# APPENDIX F

## Background Studies

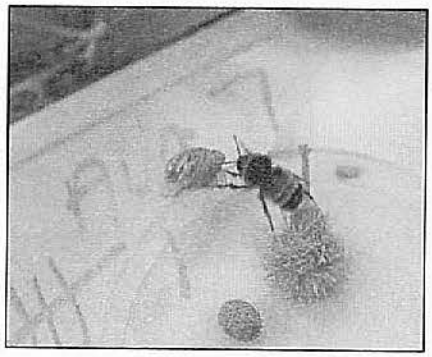
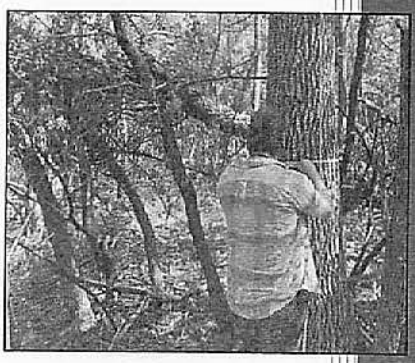
# Biological Land Inventory 2020

# Tochal Developments

**Report submitted to Tochal Developments Inc.**

**October 30th, 2020**




NATIVE PLANT SOLUTIONS

Ducks Unlimited Canada

Ducks Unlimited Canada *operating as* Native Plant Solutions

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October 30th 2020

## Executive Summary

Native Plant Solutions (NPS) was asked by Landmark Planning and Design to complete a biological land inventory on the study area that includes the investigation of nocturnal and breeding birds, flowering plants, plant communities, amphibians, arthropods, rare species, and incidental mammal observations. In 2020, the Tochal Biological Inventory was conducted to provide information to help inform future development projects within the study area. The Inventory will also help guide future site design in a way that can capitalize on existing natural assets and minimize adverse environmental effects where possible. A series of biological field surveys were designed to target specific groups of organisms that commonly occur within the various habitats of the Tochal study area, including nocturnal owls, amphibians, breeding birds, arthropods, and spring and summer vegetation. These surveys were conducted in multiple plots and survey stations that covered the study area and the adjacent reference habitat. The survey results help to develop an understanding of the specific habitats within the Tochal study area and the species they support.

Four main habitat types were identified within the Tochal study area and adjacent reference area based on the vegetation surveys; riverbank forest, floodplain forest, oak forest, and grassland. The riverbank forest is in the reference area north of the constructed berm. It is dominated by native vegetation, including common moonseed (*Menispermum canadense*), bedstraw species (*Galium sp.),* and Virginia creeper (*Parthenocissus quinquefolia*) in the herbaceous layer. The tree layer is dominated by green ash (*Fraxinus pennsylvanica*) and Manitoba maple (*Acer negundo*) and has little to no shrub layer.

The floodplain forest is a mature forest identified south of the berm on the east half of the Tochal study area. The tree layer is a mix of large green ash, bur oak (*Quercus macrocarpa*), American elm (*Ulmus Americana),* Manitoba maple, and American basswood (*Tilia Americana).* The shrub layer is well developed and dominated by choke cherry and saskatoon. The understory layer is predominantly native species, with common moonseed most commonly observed. Some introduced species are present, with Kentucky bluegrass (*Poa pratensis*) having significant ground cover in some plots.

Oak forest was identified south of the berm on the west side of the Tochal study area. This habitat is characterised by historical anthropogenic influences. The tree layer is a mix of large green ash and bur oak trees. The shrub layer is made up of introduced species that reflect the historical use of the land, including caragana (*Caragana arborescens*) and European buckthorn (*Rhamnus cathartica*). The understory varies, dominated by smooth bromegrass (*Bromis inermis*) and Kentucky bluegrass in disturbed areas, while American hog peanut (*Amphicarpaea bracteate*) and Solomon seal (*Maianthemum sp.*), both native, dominate in undisturbed areas.

Grassland is also present within the study area, mainly south of the oak and floodplain forest. This area is tame grass that is regularly mowed. It is dominated by introduced species, including smooth bromegrass, Kentucky bluegrass and quackgrass (*Elymus repens*). Some pockets of grassland habitat were also noted within the oak forest in historically disturbed areas.

In total, 80 plant species (72% native), 24 bird species (including one nocturnal owl), zero amphibians, two arthropods species, and five mammal species were detected during the Tochal Biological Inventory. Some species listed as vulnerable (provincial ranking S3) in the NatureServe Database were identified including the barred owl (*Strix varia*), Canada warbler (*Cardinellina canadensis)* and the Eastern-wood pewee (*Contopus virens*). The Canada warbler is also federally listed as a threatened species, while the Eastern-

wood pewee is listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Non-breeding populations of little brown bats (*Myotis lucifugus*) are listed as imperiled (provincial ranking S2) in Manitoba in the NatureServe database, as well as Endangered by COSEWIC, due to the spread of white-nose syndrome among bat populations. Most species were identified within multiple habitat types, emphasizing the value of preserving and/or mitigating for representative habitat types where possible, with emphasis on the mature forests, including the floodplain forest and oak forest.

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# 1. Introduction

## 1.1 Study Area

Native Plant Solutions (NPS) was asked by Landmark Planning and Design to complete a biological land inventory on the study area that includes the investigation of nocturnal and breeding birds, flowering plants, plant communities, amphibians, arthropods, rare species, and incidental mammal observations.

The study area is approximately 22.5 acres in size and located in the St. Norbert area of Winnipeg. It is bordered by the Red River to the north and east, and LeMay Avenue to the South (Figure 1). The study area consists mainly of forested habitats with some tame grassland habitat. A forest patch, approximately 20 acres in size, to the north of the study area was also surveyed as a reference habitat in order to determine if the reference area provides similar habitat services as the Tochal study area.

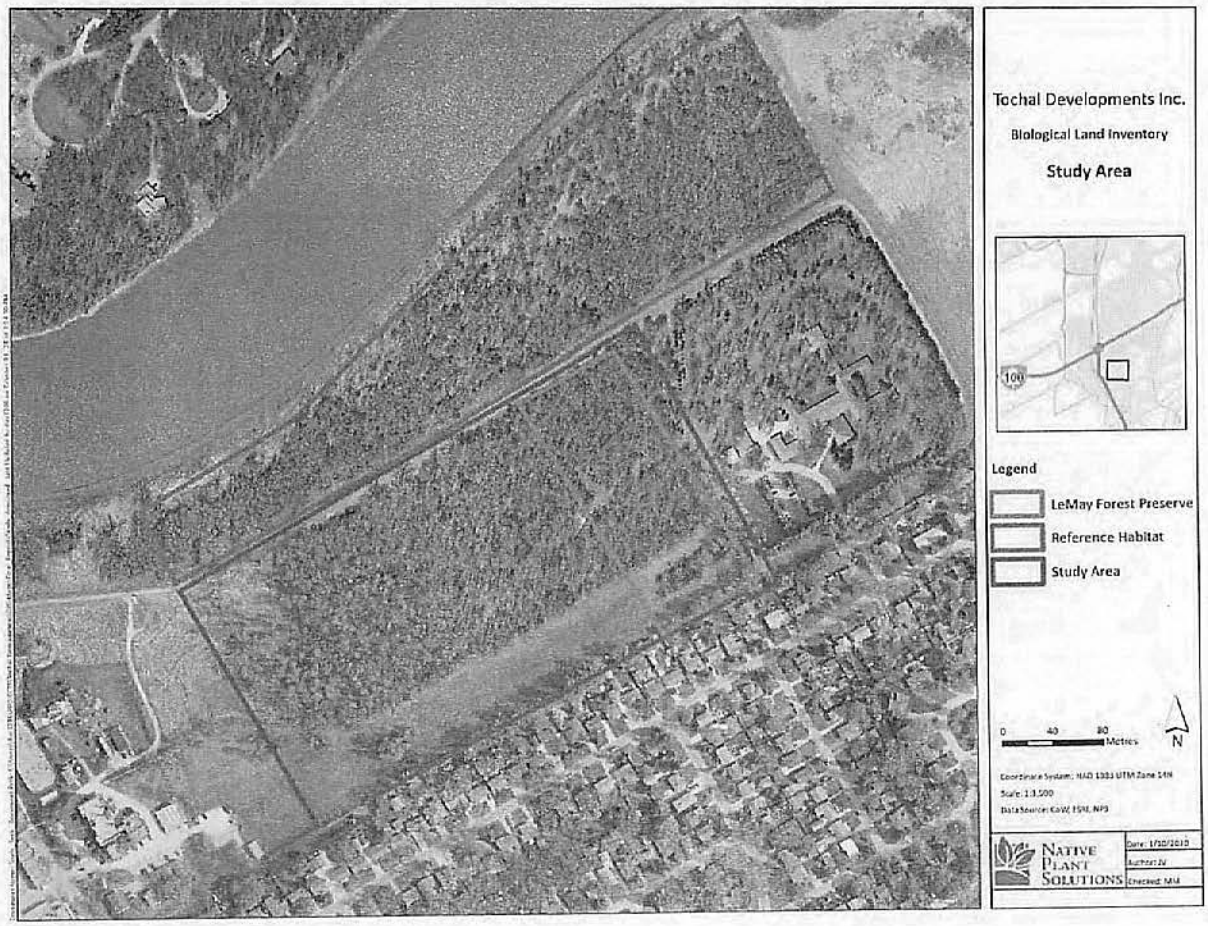


**Figure 1.** Map of the Tochal study area and reference area.

### 1.2 Intent of Biological Inventories

Larger-scaled biological inventories are completed to provide information that will help guide development projects by both protecting and promoting biodiversity conservation. Findings from the inventory enables decision makers to take informed actions that help minimize or avoid adverse environmental effects. It not only identifies areas of high biodiversity or uniqueness, but also captures more rigorous data on the variables that support biological productivity within an area. Inventory findings can then be used to help direct landscape and development plans so that potential adverse environmental effects are lessened, and sensitive habitats protected or even promoted within urban community designs. Findings from the Tochal Biological Inventory will help to identify and provide recommendations for those locations where further habitat fragmentation or habitat loss may impact sensitive species or species of special interest. The overall objective of the Tochal Biological Inventory is to develop a better understanding of the local flora and fauna within the Tochal site boundaries and how these communities are structured within the available natural habitats that exist.

### 1.3 Recommended Field Inventories

Field inventories were designed to target specific groups of organisms that commonly occur within the grassland and forested habitats of Tochal and to identify communities of interest to the City of Winnipeg's Naturalist Division. Field surveys were conducted during those times of the year when the organisms of interest were most susceptible to detection. The biological surveys conducted for birds included a nocturnal owl survey and a breeding bird survey. Additional wildlife surveys conducted were an amphibian survey, arthropod survey and incidental mammal observations. Vegetation surveys included a survey of the spring flowering plants, followed by a comprehensive vegetation survey mid-summer, which included a full inventory of plant diversity and community composition.

Each of the recommended surveys had a different window of time when they were performed and different methods of data collection. The timelines for the surveys were conducted as follows:

1) Nocturnal owl/bird surveys - late March to early April
2) Amphibian surveys - late April to early May
3) Breeding bird - June
4) Flowering plant survey - June
5) Arthropod survey - late July to early August
6) Comprehensive vegetation survey - late July to early August
7) Incidental mammal observations - late March to August

## 2. Flowering Plant Survey and Comprehensive Vegetation Survey

### 2.1. Methodology

NPS conducted two vegetation surveys to determine the vegetation composition and diversity, and to evaluate the habitat type and quality across the Tochal study area. This information also creates a baseline for understanding the structure of the bird, amphibian, and mammal communities within the study area. The two vegetation surveys include a spring flowering plant survey in spring and a comprehensive vegetation survey mid-summer.

The flowering plant survey was conducted on June 9th, 2020. This survey was designed to detect spring flowering plants at the height of their bloom period. The survey included fourteen 5 m x 5 m plots that covered all of the main habitat types present in the study area, as well as two plots within the reference habitat north of the study area (Figure 2). Plots were originally named based on their location on the aerial imagery (forest plots in forested areas, grassland plots in grassland areas). Plots were later assigned a habitat classification based on survey results.

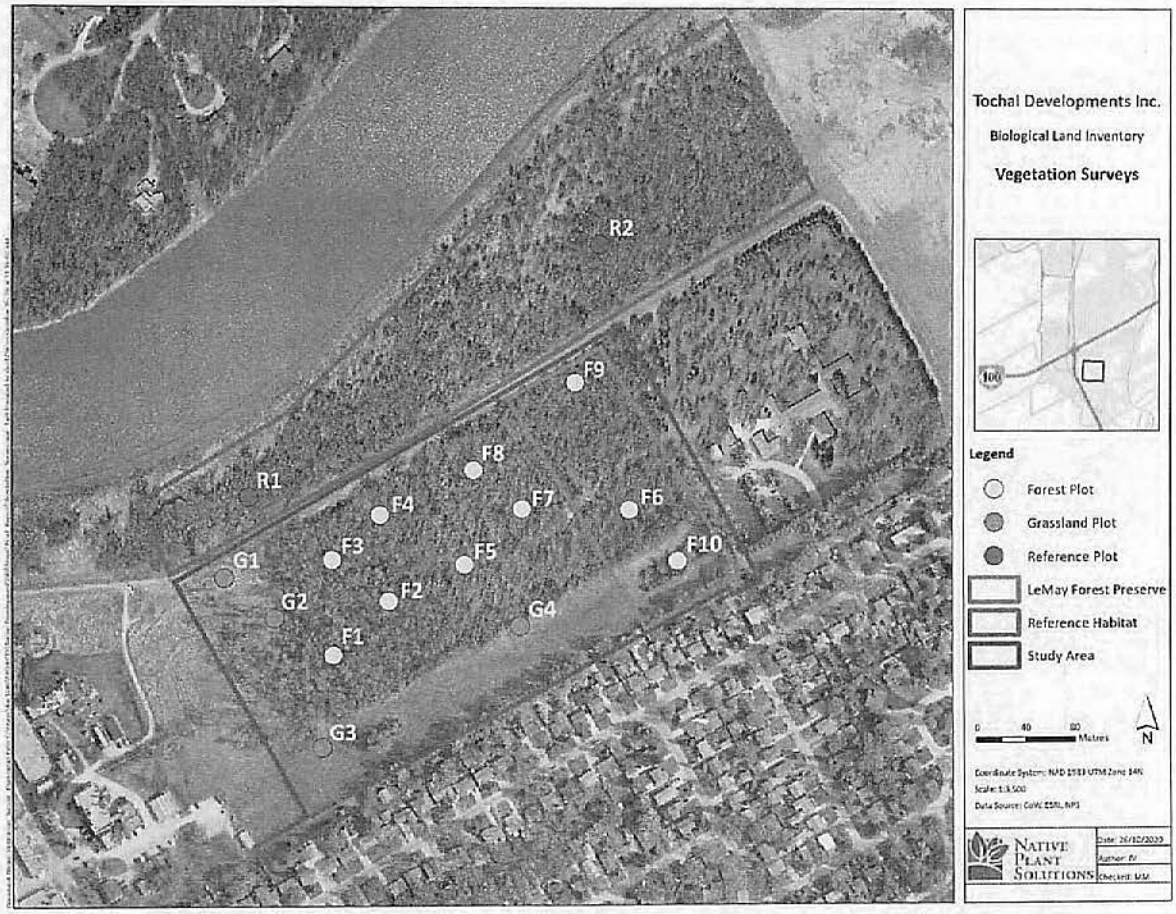


**Figure 2.** The locations of spring and summer vegetation survey plots.

Plot delineation was based on methodology in Nash (2016). The first corner flag was placed in the ground and the 5 m x 5 m plot was delineated from that point. Measuring tape and flagging tape were placed along the edge of the quadrat to clearly delineate the boundary. A plant was considered within the plot if more than 50% of the plant was located inside the flagged plot.

NPS surveyors searched each quadrat and recorded all flowering plant species to the species level, where possible, and estimated the percent cover for each species identified. If a species could not be identified in the field, a sample of the plant, including identifying parts (i.e., leaves, stems, flowers, or fruit), was taken to be further analyzed with the help of additional resources (i.e., books or herbarium). To preserve any potential rare species, if less than three individual plants of an unknown species were present in a

plot, no samples were collected. Instead, photos were taken for later identification of the plant. Plants that were not flowering were not recorded, unless they were a species of special interest or a rare species.

Flags were left on these plots allowing for the same plots to be surveyed a second time during the comprehensive vegetation survey, completed on July 30th, August 6th and August 7th, 2020.

The methodology within the comprehensive vegetation survey, detailed vegetation assessment, unless otherwise stated, were conducted as described in Roberts-Pichette and Gillespie (1999).

The comprehensive vegetation survey classified plants into three categories, as defined in the EMAN Terrestrial Vegetation Monitoring Protocols:

1) Trees (diameter at breast height (DBH) >10 cm)
2) Shrub and small tree (>1 m high and <10 cm DBH)
3) Herbaceous and woody plants (<1 m high)

A tree was considered within the plot if more than 50% of its stems fell within the flagged plot. Table 1 defines all the parameters that were assessed for each tree located in the plots. Woody vegetation categorized within the small trees and shrubs layer were identified to species and measured for height and tree condition.

