinii	Small Yellow Water Buttercup	S5
Thalictrum dasycarpum	Hairy Meadowrue	S5
Thalictrum venulosum	Veiny Meadowrue	S5
RHAMNACEAE	BUCKTHORN FAMILY	
Rhamnus alnifolia	Alder-leaved Buckthorn	S5
ROSACEAE	ROSE FAMILY	
Agrimonia gryposepala	Common Agrimony	S1S2
Amelanchier alnifolia	Saskatoon	S5
Comarum palustre	Marsh Cinquefoil	S5
Crataegus chrysocarpa	Round-leaved Hawthorn	S4S5
Dasiphora fruticosa	Shrubby Cinquefoil	S5
Fragaria virginiana	Smooth Wild Strawberry	S5
Geum aleppicum	Yellow Avens	S5
Geum rivale	Water or Purple Avens	S3S4
Potentilla anserina ssp. *anserina*	Silverweed	S5
Potentilla norvegica	Rough Cinquefoil	S5
Potentilla sp.	A Cinquefoil	
Prunus pensylvanica	Pin Cherry	S5
Prunus virginiana	Chokecherry	S5
Rosa acicularis	Prickly Rose	S5
Rubus arcticus	Stemless Raspberry	S5
Rubus chamaemorus	Cloudberry	S5
Rubus idaeus	Raspberry	S5
Rubus pubescens	Trailing Dewberry	S5
Spiraea alba	Meadowsweet	S5

Family/Species	**Common Name**	**MBCDC Rank**
RUBIACEAE	MADDER FAMILY	
Galium boreale	Northern Bedstraw	S5
Galium labradoricum	Northern Bog Bedstraw	S4S5
Galium trifidum	Three-petal Bedstraw	S5
Galium triflorum	Sweet-scented Bedstraw	S5
Houstonia longifolia	Long-leaved Bluets	S3S5
SALICAEAE	WILLOW FAMILY	
Populus balsamifera	Balsam Poplar	S5
Populus tremuloides	Trembling Aspen	S5
Salix arbusculoides	Shrubby Willow	S2S3
Salix bebbiana	Bebb's Willow	S5
Salix candida	Hoary Willow	S5
Salix exigua	Sandbar Willow	S5
Salix famelica	Starved Willow	S4
Salix glauca	Smooth Willow	S4
Salix myrtillifolia	Myrtle-leaved Willow	S5
Salix pedicellaris	Bog Willow	S5
Salix planifolia	Flat-leaved Willow	S5
Salix pseudomonticola	False Mountain Willow	S4S5
Salix pyrifolia	Balsam Willow	S4S5
Salix spp.	Willow	
Salix vestita	Rock Willow	S3
SANTALACEAE	SANDALWOOD FAMILY	
Comandra umbellata	Bastard Toadflax	S5
Geocaulon lividum	Northern Comandra	S5
SARRACENIACEAE	PITCHER PLANT FAMILY	

Family/Species	**Common Name**	**MBCDC Rank**
Sarracenia purpurea	Pitcher Plant	S4S5
SAXIFRAGACEAE	SAXIFRAGE FAMILY	
Heuchera richardsonii	Alumroot	S5
Mitella nuda	Mitrewort	S5
Parnassia palustris	Grass of Parnassus	S5
Saxifraga tricuspidata	Three-toothed Saxifrage	S4S5
SCROPHULARIACEAE	FIGWORT FAMILY	
Castilleja coccinea	Scarlet Paintbrush	S4S5
Euphrasia frigida	Northern Eyebright	S4S5
Melampyrum lineare	Cow-wheat	S3S5
Pedicularis labradorica	Labrador Lousewort	S3S4
Pedicularis macrodonta	Muskeg Lousewort	S2S3
Linaria vulgaris	Yellow Toadflax	SNA
URTICACEAE	NETTLE FAMILY	
Urtica dioica	Stinging Nettle	S5
VERBENACEAE	VERVAIN FAMILY	
Phryma leptostachya	Lopseed	S3
VIOLACEAE	VIOLET FAMILY	
Viola canadensis	Canada Violet	S5
Viola spp.	Violet	
NON-VASCULAR SPECIES		
Bryophytes		
Dicranum spp.	Dicranum Moss	

Family/Species	**Common Name**	**MBCDC Rank**
Hylocomium splendens	Stairstep Moss	S4S5
Pleurozium schreberi	Red-stemmed Feather Moss	S4S5
Polytrichum spp.	A Hair Cap Moss	
Sphagnum spp.	Peat Moss	
Lichens		
Cladonia arbuscula ssp. *mitis*	Green Reindeer Lichen	S4
Cladonia rangiferina	Grey Reindeer Lichen	S5
Cladonia stellaris	Star-tipped Reindeer Lichen	S5
Cladonia sp.	Cladonia	
Flavocetraria nivalis	Crinkled Snow Lichen	S4
Peltigera sp.	Pelt Lichen	

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