**Table 1.** Parameters recorded during tree survey.

| Overview of Parameters | |
|---|---|
| **Parameter** | **Description** |
| Tree Number | Beginning at the first corner flag of the plot, each tree species is numbered to keep track of each measured tree. |
| Layer | Each tree is categorized as being in the Tree layer, or Small Trees and Shrubs based on the diameter at breast height measurement. |
| Species | Each tree and shrub were identified to the species level where possible. |
| Diameter at Breast Height (DBH) | The standard location on a tree at which diameter measurements are taken, defined as 1.3 m above the ground. |
| Height (m) | The measurement of the tree from ground level to the tip of the tree. |
| Tree Condition | There are five categories: alive standing, standing dead top, alive broken, alive leaning, and alive fallen (Nash 2016). |
| Bark Retention | Bark retention describes the level to which bark is held on to a tree and is classified into seven codes categories, ranging from class 1 (all bark present) to class 7 (no bark present) (Nash 2016). |
| Wood Condition | Wood condition assesses presence and extent of decay and allows for the assessment of whether a tree can be viable timber (Nash 2016). |
| Loss Indicators | Each tree was assessed for indicators of loss, including defects such as scars, frost cracks, conks, broken tops, and decay (Nash 2016). |
| Wildlife usage | All signs of wildlife usage were recorded, including direct observations of species using the trees during surveys. |

Diameter at Breast Height (DBH), measured for each tree in the plot, is a standard for measuring tree size. The measurement is recorded at 1.3 m above the ground. Many trees are irregular in form, including having growths, multiple stems, and/or forks at DBH, and require special considerations as to where measurements are taken when measuring the DBH. DBH was determined using a measuring tape to record the circumference of a tree, recorded to two decimal places, and later converted to DBH. DBH measurements were not taken for plants within the small trees and shrubs layer.

Tree, small tree and shrub heights were measured using an electronic clinometer. The surveyor stands at a distance from the tree/shrub that allows them a clear view of the top and bottom of the tree/shrub. The distance is measured using a tape measure and entered into the clinometer. The surveyor then takes a measurement of the angle and distance to the top and bottom of the tree from their position using the laser sight of the clinometer. The instrument then automatically calculates and outputs the height of the tree/shrub being measured.

Herbaceous vegetation includes grasses, forbs, and woody vegetation that is less then 1 m high. Two variables were recorded for plants in the herbaceous layer; species and percent cover. Similar to the flowering plant survey, herbaceous vegetation was identified to the species level. Percent cover for each identified species was estimated to the nearest five % using a canopy cover. Typically, canopy cover is determined by finding a percentage of vegetative cover within a quadrat, which can result in a total cover greater than 100% (because of overlapping layers of leaf material). Any species with a small percent cover was recorded as <5% cover. If only one plant of a given species was present its coverage was recorded as being 'trace'.

NPS previously surveyed trees, using the above methodology, in an area approximately five acres in size on May 12th, 2020 (Figure 2). The data taken during that survey has been incorporated into the following results. In order to make the survey program more efficient and avoid re-surveying trees no measurements of trees were retaken (i.e., DBH, height, or condition) for any trees within vegetation plots that fell within this area in order to make the survey program more efficient (See Appendix A for the full LeMay Forest Preserve Tree Survey report).

### 2.2. Data Analysis

Once collected the data was used to classify the type of habitats present within the study area and reference area. Habitat classification was based on the City of Winnipeg guidelines (City of Winnipeg 2020). Classification was based on the composition of native and introduced plant species present with in each plot, including their percent cover. Other characteristics, such as % bare ground within a plot helped to determine how the habitat would naturally exist with no human disturbance. The presence of indicator species were also used to determine the habitat type, for example, the dominant presence of bur oak (*Quercus macrocarpa*) in the oak forest.

This data was then used to produce a map that delineates where each habitat type was located within the Tochal study area and reference area using ArcGIS. The same program was used to determine the total area of each habitat type.

Once the habitat types were determined each habitat was assessed and assigned a ranking from A – D based on guidelines provided by the City of Winnipeg (City of Winnipeg 2020; Appendix B). Rankings were determined based on the presence of anthropogenic disturbances and non-native (introduced) vegetation. Further analysis of the condition rankings, along with tree value appraisal can be found in the Tochal Arborists Report in Appendix C.

The conservation ranking of all species that were identified within the spring flowering and comprehensive vegetation surveys were checked in the NatureServe database to determine if any of the species present are considered rare (See Appendix D for provincial ranking definitions; NatureServe 2020B).

Characterizing the structure of the vegetation included calculating the average tree heights and DBH within each habitat type (using data from all plots that fell within a specific habitat type). Density of trees and small trees and shrubs within a habitat type were calculated by dividing the number of trees (or small trees/shrubs) within all plots in a given habitat type by the total area of all plots with a habitat type.

## 2.3 Results

### 2.3.1 Overview

During the flowering plant survey, conducted in June 2020, 27 species were identified. 68 species were identified during the comprehensive vegetation survey conducted in July/August, as well as one plant that could not be identified to the species level. Four species were unique to the flowering plant survey and were not identified during the comprehensive vegetation survey. Incidental observations accounted for seven additional species within the study area. A total of 80 unique species were identified between the two surveys and incidental observations (Appendix E). Of the species observed, 72% (N=57) of the species are native to Manitoba a with 28% (N=23) being introduced species. Overall, there are three main habitat types for the study area and one dominant habitat type within the reference area. The condition of each habitat type is ranked based on the City of Winnipeg habitat condition ranking standards (City of Winnipeg 2020; Appendix B).

### 2.3.2 Habitat Classification

The reference and study areas are reflective of a typical Winnipeg river bottom forest matrix. There are three major components to a river bottom forest, including the riverbank, the floodplain, and the terrace. Their occurrence follows a predictable pattern, starting from the river with transitions from one component to the next, occurring perpendicular to the river (Figure 3). These components are all present in different areas of the reference area and the Tochal study area as well as a grassland habitat component (Table 2). The riverbank forest dominates the reference area, while the floodplain forest dominates the study area. The terrace is represented in the study area as oak forest (Figure 4). See Appendix F for photo examples of each habitat type.

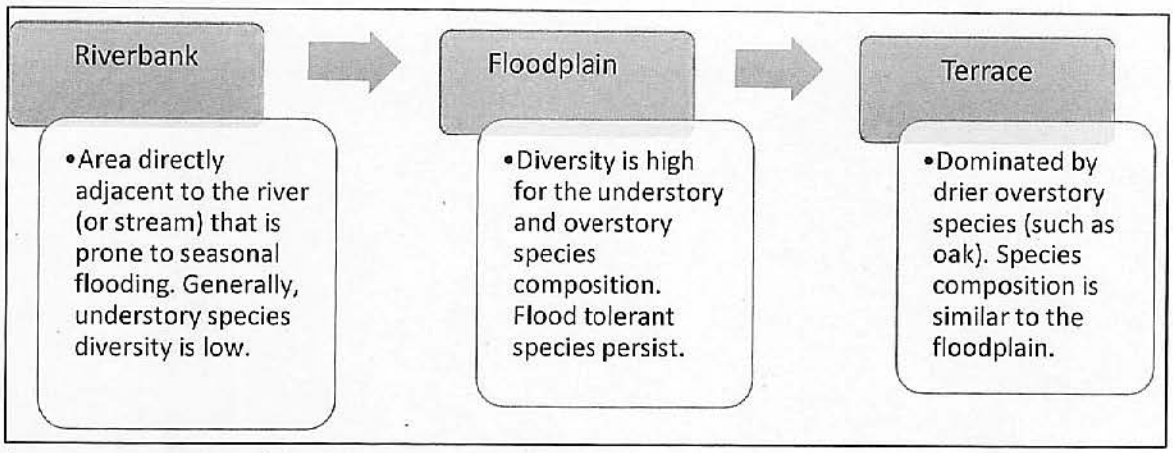


**Figure 3.** Description of the river bottom forest matrix.

**Table 2.** Overview of habitat size and condition.

| Habitat Type | Acres | Hectares | Condition |
|---|---|---|---|
| Floodplain Forest | 11.21 | 4.54 | A |
| Grassland (within Oak Forest) | 0.42 | 0.17 | C |
| Grassland (south of Forest habitats) | 5.11 | 2.07 | D |
| Oak Forest | 6.14 | 2.49 | B |
| Riverbank Forest | 8.09 | 3.27 | A |

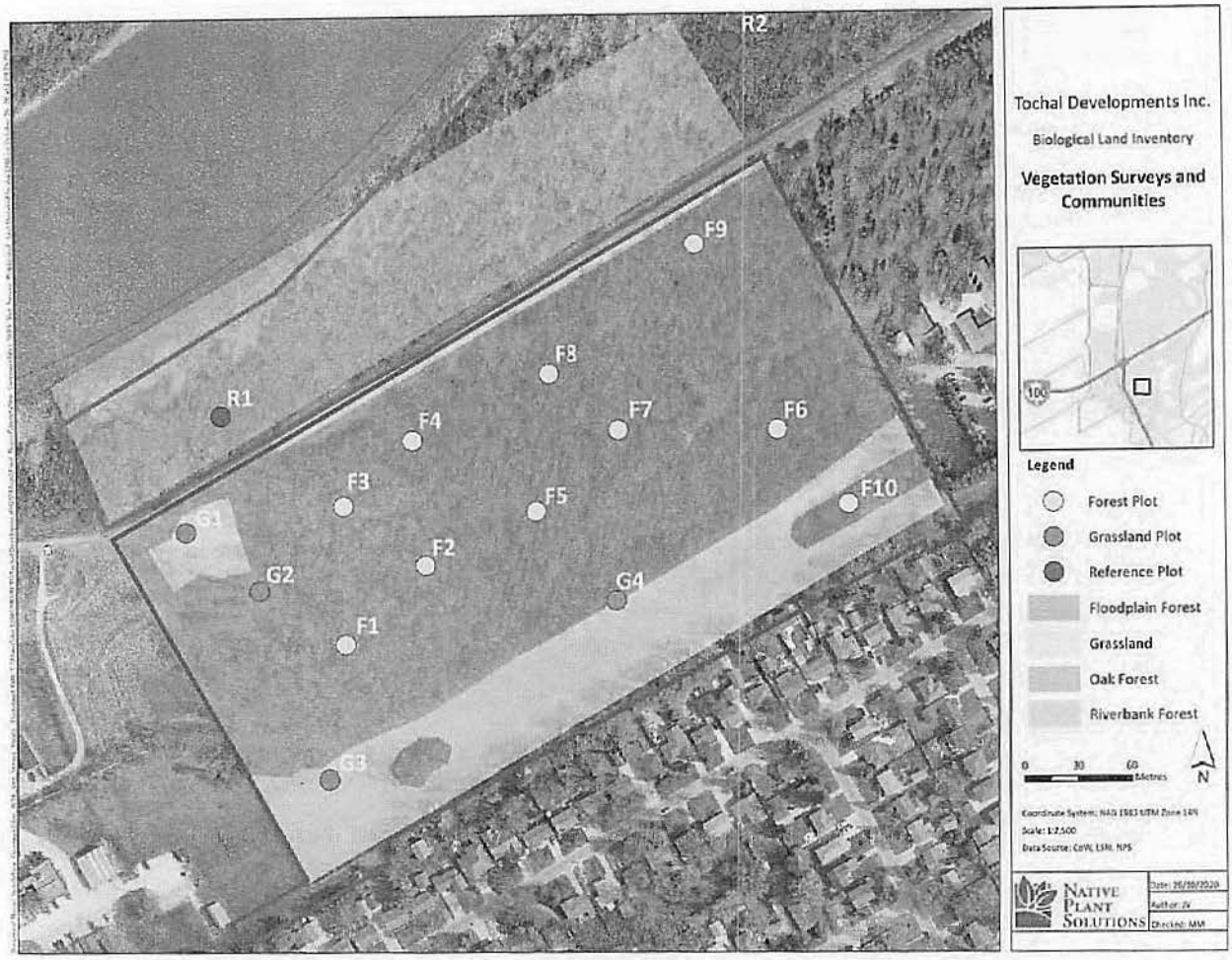


**Figure 4.** Map of habitat types classified within the Tochal study area and reference area with vegetation plots.

### 2.3.3 Riverbank Forest

**Figure 5.** Riverbank forest example with low vegetation cover and no shrub layer present.

*Historical*

There are two events that define the characteristics of the riverbank forest; flooding and spring ice jams. Flooding occurs when the water level rises beyond its banks and inundates the surrounding land. In southern Manitoba, flooding occurs annually, during the spring, and seasonally, during significant rain events, and deposits sediments and coarse woody material on the riverbank forest floor. Ice jams can rip large trees out from their roots and damage bark, leaving trees susceptible to insects, disease, or further physical damage from the elements. These natural disturbances often create valuable wildlife habitat, sought after by birds of prey and mammals as places of refuge. These two events heavily influence the species composition of wildlife and vegetation. A healthy riverbank forest has large areas of bare ground, some of which remain bare the entire year, while some of the bare ground will become vegetated with annual grasses or forbs, and tree seedlings during the growing season. The riverbank forest generally has few shrubs and low tree species diversity, as there are few trees and shrubs that can tolerate the disturbances of flooding and ice jams that affect this zone.

*Herbaceous Layer*

The herbaceous layer of the riverbank forest plots (R1 and R2; Figure 4) had a species richness of 22; 12 species in R1 and 15 in R2. Common moonseed (*Menispernum canadense*), bedstraw species (*Galium sp.*), and Virginia creeper (*Parthenocissus quinquefolia*) dominate the understory of plots located in the reference area. Bare ground was estimated to cover 35% in both R1 and R2, which is typical of a riverbank forest habitat type (Figure 5).

Of all the species observed within the herbaceous layer of the riverbank forest, four species are considered introduced species including dandelion (*Taraxacum officinale),* ground ivy (*Glechoma hederacea*), smooth bromegrass (*Bromus inermis*), sow thistle (*Sonchus arvensis),* and Virginia wild rye (*Elymus virginicus*). All introduced species had a percent cover of <5 or 'trace' with the exception of ground ivy that had 10% cover.

*Small Tree and Shrub Layer*

The small tree and shrub layer present in plot R1 was made up of three small tree seedlings; Manitoba maple (*Acer negundo*) and American elm (*Ulmus americana*). No shrubs were present. No shrubs or small trees were identified in plot R2.

*Tree Layer*

Within the tree layer of the riverbank forest two tree species were identified; green ash (*Fraxiunus pennsylvanica*) and Manitoba maple. Tree density calculated for these plots combined was 0.14 trees/$m^2$. DBH of the trees identified ranged from 12.70 to 27.40 cm; an average of 21.30 cm DBH overall. Tree heights ranged from 9.5 to 27.2 m; an average height of 20.5 m. All trees were alive standing (AS) with all bark present, no signs of decay, all or most foliage present, with some trees having lost some small branches or twigs.

*Habitat Condition Ranking*

Overall there was little, to no, anthropogenic disturbances observed to be impacting the reference area/riverbank forest. Some introduced species were observed but only with minimal coverage when present. Overall the riverbank forest is dominated by native species and therefore is assigned a condition ranking of A (Appendix B).

### 2.3.4 Floodplain Forest

*Historical*

Historically, a floodplain forest would be seasonally inundated with water during spring flooding from snow melt, the extent of which would be caused by the severity and duration of flooding at the time. Typically, a floodplain forest would also be affected by spring flooding, reducing the understory diversity, however, the Tochal study area is bordered by a constructed berm to the north which buffers the impact spring flooding has on species composition.

*Herbaceous Layer*

The herbaceous layer of plots within the floodplain forest (plots F4-F10; Figure 4) had an overall species richness of 43. A majority of plots had a high percent cover of common moonseed (Figure 6), with American hog-peanut (*Amphicarpaea bracteate*), sweet scented bedstraw (*Galium odorata*), peck's sedge (*Carex peckii*), and Virginia creeper being commonly observed in most plots throughout this habitat type. Indicators of a healthy old growth forest were also observed including nodding trillium (*Trillium cernuum*) and downy yellow violet (*Viola pubescens*). Common moonseed is also provincially ranked as S3 (vulnerable) in Manitoba by NatureServe. Of all the species observed only six are introduced species, all having a percent cover of <5 or 'trace' except for tatarian honeysuckle (*Lonicera tatarica*) in plot F6 having 5%.

**Figure 6.** Floodplain forest with a herbaceous layer dominated by common moonseed.

*Small Tree and Shrub Layer*

The small tree and shrub layer of the floodplain forest includes six species; two shrubs and four small tree species. The shrub species include saskatoon (*Amelanchier alnifolia*) and choke cherry (*Prunus virginiana*). The tree species include American elm, bur oak, green ash and Manitoba maple. The average height of the small trees identified was 7.04 m. This layer had an overall density of 0.42 small trees or shrubs/$m^2$.

*Tree Layer*

The same six woody species identified within the tree layer were also seen within the small tree and shrub layer. The saskatoon and choke cherry individuals included in this layer were included because of their large size and having a single stem. American basswoods (*Tilia americana*) were also observed incidentally within this habitat type. American basswoods are a shade tolerant species found only in mature forests that have had time to develop a closed canopy. The overall density of trees in the floodplain forest plots combined were similar to the riverbank forest at 0.14 $m^2$. The DBH of these trees ranged from 12.70 to 26.10 cm; an average of 17.20 cm. The heights ranged from 9.0 to 20.3 m; an average of 14.6 m. Most trees were AS with one alive leaning (AL) and one dead standing (DS). The trees were considered to have all bark present, no signs of decay, all or most foliage was present, with some trees having lost some small branches or twigs, with the exception of the DS tree that no foliage remaining, a loss of 5-25% of its bark, and had signs of decay including the presence of soft wood. Overall, the tree density, height, DBH and tree condition were continuous throughout the floodplain forest.

*Habitat Condition Ranking*

Some anthropogenic impacts exist within the floodplain forest including a small clearing with tables and tents used for traditional sweat lodge use, along with some unmaintained walking paths. Overall the disturbances have had minimal impact to the vegetation composition or canopy cover. It appears that some trees have been targeted for removal throughout the study area for reasons unknown. Overall the floodplain forest represents healthy old growth forest, dominated by native species and therefore is assigned a condition ranking of A (Appendix B).

### 2.3.5 Oak Forest

**Figure 7**. Oak forest canopy.

*Historical*

The final component of a river bottom matrix is the terrace, which is typically either the area furthest away from the river or at the highest elevation. At the Tochal study area, the oak forest represents the terrace. Despite the proximity to the river, the dominance of bur oak indicates that this area does not flood. Historically, approximately 1.4 acres of this section was historically used as a homestead. It is likely they installed drainage or flood protection measures, thereby allowing drier species to dominate. This area includes evidence of livestock grazing and several structures were found in a 1.4 acre area to the south, including stone bridges and cairns.

*Herbaceous Layer*

The herbaceous layer of plots within the oak forest (plots F1-3 and G2; Figure 4) had an overall species richness of 32. Common moonseed had a high percent cover ranging from 40-80% in most plots. Kentucky bluegrass (*Poa pratensis*) also had a high percent cover, especially when nearing areas of the oak forest with anthropogenic impacts (Plots F1 and G2; Figure 2). Other common species within the herbaceous layer included sweet scented bedstraw, Virginia creeper and American hog-peanut. Of all the species observed only six are introduced species. Kentucky bluegrass, smooth bromegrass and tatarian honeysuckle all had percent covers ranging from 15-75% within plots F1 and G2.

*Small Tree and Shrub Layer*

The small tree and shrub layer of the oak forest includes four species. The species includes choke cherry American elm, bur oak, and Manitoba maple. The average height of the small trees identified was 4.53 m. This layer had an overall density of 0.10 small trees or shrubs/$m^2$.

The historical site usage as a homestead is reflected by the presence of caragana *(Caragana arborescens)* and European buckthorn *(Rhamnus cathartica)*, observed incidentally within the oak forest. Historically,

these two introduced species were used as hedges because of their quick growth. It is now recognized that they are incredibly difficult invasive species to manage, with European buckthorn listed as a Tier 3 noxious weed in Manitoba (Government of Manitoba 2020).

*Tree Layer*

Within the tree layer of the oak forest five tree species were identified including American basswood, American elm, bur oak, green ash and Manitoba maple. Tree density calculated for these plots combined was 0.08 trees/$m^2$. DBH of the trees identified ranged from 6.70 to 50.30 cm; an average of 22.60 cm DBH overall. Tree heights ranged from 4.4 to 23.9 m; an average height of 13.0 m. All trees were alive standing with the exception of two that were alive leaning. Most trees have all bark present, no signs of decay, all or most foliage was present, with some trees having lost some small branches or twigs. Only one Manitoba maple showed some evidence of limited decay present.

*Habitat Condition Ranking*

Some anthropogenic impacts exist including an area of 1.4 acres that was historically used as a homestead and/or for grazing purposes, as evident by pugging and hummocking; divots in the soil that remain after livestock traffic. This area is also seeing encroachment of introduced vegetation species that are having a higher percent cover in the overall species composition in the herbaceous layer. However, much of the area still reflects a natural condition and is dominated by native species therefore, it is assigned a condition ranking of B (Appendix B).

### 2.3.6 Grassland

*Historical*

The grassland habitat that exists within the study area is the result of anthropogenic disturbances. Plot G1 falls within the historic homestead area within the oak forest, while plots G3 and G4 are located on the southern edge of the property outside of the forest boundary (Figure 7).

*Herbaceous Layer*

The herbaceous layer of plots within the grassland habitat (plots G1, G3-4; Figure 4) had an overall species richness of 20. Most species observed within these plots are introduced species with the most common and dominant being smooth bromegrass, Kentucky bluegrass, and alfalfa (*Medicago sativa*). Some native species were observed within plot G1 including three-leaf Solomon's plume (*Maianthemum trifolium*) and Virginia creeper; both had 15% cover. The area south of the oak and floodplain forests, where plots G3 and G4 can be found is frequently mowed.

*Small Tree and Shrub Layer*

Plot G1, located in the historical homestead area, had a shrub layer made up of tatarian honeysuckle, an introduced variety of honeysuckle. It had an overall density of 0.28 plants/$m^2$. Plots G3 and G4 had no shrub layer present.

*Tree Layer*

No tree layer was present on any plots within the grassland habitat type.

*Habitat Condition Ranking*

The grassland habitat containing Plot G1 (Figure 4) is typical of an old agricultural area that has not been recently used. It is dominated by introduced species, however native species are still present and may return; therefore, it has been given a condition ranking of C (Appendix B).

The grassland habitat containing plots G3 and G4, is heavily disturbed, dominated by introduced species and has few native species present. Therefore, it has been given a habitat condition ranking of D (Appendix B).

### 2.3.7 Reference Habitat and Study Area Comparison

The reference habitat and the study area habitats observed on the Tochal site are considerably different and provide different ecological services. During the nocturnal owl and amphibian surveys, it was noted that the reference habitat was flooded up to the berm with excess water from the rising river, while the only patches of the study area was inundated with water from snow melt. The more extensive flooding experienced by the riverbank forest within the reference area has decreased the species richness compared to the other forest types. The reference area also has a higher percent cover of bare ground (n=35%) than the oak forest and floodplain forest habitats (N=20.3%, 28.6% respectively) due to the more extensive and longer lasting flooding it experiences. The flooding also impacts the shrub layer by drastically reducing the density of small trees and shrubs present. While tree density is the same between the floodplain forest and riverbank forest habitats, the floodplain forest has a more developed shrub layer with a density of 0.42 small trees and shrubs/$m^2$ and the riverbank forest has 0.06 small trees and shrubs/$m^2$

Species richness within the riverbank forest (N=22) of the reference habitat is reduced compared to the floodplain forest and oak forest (N=43, N=32 respectively). However, some species observed were unique to the reference habitat, including beggar's tick (*Bidens frondosa*), ground ivy, purple avens, red baneberry (*Actaea rubra*), red-osier dogwood (*Cornus sericea)* and tufted loostrife (*Lysimachia thrysiflora*). All of these species had a ground cover of <5% or 'trace', with the exception of ground ivy which had a 10% ground cover in the plot it was found in.

While the habitats are similar in some respects, the decrease in species richness and habitat complexity (i.e., decrease in the presence of a shrub layer) reduces the variety of niches available for wildlife use and therefore will likely reduce the species richness of wildlife using the reference area as compared to the study area.

**Table 3.** A comparison of the parameters recorded for the reference area and study area.

| Parameter | Study Area | | | Reference Area |
|---|---|---|---|---|
| | Grassland | Floodplain Forest | Oak Forest | Riverbank Forest |
| Average DBH (cm) | - | 17.2 | 22.6 | 21.3 |
| Average Tree Height (m) | - | 14.6 | 13 | 20.5 |
| Tree Density (trees/$m^2$) | 0 | 0.14 | 0.08 | 0.14 |
| Small Tree and Shrub Density (small trees and shrubs/$m^2$) | 0 | 0.42 | 0.1 | 0.06 |
| Species Richness | 20 | 43 | 32 | 22 |
| Total Native Species | 6 | 37 | 37 | 18 |
| Total Introduced Species | 14 | 6 | 6 | 4 |
| Average % Bare ground/plot | 0 | 28.6% | 20.3% | 35% |
| Dominant Species by Vegetation Layer | | | | |
| Herbaceous | Kentucky bluegrass, smooth bromegrass, alfalfa | common moonseed, American hog-peanut, sweet scented bedstraw, peck's sedge | common moonseed, Kentucky bluegrass | common moonseed, Virginia creeper |
| Shrub | - | saskatoon, choke cherry, American elm, bur oak, green ash, Manitoba maple | choke cherry, American elm, bur oak, Manitoba maple | Manitoba maple, American elm |
| Tree | - | saskatoon, choke cherry, American elm, bur oak, green ash, Manitoba maple | American basswood, American elm, bur oak, green ash, Manitoba maple | green ash, Manitoba maple |

# 3. Nocturnal Owl Surveys

## 3.1 Methodology

Owl species sit at the top of the food chain and are subsequently good indicators of ecosystem health. Due to the nocturnal nature of most owls, their presence is often overlooked, and they are not included in conventional bird surveys. Nocturnal owl surveys are conducted at a time of year when owls are most vocal (i.e., breeding season), which can vary from region to region and from species to species. In Manitoba, the protocol for long-term owl surveys is to conduct them between late March and mid-April (Takats et al. 2001). Surveys were repeated four times between April 1, 2020 and April 23, 2020 on April 4th, 16th, 23rd and 30th, to detect seasonal variation in species and abundance of owls.

The Guidelines for Nocturnal Owl Monitoring in North America (Takats et al. 2001) recommends a spacing of 1.6 km between stations to ensure the same owl is not heard during consecutive stops; however, the provincial and state protocols listed within the document range from 400 m to 2 km. As a result, a distance of 800 m was selected for surveys at Tochal so that calling owls are not missed during the survey, while limiting the probability of double counting individuals. In the case of the Tochal study area, one survey station allowed for sufficient coverage of the study area to detect all calling owls present. The owl survey station was located between the study area and the reference habitat in order to allow for detection of owls within both areas (Figure 8). At the same time the survey location was also within vocal detection range of the grassland to detect species that may be using both forested and grassland habitats.

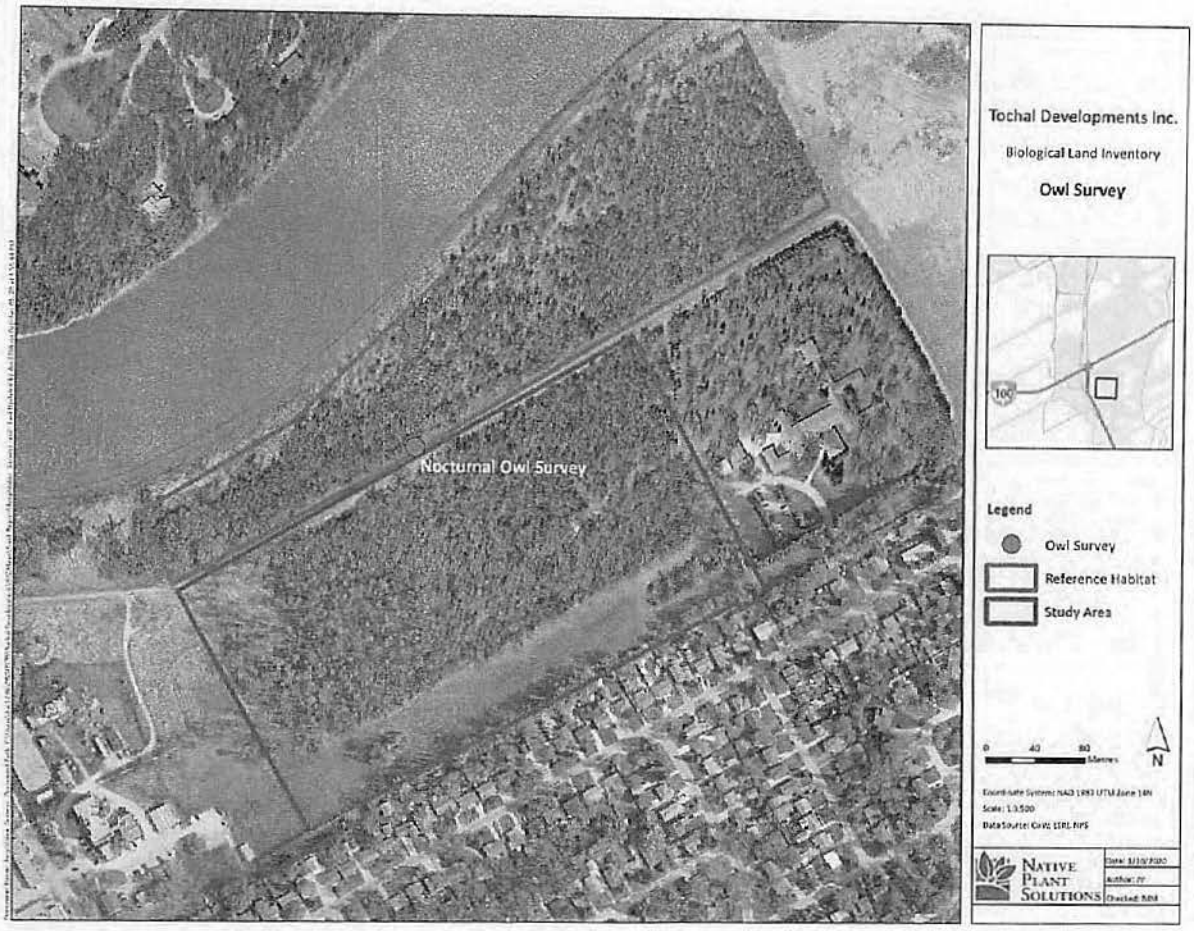


**Figure 8.** Nocturnal owl survey point location.

During a single five-minute listening period, the surveyor recorded the number of owl calls, the species, and the approximate direction and distance from the observer.

Surveys took place between a half an hour after sunset (approximately 9:00 pm) and midnight, as recommended by Takats et al. (2001). The survey ended at midnight, as call rates are the most frequent immediately after dark and in the early morning but decline during the middle of the night for some species (Takats et al., 2001).

### 3.2 Results

Throughout the nocturnal owl surveys, calls of the barred owl (*Strix varia*) were recorded as follows:

- One individual in the reference habitat on April 23rd; and
- Five individuals in the Tochal study area on April 30th.

Additionally, owl nests and feathers where observed during the vegetation inventory and breeding surveys completed later in the season.

### 3.3 Species Overview

The barred owl nests in dense woodland and forest, most often in areas bordering waterways. They require mature trees that provide cavities suitable for roosting and nesting, therefore, they are often present in older forest habitats. They prefer a canopy closure of 60% or greater. These characteristics are present within the Tochal study area. When forest habitats become fragmented, barred owls are often replaced with great horned owls, a trend that was not observed within the study area, suggesting that the study area provides good quality, mature forest (NatureServe 2020). Populations of barred owls in Manitoba are ranked in NatureServe as S3S4, between vulnerable and apparently secure.

## 4. Amphibian Surveys

### 4.1 Methodology

Amphibian species can be extremely sensitive to changes in the environment, due to their cold-blooded nature and dependency on both terrestrial and aquatic habitats. Subsequently, amphibians serve as an indicator to overall environmental health and diversity of available habitats. Maintaining suitable habitat for amphibians also ensures habitat for a wide range of other animals, because it involves the protection of both terrestrial and aquatic areas.

Amphibian surveys were conducted weekly for four weeks, at three survey points within the Tochal study area and reference area (Figure 9). These surveys were repeated weekly between April 30$^{th}$ and May 19$^{th}$, 2020. This timing is based on recommendations from the Manitoba Herps Atlas (2012) which states that in Manitoba, frog and toad species breed at various times throughout the spring and early summer, ranging from mid-April into July. Species that exist in and around Winnipeg generally cease calling around mid-June (Manitoba Herps Atlas 2012). Surveys were conducted on a weekly basis in order to account for variation amongst species that call during different times of the year. This is a similar system used by the Marsh Monitoring Program in Ontario (Konze & McLaren 1997) and recommended by the North American Amphibian Monitoring Program protocol (Patuxent Wildlife Research Centre 2012).

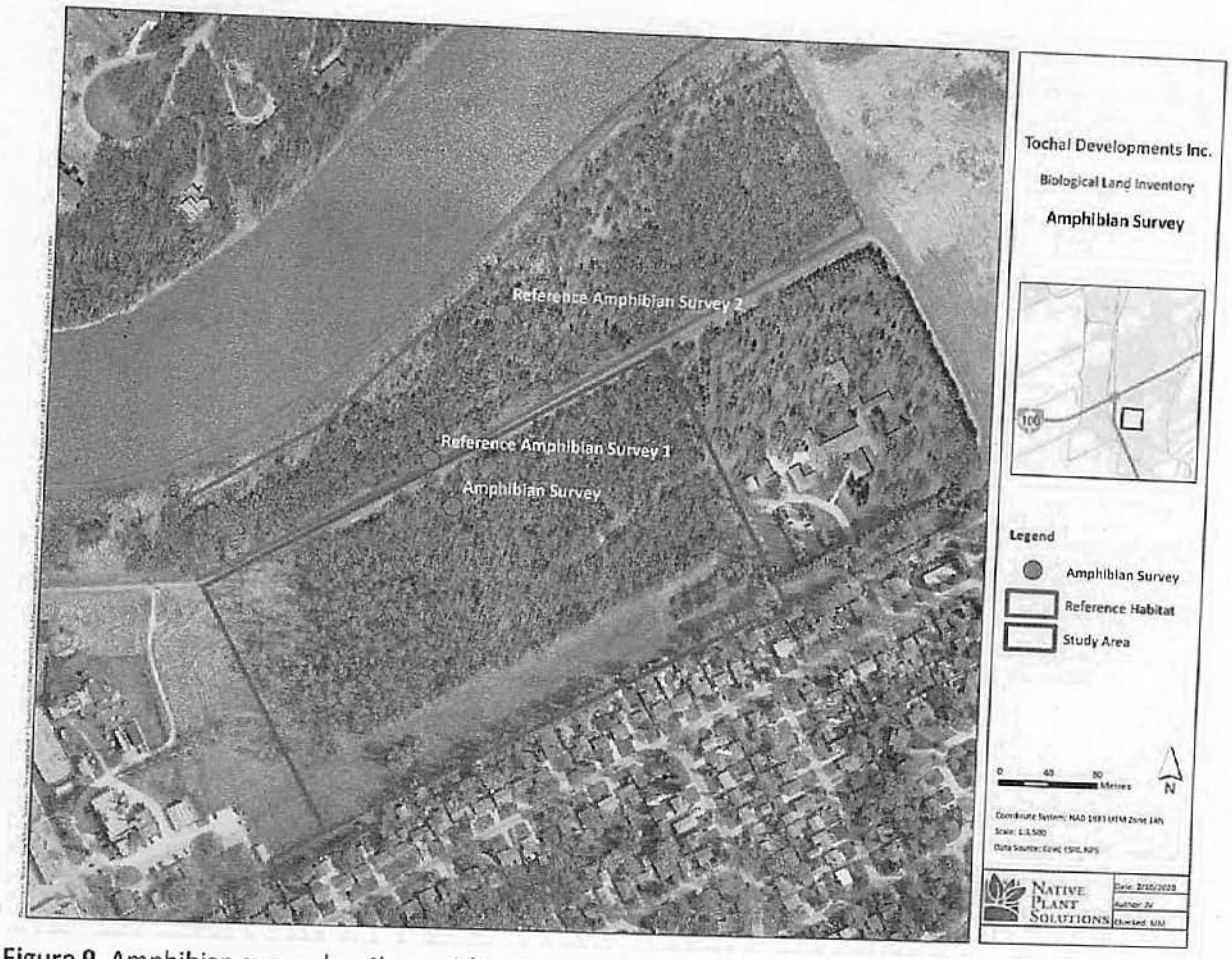


**Figure 9**. Amphibian survey locations within the study area and reference area.

Surveys started 30 minutes after sunset (Approximately 8:45 pm) and were completed by 1 am (Patuxent Wildlife Research Centre 2012; Saskatchewan Ministry of Environment 2009). Surveys were not conducted during heavy rainfall or winds stronger than 20 km/hr (Patuxent Wildlife Research Centre 2012). Sample locations included floodplain forest habitat within the study area and riverbank forest habitat within the reference area. Sample locations had a minimum spacing of 500 m between each other and were 200 m away from major roads in order to decrease noise distractions.

At each sample location one five-minute listening period was conducted immediately upon arrival and the amphibian call index for each species was recorded (Patuxent Wildlife Research Centre 2012). The amphibian call index is recommended by the North American Amphibian Monitoring Program protocol (Patuxent Wildlife Research Centre, 2012) and is a standard three-level calling code used by the United States Geological Survey, Environment Canada, the Fish and Wildlife Branch of the Saskatchewan Ministry of Environment, and the Marsh Monitoring and the Backyard Frog Survey Programs in Ontario.

Global Positioning System (GPS) coordinates, time, wind code, air temperature, and a brief description of any excessive noise occurring during the survey (e.g. dog barking, cars, train, etc.) were recorded at each

station, as well as at the beginning and end of each survey period. As per the North American Amphibian Monitoring Program protocol (Patuxent Wildlife Research Centre, 2012), any major noise disturbance lasting over one minute permitted the surveyor to break the listening period into two parts.

### 4.2 Results

No amphibians were detected within the study area or the reference habitat during the amphibian surveys. The forest and grassland habitat conditions of the study area do not provide the habitat required for breeding frogs, which includes a suitable waterbody for laying eggs in. Some pools of water were present due to snow melt, however no standing water was present during the breeding season for frogs in April.

## 5. Breeding Bird Surveys

### 5.1 Methodology

Breeding bird surveys are important to identify the diversity and abundance of birds using an area. Not only does it determine the species present, but it also identifies the habitat types used by different groups of birds, such as waterfowl, raptors, or blackbirds. These surveys give important indications of the ability of a habitat to support high species diversity.

Three locations were surveyed at the Tochal study area, using a point count. Two survey locations were stratified across the Tochal study area to ensure both forest and open habitat was surveyed (Bird Point Count 1 & 2). An additional survey location fell within the reference area (Reference Bird Point Count; Figure 10). Each survey location was located a minimum of 200 m apart (British Columbia Ministry of Environment 1999; Gregory et al. 2004).

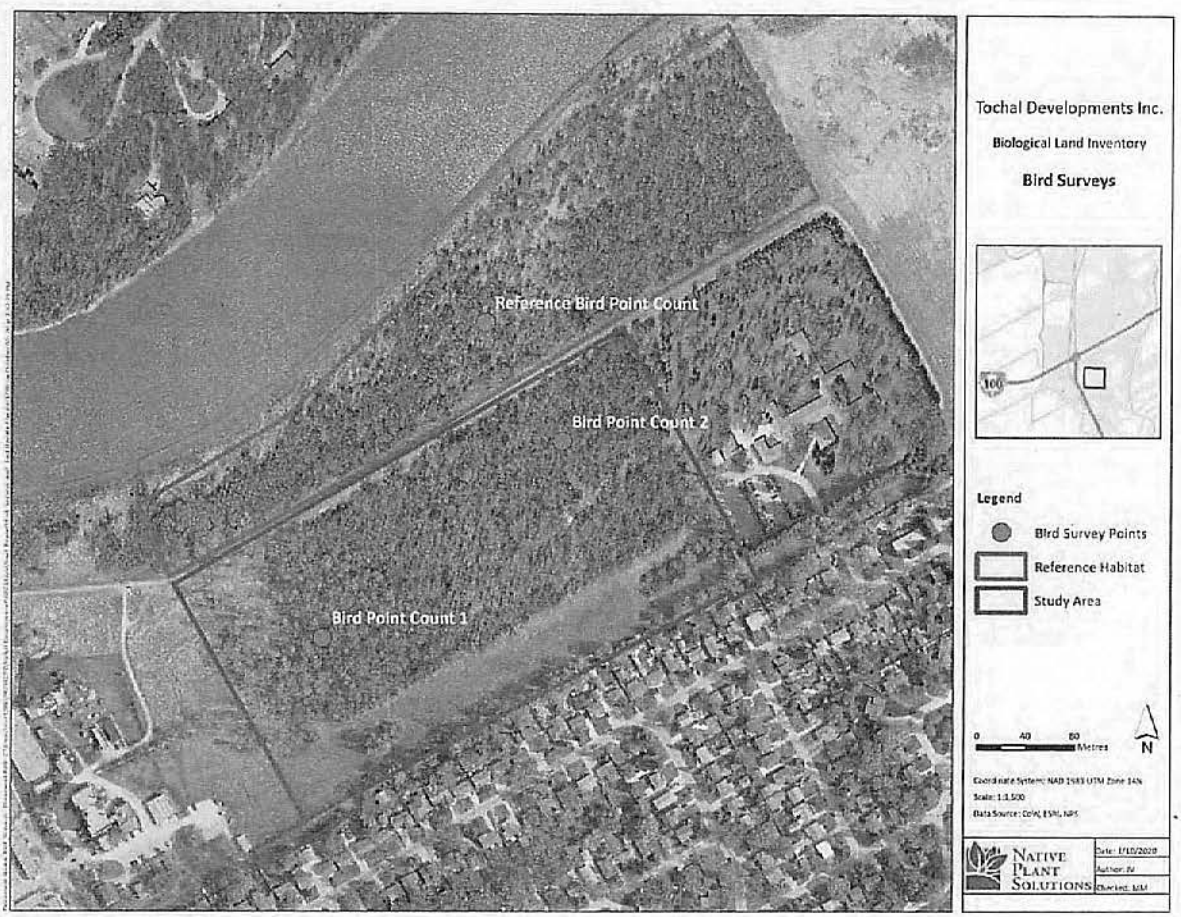


**Figure 10.** Location of breeding bird survey locations.

Each location was surveyed once per week between June 2nd and June 24th, 2020, which falls within the breeding bird season (late May to early July). A total of 12 surveys were completed. Surveys commenced 30 minutes after sunrise (approximately 5:20 am) and continued until 8:30 am, which is the time period when most species exhibit the highest rates of singing and displaying. Surveys were not conducted during heavy rainfall or winds stronger than 20 km/hr to ensure the greatest probability of detection.

The point count surveys consisted of a two-minute period of silence, followed by a five-minute observation period to detect birds by sight and by vocalizations. A five-minute observation period is standard practice when surveying birds. It allows for a higher probability of detecting all species present while limiting chances of double counting individuals. It also ensures that survey effort was consistent at all locations (Ralph et al. 1993).

At each sample station the GPS coordinates, time, wind speed, and weather data were recorded.

## 5.2 Results

A total of 256 individual birds were detected during the breeding bird surveys (Appendix G). Overall, this includes 23 different species identified by sight and sound. Birds from an unidentified gull species and an unidentified woodpecker species were also recorded. Two additional species were also identified

incidentally during the vegetation surveys. The most common bird species was the yellow warbler (*Setophaga petechia)* (n=76), followed by the cedar waxwing (*Bombycilla cedrorum*) (n=54) and the American robin (*Turdus migratorius*) (n=28). Species richness was 14 for both Bird Point Count 1 and the Reference Bird Point Count, while Bird Point Count 2 had a species richness of 19. Bird Point Count 2 falls within floodplain forest. The mature age and complexity of the floodplain forest provides habitat for a wider array of species (Hobson and Bayne 2000), and therefore we see greater species richness in this habitat type compared to the oak forest or the riverbank forest. Overall, the species present within the study area tend to use large, mature trees affected by rot which are soft enough to be excavated for cavity nesters, including multiple woodpecker species, wood ducks (*Aix sponsa*), black-capped chickadees (*Poecile atricapillus*) and white-breasted nuthatches (*Sitta carolinensis*) (Gutzat and Dormann 2018; Pridham and McLeod 2001). Trees capable of providing this habitat feature are difficult to replace, taking decades to reach the required size and softness.

While the Reference Bird Point Count had similar species richness to Bird Point Count 1 and 2 in the study area, they differ in the type of species present. The Reference Bird Point Count had American redstarts (*Setophaga ruticilla*), red-winged black birds (*Agelaius phoeniceus*), an unidentified gull species (*Larus sp.*), and a higher occurrence of magnolia warblers (*Setophaga magnolia*). The reference site lacked species such as the clay-colored sparrow (*Spizella pallida*), Eastern wood pewee (*Contopus virens*), great crested flycatcher (*Myiarchus crinitus*), least flycatcher (*Empidonax minimus*), black-capped chickadee, ovenbird (*Seiurus aurocapillus*), white-breasted nuthatch, and the chipping sparrow (*Spizella passerina*), which were observed in the study area. These species rely on large old growth trees, which are more common in the floodplain forest and oak forest habitats present in the study area.

### 5.3 Species Overview

Observed bird species of special interest include the Canada warbler (*Cardellina canadensis*), which has a provincial rating of S3 and is listed federally under COSEWIC as a threatened species. This federal designation exists, as 80% of this species' population is limited to breeding habitat within Canada. They continue to face a long term, significant decline in population, with no sign of this trend reversing. The cause for their decline is unknown; however, the loss of overwintering habitat in South America is suspected. Their habitat preference includes old growth, moist, mixed deciduous forest, with a well developed and structurally complex forest floor (COSEWIC 2008), similar to what was observed in the Tochal study area. The reference habitat lacks a well-developed shrub layer or a complex forest floor, due to frequent flooding from the river. Subsequently, fewer Canada warblers were observed in the reference habitat plot surveys compared to the study area.

The Eastern-wood pewee (*Contopus virens*) also has a provincial rating of S3 and is federally listed as a species of Special Concern under COSEWIC. While it is a common and widespread song bird, it has experienced a 25% decline in population over the last 10 years. The Eastern-wood pewee has a specialized diet of flying insects, whose population decline has been linked to a loss of food sources. A loss of overwintering habitat in South America also contributes. Their habitat preference includes the canopy layer of forest clearings or edges of deciduous and mixed forests. They are most prevalent in forests of intermediate age, or mature forests with little understory (COSEWIC 2012). The Eastern-wood pewee was most abundant in the west portion of the study area where plot Bird Point Count 2 was located.

It is important to note that all construction activities affecting natural habitats should be conducted outside of critical bird breeding seasons. In accordance with the Migratory Birds Convention Act (1994), disturbance or destruction of nests or eggs of migratory birds is prohibited (Government of Canada 2018). The majority of species detected within the Tochal study area are migratory bird species fall under this Act are therefore protected during breeding season. The regional nesting period for Winnipeg, as set by Environment Canada, is late-April to late-August (Government of Canada 2018B). Development in accordance to this standard will lessen the impact on all wildlife species.

# 6. Arthropod Survey

## 6.1 Methodology

Bumble bee species were the focus of the arthropod surveys. As important pollinators of the landscape, they provide a key service to local wild and domestic flowering plants, contributing to their reproductive success. Habitat loss and fragmentation has caused an overall decline of wild bee populations, with some species such as the rusty patched bumble bee (*Bombus affinis*) experiencing over 90% decline in population (US Fish and Wildlife 2019). Understanding how the Tochal study area supports bumble bee populations can indicate the health and diversity of the area.

Surveys were conducted using a non-lethal method, which collects and releases the bees back into the environment. Four survey plots were distributed throughout all habitat types of the Tochal study area, including one within the reference habitat north of the study area (Figure 11). Each survey plot was 3 acres in size (US Fish and Wildlife 2019). At least one person-hour was spent looking for bumble bees per 3 acre plot, or until at least 150 bumble bees were sighted. If a plot was deemed to be of lesser quality for bumble bee species (i.e., no or few desirable flower species in bloom), less time was spent surveying that plot (US Fish and Wildlife 2019). Surveys were conducted when temperatures were above 15.5 °C, during dry conditions (i.e., no rain or fog). Optimal weather conditions included sunny days with low wind speeds. The landscape within each plot was scanned for bumble bee activity (US Fish and Wildlife 2019). If bumble bees were not obvious, surveyors travelled from flower patch to flower patch looking for active bumble bees.

Upon sighting a bumble bee, photos the bee was taken using a digital SLR camera prior to capture with a petri dish. The bumble bee was then given a specimen number, photographed again and released.

## 6.2 Results

On August 7th, 2020, arthropod surveys were conducted throughout the Tochal study area and the reference habitat. Three plots were surveyed in the study area; however, no bumble bees were observed in this area (Figure 11). The habitat was largely forest understory with no flowering plants and subsequently, did not provide good bumble bee habitat. A limited number of flowering plants were identified during the spring surveys conducted in June, suggesting that the forested area (bee survey plots 2 and 3) are not suitable bumble bee habitat.

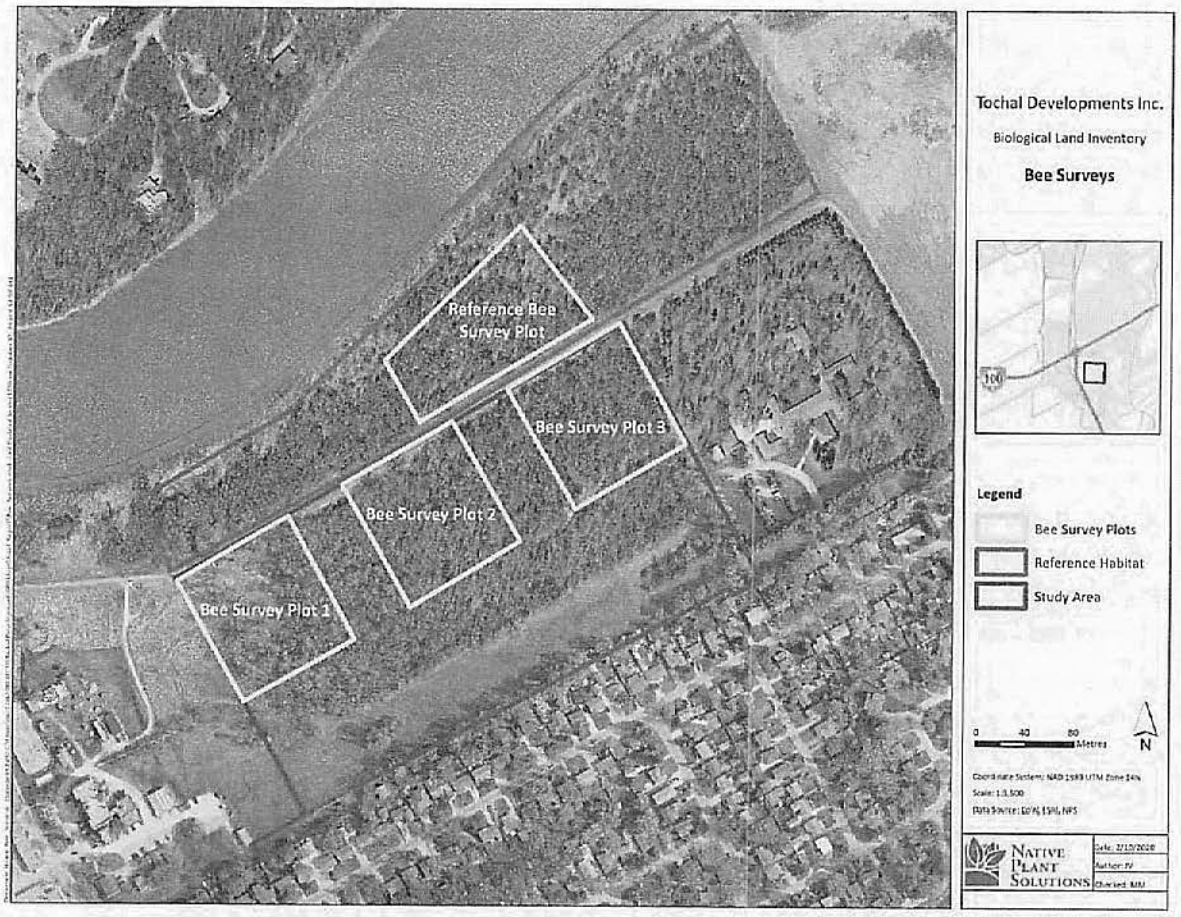


**Figure 11.** Location of arthropod surveys within the Tochal study area and reference area.

While conducting the survey in bee survey plot 1, an area of open grassland, shrubs, and some old growth trees, an incidental honey bee hive was identified with 200 or more honeybees *(Apis spp.)*. The hive was located in an old, cracked American elm tree trunk. This hive likely subsisted on the multitude of caragana and tatarian honey suckle shrubs, as well as the common milkweed that were in flower earlier in the season within this plot.

Within the bee survey reference plot an estimated 21 bumble bee individuals were observed but were unable to be sampled or identified. In addition, two bumble bees were captured and photographed. They were later identified to be a yellow-banded bumble bee (*Bombus terricola*) and tri-colored bumble bee (*Bombus ternaris*). Both species are ranked provincially as being secure in their population numbers. The bumble bees observed in the reference habitat were making use of a large localized patch of Canada thistle flowers. The natural forest understory within the plot was not being used by bumble bees due to a lack of available food sources.

# 7. Incidental Mammal Observations

## 7.1 Methodology

Mammals are a valuable part of an ecosystem. The variety of species that comprise this group can be broad and occupy diverse niches, acting as both predator and prey. Many urban mammals are often small and conspicuous in their environment. However, they can impact urban areas, often coming into conflict with humans via property damage, vehicle collisions, or disease transmission. By understanding what mammal species exist within the study area efforts can be made to mitigate these effects.

Mammal data was collected incidentally during all site visits. Observations included species and numbers, as well as evidence of animal presence such as tracks, feces, beds and trails.

## 7.2 Results

Throughout all surveys five mammal species were observed during the surveys (Appendix G). Mammal observations in the both the study area and reference habitat included multiple white-tailed deer (*Odocoileus virginianus*), North American red squirrels (*Tamiasciurus hudsonicus*), an American mink (*Vision vision*), and a raccoon *(Procyon lotor*). These species are secure in their population numbers and exhibit a generalist use of habitat resources.

Vocalizations of a bat species were also heard in early spring during the nocturnal owl surveys. Little brown bats (*Myotis lucifugus*) are the earliest and only species active during this time of year. They are provincially listed as S2N, meaning that non-breeding populations of little brown bats are at a high risk of extirpation within the area due to steep declines or severe threats to the population. Federally, little brown bats are listed under COSEWIC as endangered. The population of hibernating little brown bats has declined 94% overall in eastern Canada, due to the introduction of a pathogen causing fungal disease known as white-nose syndrome. While western populations have faired better, the current range of white-nose syndrome has been expanding at a rate of 200 to 250 km per year and is likely to affect the entire Canadian population within 12 to 18 years (COSEWIC 2013). Their habitat typically includes large-diameter trees and forest edges along waterways, where they forage for insects over water bodies.

# 8. Conclusion

The data collected throughout the Tochal Biological Inventory indicates the many plant and wildlife species that inhabit the area as well as the quality of the habitats overall. Overall the floodplain forest and riverbank forest depict high quality habitat (grade A) dominated by native species and large mature trees that provide habitat to a wide number of wildlife species, with emphasis on the floodplain forest due to its higher species and structural diversity in comparison to the riverbank forest. These forest types support a handful of provincial and federal species of concern including the barred owl, Canada warbler, Eastern-wood pewee, and little brown bats. While species rankings do not constitute any legal obligations on the part of the landowner, they are important to be aware of when planning future developments. These species all rely on mature forest stands, emphasizing the value of preserving and/or mitigating for the mature forest stands present at Tochal.

The majority of breeding bird species detected within the Tochal study area are migratory bird species and in accordance with the Migratory Birds Convention Act (1994), disturbance or destruction of nests or eggs of migratory birds is prohibited (Government of Canada 2018) during breeding season. The regional nesting period for Winnipeg, as set by Environment Canada, is late-April to late-August (Government of Canada 2018B). Development in accordance to this legal standard will lessen the impact on all wildlife species.

## 9. References


British Columbia Ministry of Environment. 1999. Inventory methods for forest and grassland songbirds: standards for components of British Columbia's biodiversity No. 15. Ministry of Environment, Lands and Parks, Resources Inventory Branch for the Terrestrial Ecosystems Task Force, Resources Inventory Committee, Victoria, BC. 37 pp.

City of Winnipeg. 2020. Habitat assessment and grading. [Online] Available: https://winnipeg.ca/publicworks/parksOpenSpace/NaturalistServices/NaturalAreas/Assess.stm (Accessed: September 15, 2020).

Cornell University.2019. All about birds, barred owl. [Online] Available: https://www.allaboutbirds.org/guide/Barred_Owl/overview (Accessed: October 21, 2020).

COSEWIC. 2008. COSEWIC assessment and status report on the Canada warbler *Wilsonia Canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp.

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern wood-pewee *Contopus virensin* Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp.

COSEWIC. 2013. COSEWIC assessment and status report on the little brown myotis *Myotis lucifugus*, northern myotis *Myotis septentrionalis* and tri-colored bat *Perimyotis subflavusin* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp

Government of Canada. 2018. Migratory Birds Convention Act (MBCA) and Regulations. [Online] Available: https://www.canada.ca/en/environment-climate-change/services/migratory-birds-legal-protection/convention-act-regulations.html (Accessed October 22, 2020).

Government of Canada. 2018B. Nesting periods. [Online] Available: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html (Accessed October 22, 2020).

Government of Manitoba. 2020. Declaration of noxious weeds in Manitoba. [Online] Available: https://www.gov.mb.ca/agriculture/crops/weeds/declaration-of-noxious-weeds-in-mb.html# (Accessed October 21, 2020).

Gregory, R.D., D.W. Gibbons, and P.F. Donald. 2004. Bird census and survey techniques. Pages 15-55 *in* W.J Sutherland, I. Newton, and R. Green (eds.). Bird Ecology and Conservation, Oxford University Press, New York, NY.

Gutzat, F. and C.F. Dormann. 2018. Decaying trees improve nesting opportunities for cavity-nesting birds in temperate and boreal forests: A meta-analysis and implications for retention forestry. Ecology and Evolution. 8(16):8616-8626.

Hobson, K.A. and E. Bayne. 2000. The effects of stand age on avian communities in Aspen-dominated forests of central Saskatchewan, Canada. Forest Ecology and Management. 136:121-134.

Konze, K. and M. McLaren. 1997. Wildlife monitoring programs and inventory techniques for Ontario. Ontario Ministry of Natural Resources. Northeast Science and Technology. Technical Manual TM-009. 139 pp.

Manitoba Herps Atlas. 2020. Species info. [Online] Available: http://www.naturenorth.com/Herps/Manitoba_Herps_Atlas.html [2012 April 9].

Nash, J. 2016. City of Edmonton temporary sample plot (TSP) and permanent sample plot (PSP) procedures. Greenlink Forestry Inc.

NatureServe. 2020. Myotis lucifugus Little Brown Myotis. [Online] Available: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.100473/Myotis_lucifugus (Accessed: October 8, 2020).

NatureServe. 2020B. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available https://explorer.natureserve.org/. (Accessed: October 23, 2020).

NatureServe. 2020. Strix varia barred owl. [Online] Available: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.103621/Strix_varia (Accessed: October 8, 2020).

Patuxent Wildlife Research Centre. United States Geological Survey. 2020. Protocol description. North American amphibian monitoring program. [Online] Available: http://www.pwrc.usgs.gov/naamp/index.cfm?fuseaction=app.protocol (Accessed April 9, 2020).

Pridham, D. and G. McLeod. 2001. A landowner's guide to selling standing timber. Ontario Woodlot Association. Kempsville, Ontario.

Ralph, C.J., S. Droege, and J.R. Sauer. 1995. Managing and monitoring birds using point counts: standards and applications. USDA Forest Service General Technical Report. PSW-GTR-149.

Roberts-Pichette, P. and L. Gillespie 1999. Terrestrial vegetation biodiversity monitoring protocols. EMAN Occasional Paper Series, Report No. 9. Ecological Monitoring Coordinating Office, Burlington, Ontario.

Takats, D.L, C.M Francis, G.L. Holroyd, J.R. Duncan, K.M. Mazur, R.J. Cannings, W. Harris, and D. Holt. 2001. Guidelines for nocturnal owl monitoring in North America. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, AB. 32 pp.

US Fish and Wildlife Service. 2019. Survey protocols for the rusty patched bumble bee (*Bombus affinis*).

# Appendix A. LeMay Forest Preserve Tree Surveys

May 27, 2020

Tochal Developments Inc.
Winnipeg, MB

ATTENTION: Mazyar Yahyapour
RE: LeMay Forest Preserve Tree Surveys

## Introduction

Native Plant Solutions (NPS) has been asked by Tochal Developments Inc. to complete a tree survey on an area of approximately 5 acres located in St. Norbert, Winnipeg. The tree survey investigates the tree species, tally, density, size, condition and age in order to characterize the 5 acres of forest that make up the study area. The information from the tree surveys can then be used to estimate of the number of trees present as well as to calculate an approximate wood volume estimate.

## Methodology

### *Plot Selection*

The site was visited for an initial inspection on May 8, 2020 to determine the variability and density of the habitat in order to best structure the surveys. The distribution of tree species, sizes and density was consistent throughout the study area so it was deemed that 6 plots would be sufficient to characterize the trees present (Figure 1). Upon entering the study area plots were randomly selected by throwing a pin flag and surveying the area it landed.

Plot delineation was based on methodology in Nash (2016) by delineating 25 $m^2$ plots placed randomly throughout the study area. The first corner flag was placed in the ground and 25 X 1 m plot was delineated from that point. The measuring tape and flagging tape was placed along the edge of the quadrat to clearly delineate the boundary. A tree or shrub was considered within the plot if more than 50% of the plant was located inside of the flagged plot.

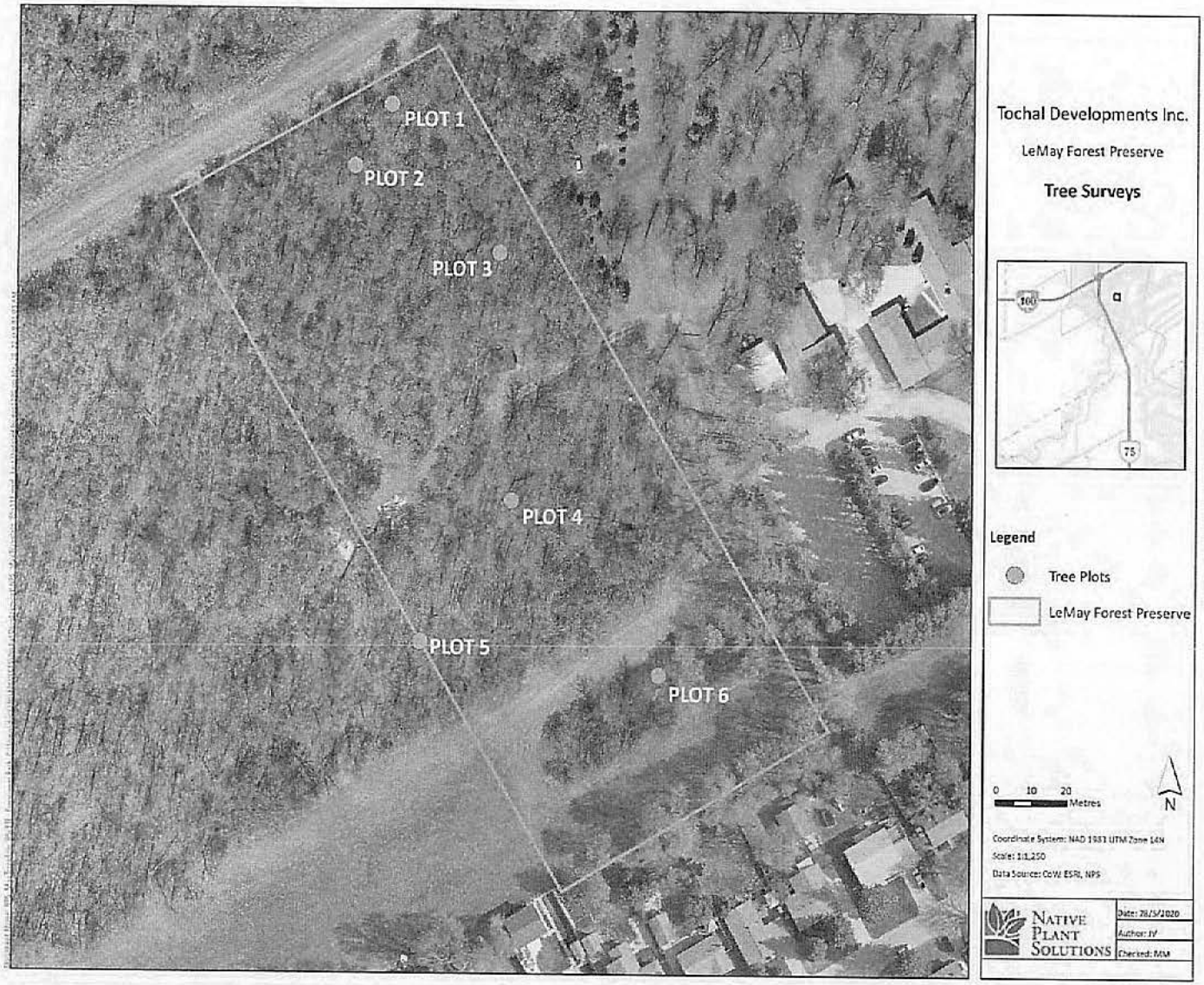


**Figure 1.** Map of the study area with six tree survey plot locations.

*Survey*

All live and dead trees in the plot were counted if the DBH was greater than 10 cm. Trees with a DBH less than 10 cm and height greater than 1 m were counted as part of the small tree and shrub. If the heights were less than 1 m it is considered part of the herbaceous layer and was not counted. If a tree had multiple stems with the branches separate below 1.3 m, each stem that had a DBH of at least 10 cm was recorded as being an individual tree. All trees with stems that were at least half in the plot were recorded (Roberts-Pichette and Gillespie 1999). Table 1 defines all the parameters that were assessed for each tree located in the plots. Small trees and shrubs were identified but no measurements were assessed on them.

**Table 1**. Parameters recorded during tree survey.

| **Overview of Parameters** | |
|---|---|
| **Parameter** | **Description** |
| Tree Number | Beginning at the initially marked corner of the plot, each tree species is numbered to keep track of each measured tree. |
| Layer | Each tree is categorized as being in the Tree layer, or Small Trees and Shrubs based on the diameter at breast height measurement. |
| Species | Each tree and shrub were identified to the species level where possible. |
| Diameter at Breast Height (DBH) | The standard location on a tree at which diameter measurements are taken, defined as 1.3 m above the ground (Roberts-Pichette and Gillespie 1999). |
| Height (m) | The measurement of the tree from ground level to the tip of the tree. |
| Tree Condition | Each tree is categorized into five categories: alive standing, standing dead top, alive broken, alive leaning, and alive fallen. |
| Bark Retention | Bark retention describes the level to which bark is held on to a tree and is classified into seven codes categories from, ranging from class 1 (all bark present) to class 7 (no bark present). |
| Wood Condition | Wood condition assesses presence and extent of decay and allows for the assessment of whether a tree can be viable timber. |
| Loss Indicators | Each tree was assessed for indicators of loss including defects such as scars, frost cracks, conks, broken tops, and decay. |
| Wildlife Usage | All signs of wildlife usage were recorded, including direct observations of species using the trees during surveys. |

DBH, measured for each tree in the plot, is a standard for measuring tree size. The measurement is recorded at 1.3 m above the ground (Roberts-Pichette and Gillespie 1999). Many trees are irregular in form and require special considerations when measuring the DBH. DBH was measured by using a measuring tape to record the circumference of a tree, recorded to two decimal places, and later converted to DBH.

Tree heights were measured using an electronic clinometer. Methods for measuring tree heights can vary based on tree irregularities and ground elevation.

A non invasive approach was taken for estimating tree age, using a formula developed by the International Society of Arboriculture. A growth factor (MNDNR 2020) is assigned to each tree species, which is multiplied by the diameter of the tree. The growth factors used in this document were taken from the Minnesota Landscape Arboretum, and it should be noted that this method for estimating tree age does not take into account local site variations in nutrients or hydrology that effect the growth rate. Therefore, the ages listed in this document are only an estimate, with variation being + 45 years.

Volume estimates are calculated by determining the basal area of each tree. Basal area is the cross-sectional area of the stem and can be calculated using DBH. An estimate of the volume can then be calculated by multiplying the basal area and the height with a form factor that allows for consideration of the shape of the stem. Form factors are pre-determined standards based on the shape of a tree. The form factor of 0.42 was used as an average of all tree shapes. The resulting volume is an approximation (Husch et al. 2020).

Results

A total of six plots using the methods described above were visited on May 12, 2020. The following provides an overview of the results of the tree survey conducted on the Tochal Developments Inc. property.

*Successional Stage*

An estimate of the successional stage of each plot was determined. Plots 1-5 are an intermediate seral stage habitat based on the high ratio of saplings and mature trees in comparison to seedlings as well as the vertical complexity of the canopy. The trees have not yet reached a stage of decline that would be seen in climax forest habitat. Plot six, located in a strip of forest south of the main forest habitat is considered a mature seral stage habitat because of the high proportion of large mature trees dominating the canopy.

*Trees*

A total of 23 trees were observed in the 6 surveyed plots (150 $m^2$ total area). Bur oak (*Quercus macrocarpa*) was the most common tree species observed accounting for 35% of the total number of trees observed in all plots, followed by green ash (*Fraxinus pennsylvanica*) making up 26% (Figure 2).

Tree heights ranged from 4.6 m to 13.8 m, with an overall average of 13.8 m. This varied by species. Basswood (*Tilia americana*) trees were the tallest, followed by Green ash, with American elm (*Ulmus americana*) being the shortest trees present (Figure 3).

The DBH of tree ranged from 9 cm to 59.3 cm, with an average of 21.6 cm (Figure 4). Basswood had the largest DBH, followed by green ash. Manitoba maple had the smallest DBH.

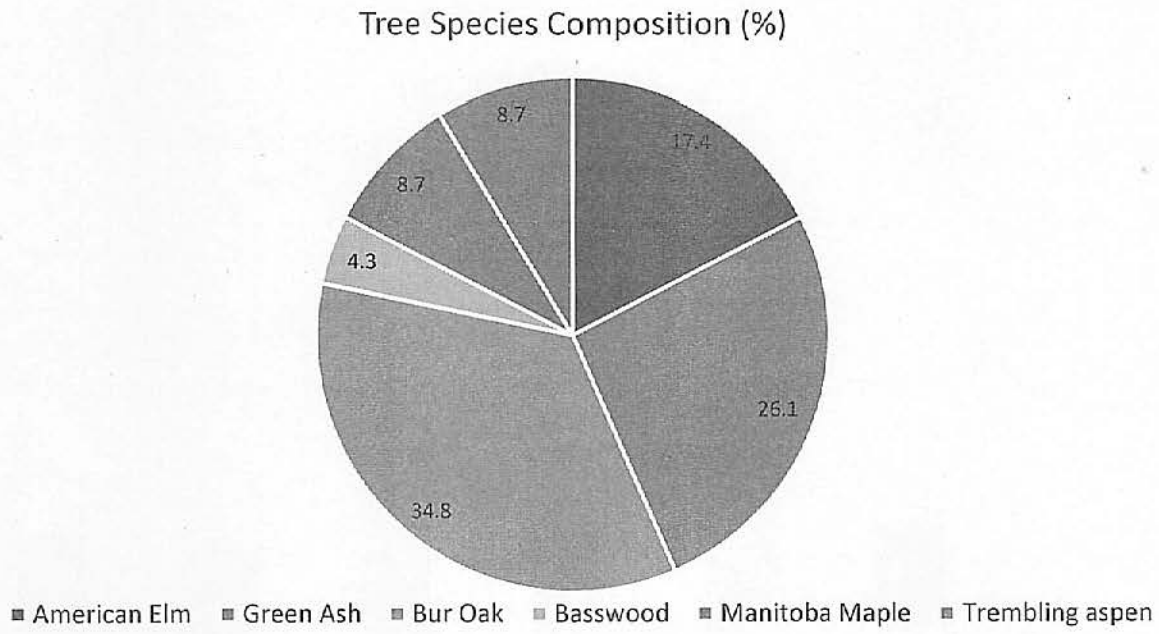


**Figure 2.** Composition of tree species within the survey plots of the study area.

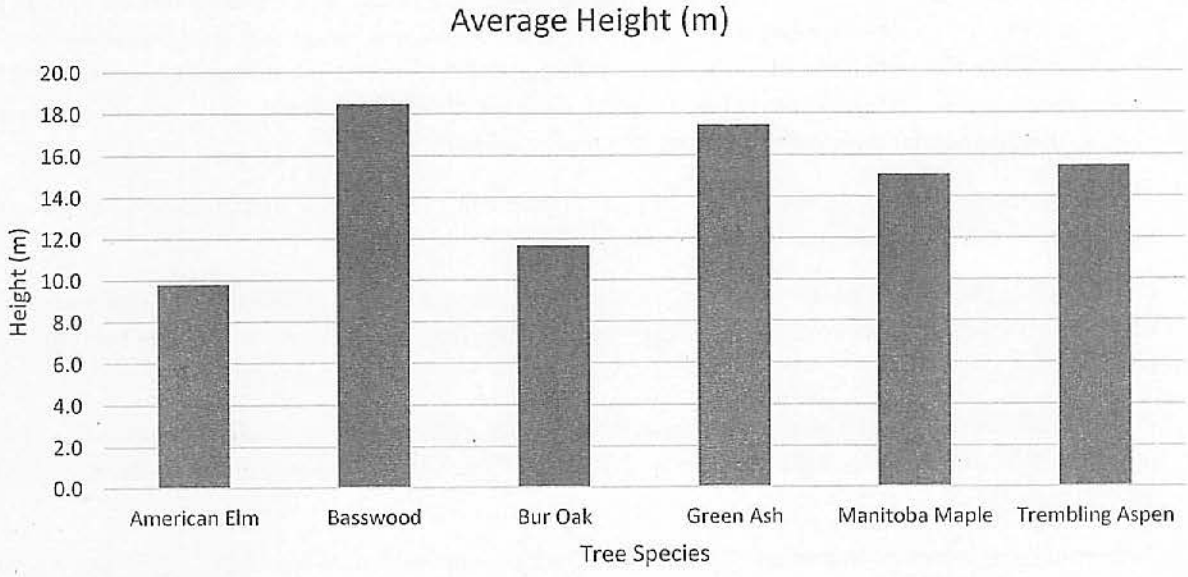


**Figure 3.** Average height by species of all trees within survey plots.

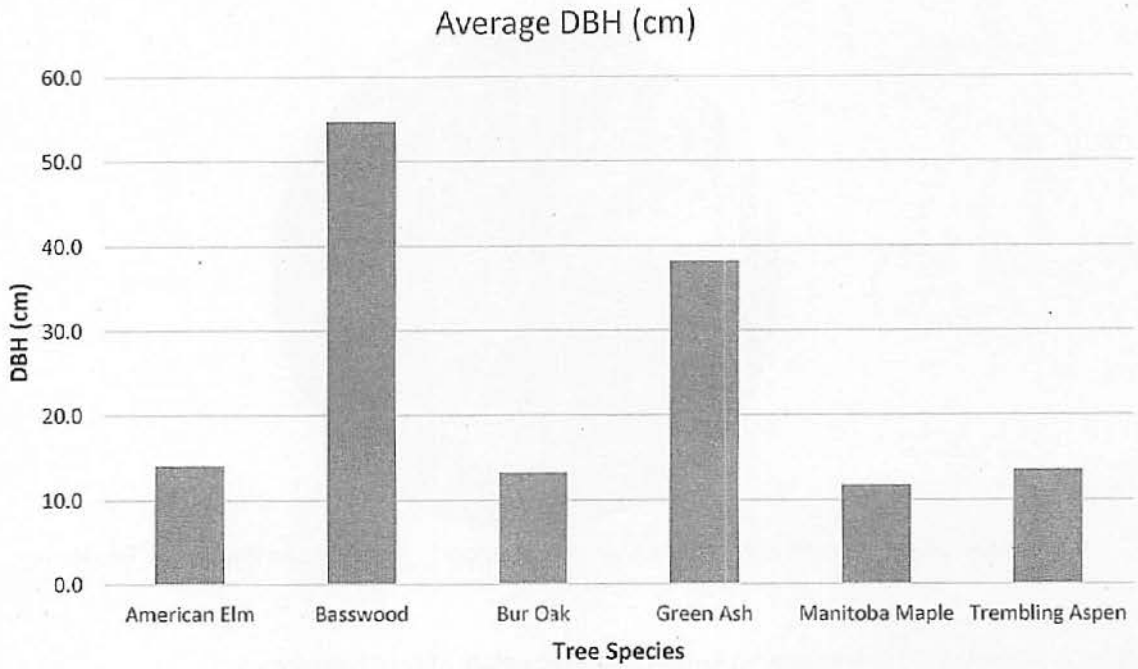


**Figure 4.** Average DBH by species of all trees within survey plots.

Of all the trees present 20 were alive standing, two were dead standing and one was alive leaning. Bark retention was rated as a 2 – bark lost on damaged areas only (<5%) for 13 trees while 10 had all bark present. Eight of the trees exhibited signs of probable limited internal decay and/or deformities for wood condition, while the remaining 14 had no signs of decay. The loss indicators that were observed included direct observation of decay or missing wood (n=1), dead tops (n=2), frost crack (n=1), and other indicators such as mechanical damage, canker and wildlife burrows (n=5).

The estimated age of trees ranged from 22 to 237 years old. The average age of trees within the plots was 85 years old. The oldest tree species were green ash.

Wildlife were directly observed using the trees including a nesting pair of wood ducks (*Aix sponsa*) and various bird species. Evidence of woodpecker use was also observed, as well as multiple burrows at the base of trees.

The total number of trees in all plots (23 trees/150 $m^2$) was extrapolated to estimate the number of trees present in the entire 5-acre area of interest (20,234.3 $m^2$). This was determined to be 3,103 individual trees (Table 2).

Total volume of wood estimated was 8.76 $m^3$ for all plots combined (Table 3). An estimated wood volume for the entire 5-acre area of interest is 1,181.8 $m^3$.

**Table 2.** Total number of Tree species present within the survey plots and estimated for 5 acres (20,234.3m$^2$).

| Species | # of Trees/150 m$^2$ | # of Trees/20234.3 m$^2$ |
|---|---|---|
| American Elm | 4 | 540 |
| Green Ash | 6 | 809 |
| Bur Oak | 8 | 1079 |
| Basswood | 1 | 135 |
| Manitoba Maple | 2 | 270 |
| Trembling Aspen | 2 | 270 |
| Total | 23 | 3,103 |

**Table 3.** Total volume of wood present within the survey plots and estimated for 5 acres (20,234.3 m$^2$).

| Species | Volume of Trees/150 m$^3$ | Volume of trees/20,234.3 m$^3$ |
|---|---|---|
| American Elm | 0.31 | 41.8 |
| Green Ash | 5.73 | 773.0 |
| Bur Oak | 0.56 | 75.5 |
| Basswood | 1.83 | 247.0 |
| Manitoba Maple | 0.13 | 17.5 |
| Trembling Aspen | 0.2 | 27.0 |
| Total | 8.76 | 1,181.8 |

*Small Trees and Shrubs*

A total of 49 trees were observed in the 6 surveyed plots. Choke cherry was the most common small tree and shrub species observed accounting for 33% of the total species observed in all plots, followed by Bur oak making up 24% (Figure 5).

The total number of small trees and shrubs in all plots (49 trees/150 m$^2$) was extrapolated to estimate the number of trees present in the entire 5-acre area of interest (20,234.3 m$^2$). This was determined to be 6612 individual small trees and shrubs (Table 4).

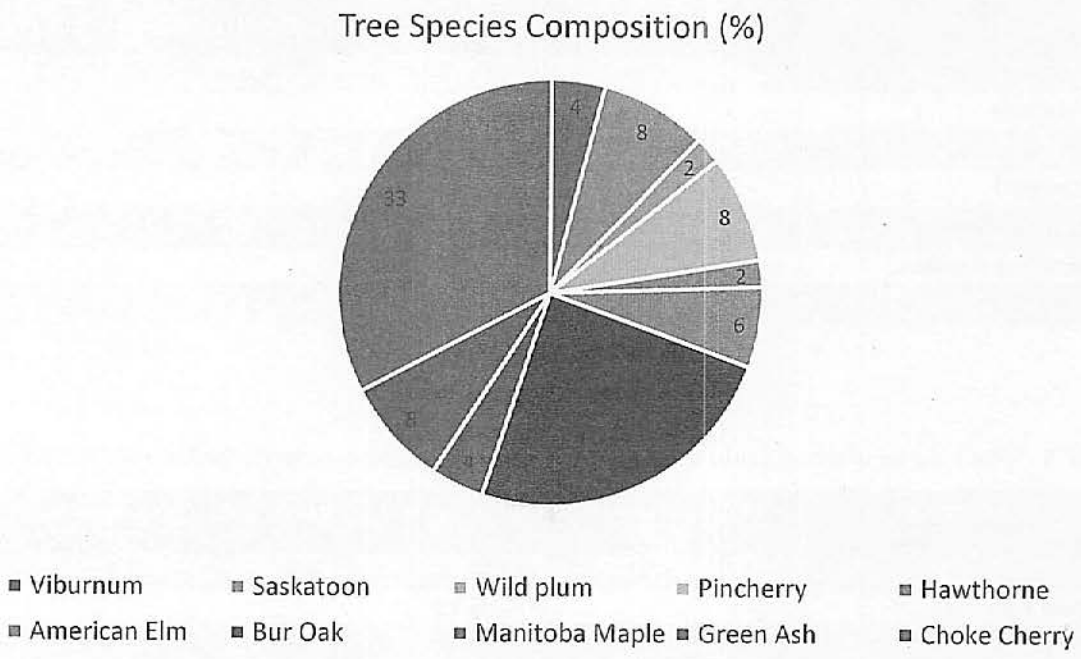


**Figure 5.** Composition of small tree and shrub species within the survey plots of the study area.

**Table 4.** Total number of small tree and shrub species present within the survey plots and estimated for 5 acres (20,234.3 $m^2$).

| Species | # of Small Trees and Shrubs/150 $m^2$ | # of Small Trees and Shrubs/20,234.3 $m^2$ |
|---|---|---|
| *Viburnum sp. | 2 | 270 |
| Saskatoon | 4 | 540 |
| Wild Plum | 1 | 135 |
| Pincherry | 4 | 540 |
| Hawthorne | 1 | 135 |
| American Elm | 3 | 405 |
| Bur Oak | 12 | 1619 |
| Manitoba Maple | 2 | 270 |
| Green Ash | 4 | 540 |
| Choke Cherry | 16 | 2158 |
| Total | 49 | 6,612 |

* **Note:** the timing of survey meant that positive identification for this species was not possible.

*Habitat Type Classification*

The proposed LeMay Forest Preserve has an overstory canopy dominated by Bur oak, Green ash, and American elm. In Winnipeg, this is defined as a Riverbottom Forest, which transitions between three zones; Riverbank, Floodplain, and Terrace (City of Winnipeg 2020). The presence of Bur oak as a dominant species indicates that this is part of the Terrace, an area which is subject to few flooding events. Bur oak dominated habitats are not common in the City of Winnipeg, as they were converted early on to residential or commercial properties, leaving only small fragments of remnant habitat remaining.

***Mitigation Ratios***

Often when a habitat is destroyed or impacted, mitigation measures are taken to restore the same type and size of habitat on a 1:1 ratio. However, issues arise when the overall gains of the mitigation project have not adequately offset the overall habitat loss that resulted from the disturbance. This often happens when the habitat restored is of lower quality than what was impacted, or a time lag exists between when the habitat restoration begins and when the habitat is fully restored and providing all ecosystem functions again (Laitila *et al.* 2014, King *et al.* 2004). For example, when replacing an old growth forest, it can take decades for the young plants to reach an age where they can provide the same ecosystem functions as an old growth forest. When mitigating high quality old growth habitats, it is unlikely that the habitat will ever reach the same level of quality or provide all the functions lost (Laitila *et al.* 2014, King *et al.* 2004).

Increasing the mitigation ratio for restored habitats is common practice in habitat restoration to compensate for lost ecosystem function. Young or early successional habitats are easier to restore, while immediate restoration of old growth habitats is impossible (Laitila *et al.* 2014, King *et al.* 2004). Early successional habitats have fewer ecosystem functions, or values, then do old growth habitats. As a result, habitat mitigation ratios must address the question of how many hectares of young forest equals the ecosystem value of 1 ha of old growth forest, given that ecosystem function will increase slowly over time until the old growth habitat is restored. Additional habitat must therefore be restored to compensate for the functions lacking during this time lag (King *et al.* 2004). Likewise, additional habitat must also be restored to make up for the functions missing given that the restored habitat will never be the same as that which was originally present (Laitila *et al.* 2014, King *et al.* 2004).

One approach to establishing mitigation ratios is through identifying categories of habitat quality and associated standards of prescribed mitigation ratios (Table 5). The following categories and ratio recommendations are based on USACE (2014), EPA (2014), Environment Canada (2012), and Castelle *et al.* (1992).

Table 5. Habitat quality categories with prescribed mitigation ratios.

| | Description | Ratio |
|---|---|---|
| Category I | Habitat that is undisturbed and contains ecological attributes that are impossible or difficult to replace within a human lifetime, if at all (i.e., a mature forest). It contains high levels of biodiversity with a high proportion of native species and provides habitat for threatened and endangered species. | 3:1 |
| Category II | Generally pristine, unfragmented habitat that provides moderate wildlife habitat for a variety of species. Does not provide critical habitat for threatened or endangered species but is dominated by native species (>50% vegetation cover of native species). | 2:1 |
| Category III | Habitat is often impacted by anthropogenic disturbance and is not considered pristine. It supports minimal wildlife habitat and has a predominance of non-native species (>50% vegetation cover of non-native species). This habitat type is plentiful in the local area. | 1.5:1 |

The understory of this site has yet to be explored, therefore, it is currently not possible to determine the extent at which this site provides habitat for threatened and endangered or native species. It is impacted by anthropogenic disturbances including unmaintained walking trails and the presence of man-made structures. However, based on estimates of successional stage (intermediate – mature) and the presence of trees with age estimates ranging from 100-300 years old, this forest would be impossible to replace within a human lifetime. Based on the age of the stand, and the lack of current understanding of the understory we would recommend that replacement of this stand would fall into a 3:1 replacement ratio (Category I).

This would entail planting 15 acres of young forest habitat with an estimated 9,309 trees (15-gallon size) to make up for the loss/disturbance of 5 acres of intermediate/mature forest habitat. If understory surveys do not determine this site to provide habitat for threatened, endangered, or native species we might suggest replacing on a 2:1 ratio (Category II). This would entail planting 7.5 acres of young forest habitat with an estimated 6,206 trees (15-gallon size).

## References


Castelle, A.J., C. Conolly, M. Emers, E.D. Metz, S. Meyer, M. Witter, S. Mauermann, M. Bentley, D. Sheldon, and D. Dole. 1992. Wetland mitigation replacement ratios: defining equivalency. Adolfson Associates, Inc., for Shorelands and Coastal Zone Management Program. Washington Department of Ecology. No. 9.

City of Winnipeg. 2020. Parks and open Space, Rivebottom Forest. [Online available at] https://winnipeg.ca/publicworks/parksOpenSpace/NaturalistServices/NaturalAreas/Riverbottom.stm] (accessed 28, May, 2020).

Environment Canada. 2012. Operational framework for use of conservation allowances. [Online available at] http://publications.gc.ca/collections/collection_2012/ec/En14-77-2012-eng.pdf (accessed 30 October 2019).

EPA. 2014. State of Ohio water quality standards. Chapter 3745-1-50 to 54 of the Administrative Code. Ohio Environmental Protection Agency, Division of Surface Water Standards & Technical Support Section. [Online available at] https://www.epa.gov/sites/production/files/2015-09/documents/oh_34751_50_to_54.pdf (accessed 30 October 2019)

Husch, B., T.W. Beers, and J.A. Kershaw Jr. 2002. Forest mensuration. John Wiley & Sons.

King, D. M., E.W. Price, and K. Rodrigues. 2004. Developing defensible wetland mitigation ratios. A companion to "the five-step wetland mitigation ratio calculator". Silver Spring (M.D.): National Oceanic and Atmospheric Administration.

Laitila, J., A. Moilanen, and F.M. Pouzols. 2014. A method for calculating minimum biodiversity offset multipliers accounting for time discounting, additionality and permanence. Methods in Ecology and Evolution. 5: 1247-1254.

Minnesota Landscape Arboretum. 2018. A Venerable Oak Tree.

Minnesota Department of Natural Resources. 2020. Project Learning Tree, Growth Factor Worksheet. [Online available at ] https://files.dnr.state.mn.us/education_safety/education/plt/activity_sheets/growthfactorworksheet.pdf( accessed 28 May 2020)

Nash, J. 2016. City of Edmonton temporary sample plot (TSP) and permanent sample plot (PSP) procedures. Greenlink Forestry Inc.

Roberts-Pichette, P. and L. Gillespie. 1999. Terrestrial vegetation biodiversity monitoring protocols. EMAN Occasional Paper Series, Report No. 9. Ecological Monitoring Coordinating Office, Burlington, Ontario.

USACE. 2014. Description of Wetland Categories and Ratios for Compensatory Mitigation. U.S. Army Corps of Engineers Alaska District.

## Appendix A. Site Photos

**Photo 1.** Tree survey plot 1.

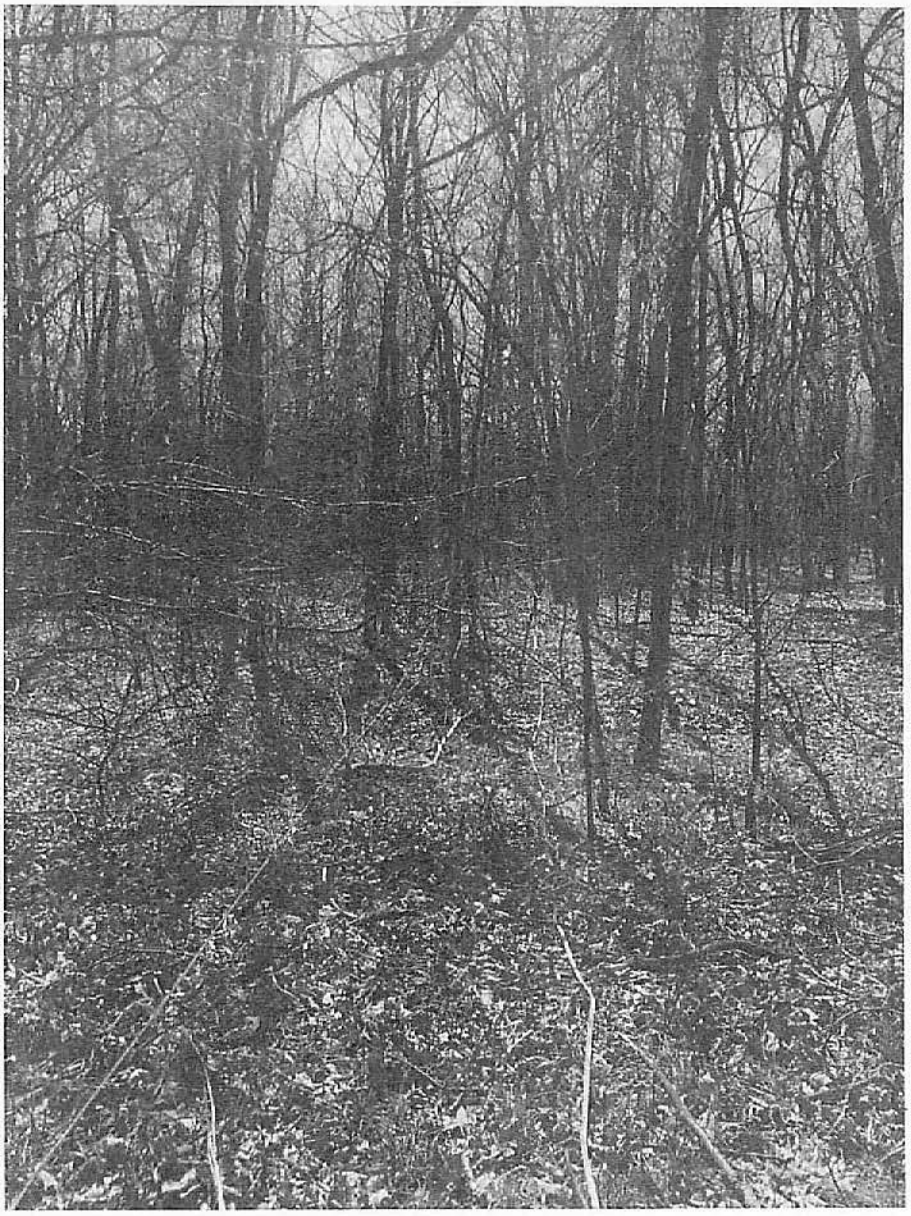

**Photo 2.** Tree survey plot 2.

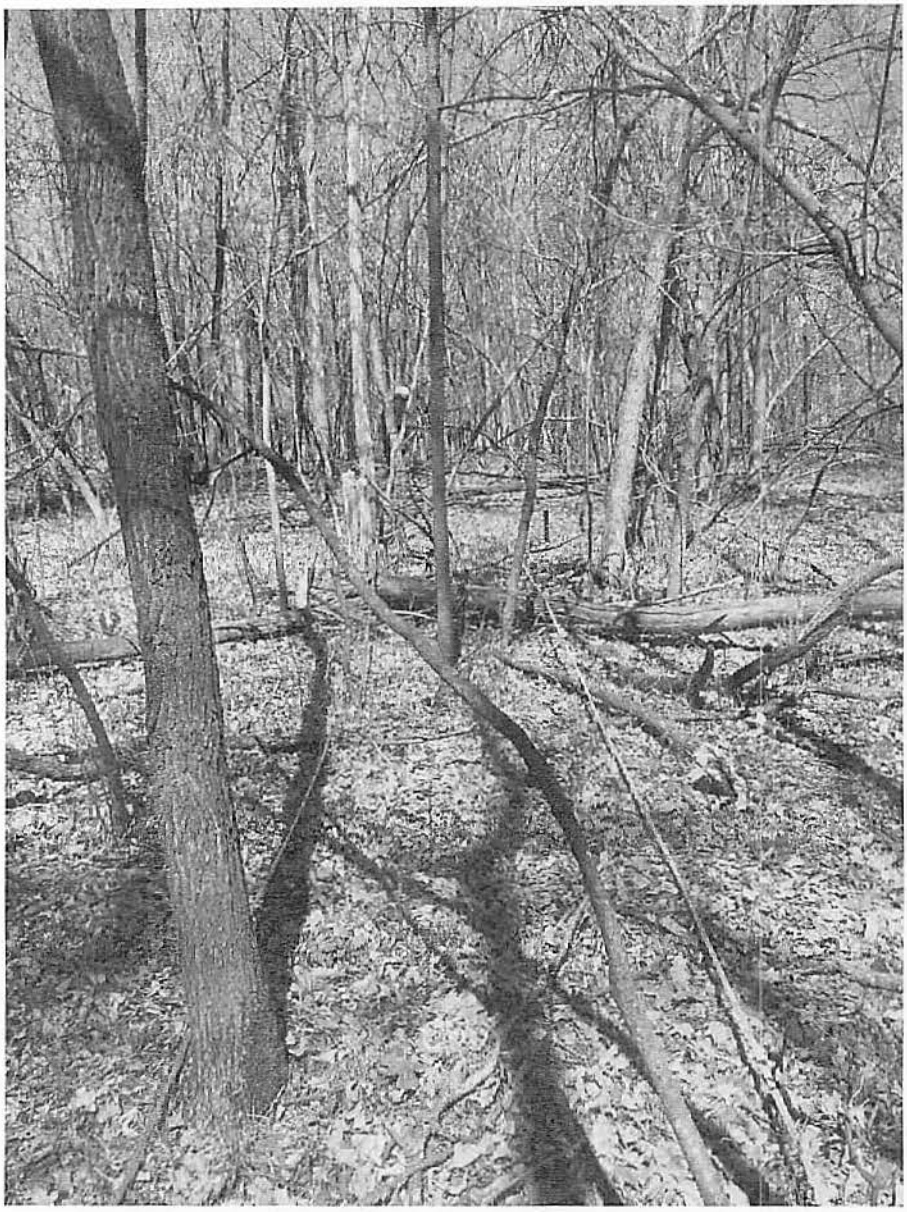

**Photo 3.** Tree survey plot 3.

**Photo 4.** Tree survey plot 4.

**Photo 5.** Tree survey plot 5.

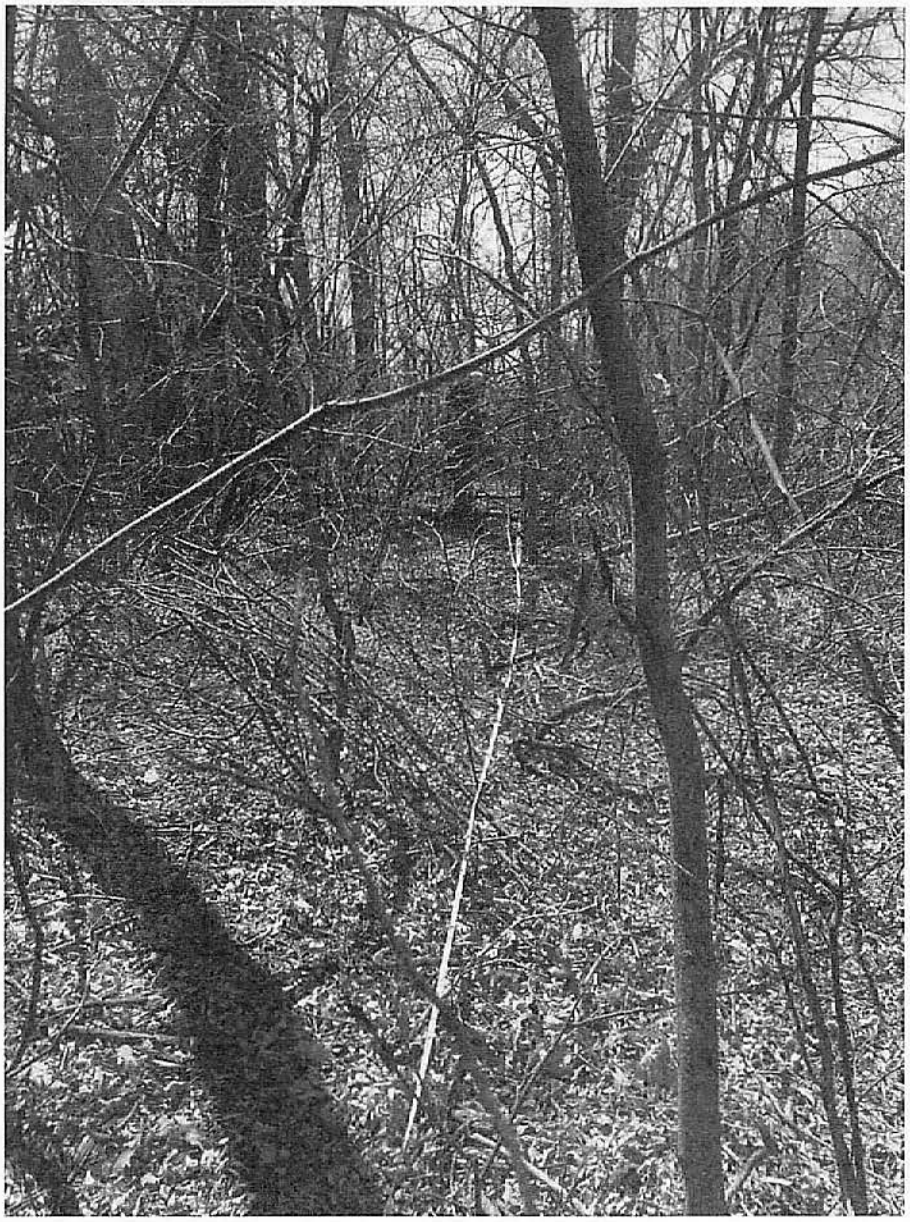

**Photo 6.** Tree survey plot 6.

## Appendix B. City of Winnipeg Habitat Assessment and Grading

When habitat is assessed it is assigned a grade from A-D. "A" is a very good grade while "D" is considered poor. The definitions for these grades are as follows.

| Grade | Justification |
|---|---|
| "A" Quality Habitat **(Maximum sensitivity to disturbance)** | Virtually undisturbed by man or recovered to an extent where community structure and composition is intact and reflects historical natural vegetation and wildlife habitat. Other factors include soil disturbance, a high degree of native vegetation present and conversely, a lack of weedy or non-native plant species. |
| "B" Quality Habitat **(High sensitivity to disturbance)** | Light to moderate disturbance, for example, encroachment of non-native species, may have a minimal amount of weeds but maintains a more natural condition where native species are still the major vegetation community. |
| "C" Quality Habitat **(Low sensitivity to disturbance)** | Moderate disturbance, a significant number of weed species which have replaced native species, few native species present. For example, an old agricultural clearing that has not been used in recent times and native plant species are slowly returning, or an area that is occasionally mowed. |
| "D" Quality Habitat **(Minimum sensitivity to disturbance)** | Heavily disturbed site, the vegetation is dominated by weed species or absent all together. None or very few native species present. |

# Appendix C. Tochal Arborists Report

## Introduction

This report is in regard to the future proposed development of the 22.5 acre Tochal study area located in the St. Norbert area of Winnipeg MB. The area is bordered by the Red River to the North and East and LeMay Avenue to the South. The study area consists mainly of forested habitats with some tame grassland habitat in the south half of the study area. Future development of this area will impact the forested habitat of this area and therefore this report documents the current condition of the tress that may be impacted by construction and provides recommendations for tree preservation. The trees in the study area were assessed for overall health, size and potential impacts that would be caused by construction.

A total of 136 trees were inventoried. These trees have been divided into three size classes including trees with diameter at breast height (DBH) of 0-10 cm, 10-30 cm and 30+ cm. Our recommendation is to preserve trees within the largest size class due to the high habitat value they have, and the extreme difficulty to replace trees of this size. Within this report we also provide recommendations for tree preservation fencing to prevent injury to any trees that will be preserved through construction.

## Methodology

Collection of tree inventory data took place on during four tree surveys from May to October 2020.

1. LeMay tree survey: Six 25 m long transects; May 12, 2020 (Appendix A).
2. Spring individual tree survey: Individual trees that were outside of plots but determined to characterize the forest; May 12, 2020.
3. The comprehensive vegetation survey : 11 5m x 5m plots; July 30, August 6 and August 7, 2020.
4. Fall individual tree survey: Individual trees that were outside of plots but determined to characterize the forest; October 6, 2020.

Condition rankings were assigned to trees that are recommended for preservation, which include trees that have a DBH greater than 30 cm. Condition rankings range from 0-100 and are based on tree canopy condition, bark condition, and foliage condition. This ranking illustrates the overall condition of the forest. See section 2.1 of the Biological Land Inventory 2020 Tochal Document for a complete description of how all tree data was collected including species, DBH and condition.

## Results

The species identified throughout the study area include American basswood, American elm, bur oak green ash, Manitoba maple and trembling aspen (Table 1). Green ash and bur oak make up the greatest % composition of all species present (Figure 1). The total trees observed during the surveys can be found in Table 2.

**Table 1.** Tree species present in study area with scientific name.

| Species | Scientific Name |
|---|---|
| American Basswood | *Tilia americana* |
| American Elm | *Ulmus americana* |
| Bur Oak | *Quercus macrocarpa* |
| Green Ash | *Fraxinus pennsylvanica* |
| Manitoba Maple | *Acer negundo* |
| Trembling Aspen | *Populus tremuloides* |

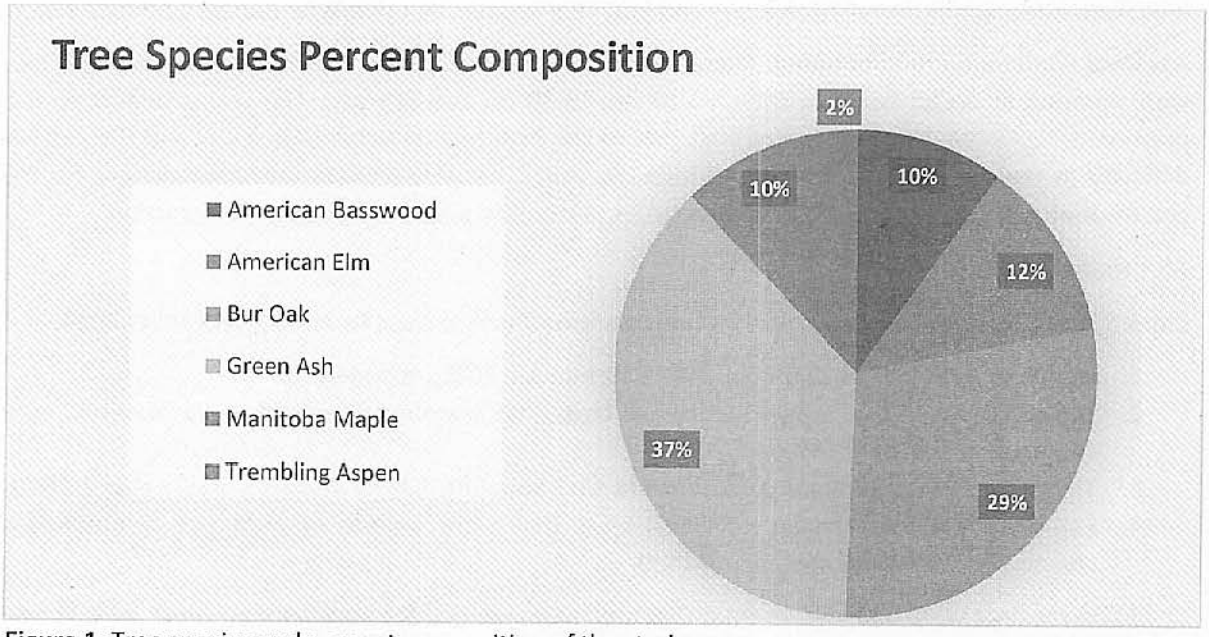


**Figure 1.** Tree species and percent composition of the study area.

**Table 2.** Trees observed during survey.

| Species | # of 0-10 cm DBH Trees | # of 10-30 cm DHB Trees | # of 30+ cm DBH Trees | *Total Trees Observed During Surveys* |
|---|---|---|---|---|
| American Basswood | 1 | 4 | 4 | *9* |
| American Elm | 13 | 7 | 2 | *22* |
| Bur Oak | 23 | 12 | 14 | *49* |
| Green Ash | 11 | 9 | 20 | *40* |
| Manitoba Maple | 9 | 5 | 0 | *14* |
| Trembling Aspen | 0 | 2 | 0 | *2* |


**Figure 2**. Location of all tree surveys.

Tree Details

The following tables (Tables 3-8) provide details on trees that were observed and measured within throughout the four tree surveys that took place on the Tochal study area. Tree condition categories are as follows: AS (alive standing), AL (alive leaning), AD (alive, dead top), DS (dead standing), or DL (dead leaning).

**Table 3.** American basswood trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| Comprehensive Vegetation Survey | G2 | 1 | 6.7 | 13.9 | AS | | Multi-stemmed tree |
| Comprehensive Vegetation Survey | G2 | 6 | 12.4 | 13.9 | AS | | Multi-stemmed tree |
| Comprehensive Vegetation Survey | G2 | 4 | 21.3 | 13.9 | AS | | Multi-stemmed tree |
| Comprehensive Vegetation Survey | G2 | 5 | 25.1 | 13.9 | AS | | Multi-stemmed tree |
| Spring Individual Trees | - | 10 | 28.6 | 17.5 | AS | | |
| Comprehensive Vegetation Survey | G2 | 2 | 30.2 | 13.9 | AS | 60% | Multi-stemmed tree |
| Comprehensive Vegetation Survey | G2 | 3 | 34.4 | 13.9 | AS | 60% | Multi-stemmed tree |
| LeMay Tree Survey | 1 | 7 | 54.7 | 18.5 | AS | 100% | |
| Spring Individual Trees | - | 8 | 59.7 | 32.1 | AS | 100% | |

Table 4. American elm trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition ranking | Notes |
|---|---|---|---|---|---|---|---|
| LeMay Tree Survey | 3 | 3 | 9.9 | 11 | AS | | |
| LeMay Tree Survey | 1 | 2 | 11.2 | 4.6 | AL | | |
| Comprehensive Vegetation Survey | F8 | 1 | 12.7 | 14.5 | AS | | |
| Comprehensive Vegetation Survey | F2 | 2 | 13.1 | 7.1 | AS | | |
| LeMay Tree Survey | 1 | 3 | 15.9 | 10.7 | AS | | |
| Comprehensive Vegetation Survey | F8 | 4 | 17.2 | 15.3 | AL | | Frost crack |
| Comprehensive Vegetation Survey | F3 | 4 | 18.5 | 10.9 | AS | | |
| LeMay Tree Survey | 1 | 1 | 19.4 | 13 | AS | | |
| Spring Individual Trees | 0 | 1 | 54 | 31.9 | AD | | Cavity nesting evident |
| Fall Individual Trees | - | 14 | 92 | - | AS | 60% | |

Table 5. Bur oak trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| Spring Individual Trees | 0 | 5 | 56.3 | 34.8 | AS | 100% | |
| Spring Individual Trees | 0 | 11 | 58.8 | 30.6 | AS | 100% | |
| Spring Individual Trees | 0 | 9 | 68.2 | 25.5 | AS | 80% | Cavity nesting evident |
| Spring Individual Trees | 0 | 7 | 69.1 | 30.2 | AS | 80% | Cavity nesting evident |
| Spring Individual Trees | 0 | 6 | 73.2 | 24.8 | AS | 80% | Cavity nesting evident |
| LeMay Tree Survey | 1 | 6 | 13 | 9.7 | AS | | |
| LeMay Tree Survey | 3 | 1 | 11.8 | 9.8 | AS | | |
| LeMay Tree Survey | 4 | 4 | 11.3 | 9.2 | DS | | |
| LeMay Tree Survey | 4 | 3 | 17.2 | 12.2 | DS | | |
| LeMay Tree Survey | 5 | 3 | 11.4 | 11.6 | AS | | |
| LeMay Tree Survey | 5 | 4 | 12.7 | 13.3 | AS | | |
| LeMay Tree Survey | 5 | 1 | 14 | 14.2 | AS | | |
| LeMay Tree Survey | 5 | 2 | 14.5 | 13.5 | AS | | |
| Comprehensive Vegetation Survey | F3 | 3 | 14.3 | 5.3 | AL | | |
| Comprehensive Vegetation Survey | F3 | 2 | 15.3 | 4.4 | AL | | |
| Fall Individual Trees | - | 11 | 68.4 | - | AS | 100% | |
| Fall Individual Trees | - | 12 | 57.6 | - | AS | 100% | |
| Fall Individual Trees | - | 15 | 49.7 | - | AS | 100% | |
| Fall Individual Trees | - | 16 | 60 | - | AS | 100% | |
| Fall Individual Trees | - | 17 | 73.5 | - | AS | 100% | |
| Fall Individual Trees | - | 2 | 48 | - | AS | 100% | |
| Fall Individual Trees | - | 5 | 84.5 | - | AS | 100% | |
| Fall Individual Trees | - | 6 | 51.7 | - | AS | 100% | |
| Fall Individual Trees | - | 9 | 57.9 | - | AS | 100% | |

Table 6. Green ash trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| Spring Individual Trees | 0 | 3 | 31.9 | 25.7 | AS | 90% | Cavity nesting evident |
| Spring Individual Trees | 0 | 4 | 47.7 | 26.2 | AS | 100% | |
| Spring Individual Trees | 0 | 12 | 50.0 | 20.5 | AS | 100% | |
| Spring Individual Trees | 0 | 13 | 51.6 | 13 | AS | 100% | |
| Spring Individual Trees | 0 | 2 | 68.6 | 35.9 | AS | 100% | |
| Spring Individual Trees | 1 | 5 | 44.9 | 20.2 | AS | 100% | |
| LeMay Tree Survey | 1 | 4 | 59.3 | 15.2 | AS | 100% | Wood ducks observed in tree |
| LeMay Tree Survey | 4 | 2 | 13.7 | 12.8 | DS | | |
| LeMay Tree Survey | 4 | 1 | 23.1 | 20.2 | DS | | |
| LeMay Tree Survey | 5 | 7 | 36.8 | 23.4 | AS | 80% | Possible wildlife burrow at base of tree |
| LeMay Tree Survey | 6 | 1 | 51.6 | 13 | AS | 100% | |
| Comprehensive Vegetation Survey | F2 | 3 | 43.0 | 23.9 | AS | 100% | |
| Comprehensive Vegetation Survey | F3 | 1 | 50.3 | 23.5 | AS | 100% | |
| Comprehensive Vegetation Survey | F4 | 3 | 13.4 | 9 | AL | | |
| Comprehensive Vegetation Survey | F4 | 4 | 15.3 | 11.6 | AL | | |
| Comprehensive Vegetation Survey | F4 | 1 | 18.8 | 19.5 | AS | | |
| Comprehensive Vegetation Survey | F4 | 5 | 19.1 | 20.3 | AS | | |
| Comprehensive Vegetation Survey | F7 | 2 | 23.2 | 19 | AS | | |
| Comprehensive Vegetation Survey | F8 | 2 | 13.4 | 12.3 | AS | | |
| Comprehensive Vegetation Survey | F8 | 3 | 13.7 | 12.4 | AS | | |
| Fall Individual Trees | - | 1 | 70.3 | - | AS | 100% | |
| Fall Individual Trees | - | 10 | 50.6 | - | AS | 100% | |
| Fall Individual Trees | - | 13 | 53.0 | - | AS | 100% | |
| Fall Individual Trees | - | 18 | 47.4 | - | AS | 90% | Cavity nesting evident |
| Fall Individual Trees | - | 19 | 43.1 | - | AS | 100% | |
| Fall Individual Trees | - | 3 | 49.7 | - | AS | 100% | |

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| Fall Individual Trees | - | 4 | 46.5 | - | AS | 100% | |
| Fall Individual Trees | - | 7 | 50.1 | - | AS | 100% | |
| Fall Individual Trees | - | 8 | 42.3 | - | AS | 100% | |

Table 7. Manitoba maple trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| LeMay Tree Survey | 2 | 1 | 9.9 | 18.5 | AS | | |
| Comprehensive Vegetation Survey | F2 | 1 | 9.9 | 9.9 | AS | | |
| LeMay Tree Survey | 3 | 2 | 13.7 | 11.7 | AS | | |
| Comprehensive Vegetation Survey | F4 | 2 | 15.3 | 13.3 | AS | | |
| Comprehensive Vegetation Survey | F7 | 3 | 15.9 | 9.4 | AS | | |
| Comprehensive Vegetation Survey | F5 | 1 | 19.1 | 13 | DS | | Standing dead tree |
| Comprehensive Vegetation Survey | F7 | 1 | 26.1 | 19.8 | AS | | |

Table 8. Trembling aspen trees (DBH>10 cm) measured in the study area.

| Survey | Plot | Tree no. | DBH (cm) | Height (m) | Tree Condition | Condition Ranking | Notes |
|---|---|---|---|---|---|---|---|
| LeMay Tree Survey | 5 | 6 | 10.8 | 15.2 | AS | 100% | |
| LeMay Tree Survey | 5 | 5 | 16.3 | 15.8 | AS | 100% | |

The locations for each of the survey locations are listed below in Table 9.

Table 9. Survey Locations

| Survey | Name | Easting | Northing |
|---|---|---|---|
| Comprehensive Vegetation Survey | F10 | 633596.39 | 5514625.81 |
| Comprehensive Vegetation Survey | F5 | 633419.69 | 5514622.20 |
| Comprehensive Vegetation Survey | F1 | 633312.91 | 5514549.64 |
| Comprehensive Vegetation Survey | F2 | 633357.70 | 5514595.42 |
| Comprehensive Vegetation Survey | F3 | 633317.39 | 5514628.50 |
| Comprehensive Vegetation Survey | F4 | 633351.87 | 5514662.84 |
| Comprehensive Vegetation Survey | F8 | 633428.38 | 5514698.75 |
| Comprehensive Vegetation Survey | F7 | 633467.71 | 5514667.36 |
| Comprehensive Vegetation Survey | F6 | 633556.49 | 5514667.00 |
| Comprehensive Vegetation Survey | F9 | 633511.00 | 5514770.31 |
| Fall Individual Tree Survey | T3 | 633537.36 | 5514781.94 |
| Fall Individual Tree Survey | T4 | 633534.78 | 5514782.13 |
| Fall Individual Tree Survey | T16 188.5 Oak | 633270.59 | 5514527.51 |
| Fall Individual Tree Survey | T6 162.5 oak | 633260.78 | 5514541.16 |
| Fall Individual Tree Survey | T17 231 Oak | 633238.93 | 5514587.45 |
| Fall Individual Tree Survey | T14 289 American Elm | 633251.50 | 5514631.24 |
| Fall Individual Tree Survey | T1 | 633540.91 | 5514798.10 |
| Fall Individual Tree Survey | T2 | 633540.86 | 5514786.73 |
| Fall Individual Tree Survey | T11 215 oak | 633247.15 | 5514567.14 |
| Fall Individual Tree Survey | T9 182 Oak | 633255.13 | 5514570.91 |
| Fall Individual Tree Survey | T19 135.5 Ash | 633234.61 | 5514560.63 |
| Fall Individual Tree Survey | T15 156 oak | 633259.15 | 5514578.53 |
| Fall Individual Tree Survey | T9 157 Ash | 633277.42 | 5514546.31 |
| Fall Individual Tree Survey | T16 163.5 Ash | 633289.76 | 5514504.25 |
| Fall Individual Tree Survey | T7 157.5 Ash | 633272.67 | 5514540.13 |
| Fall Individual Tree Survey | T13 166.5 Ash | 633236.48 | 5514578.86 |

| Survey | Name | Easting | Northing |
|---|---|---|---|
| Fall Individual Tree Survey | T5 265.5 Oak | 633267.71 | 5514553.08 |
| Fall Individual Tree Survey | T8 133 Ash | 633272.14 | 5514543.72 |
| Fall Individual Tree Survey | T6 126 Oak | 633267.63 | 5514552.98 |
| Fall Individual Tree Survey | T10 Ash 159 | 633253.03 | 5514574.99 |
| Fall Individual Tree Survey | T12 181 Oak | 633229.13 | 5514554.50 |
| Fall Individual Tree Survey | T18 149 Ash | 633229.97 | 5514560.31 |
| LeMay Tree Survey | Tree plot 3 | 633549.72 | 5514744.74 |
| LeMay Tree Survey | Tree plot 4 | 633553.81 | 5514676.95 |
| LeMay Tree Survey | Tree plot 1 | 633518.58 | 5514783.78 |
| LeMay Tree Survey | Tree plot 5 | 633527.73 | 5514638.97 |
| LeMay Tree Survey | Tree plot 2 | 633508.13 | 5514766.83 |
| LeMay Tree Survey | Tree plot 6 | 633596.27 | 5514629.56 |
| Spring Individual Tree Survey | Tree8 | 633557.64 | 5514701.20 |
| Spring Individual Tree Survey | Tree 1 | 633507.86 | 5514761.71 |
| Spring Individual Tree Survey | Tree6 | 633546.95 | 5514695.23 |

## Habitat Condition

The condition of each habitat type is shown in Figure 3, each of the forested habitats are either an A or B grade, while the grassland sections were ranked as a C or D (See appendix C for habitat ranking definitions). The species listed in Table 10 are ranked as S3, or vulnerable by NatureServe, that were observed using the forested habitats of the Tochal study area. A vulnerable ranking indicates that the species has the potential to become threatened if there is an increased loss of habitat, or increased disturbance (see Appendix A for provincial ranking definitions). The species below are typically found in old growth or undisturbed habitats and are uncommon outside of their preferred habitat. The condition of each habitat type is shown in Figure 3, each of the forested habitats are either an A or B grade, while the grassland sections were ranked as a C or D.

**Table 10.** Provincially ranked S3 species found within the forested area of Tochal.

| Species | Scientific Name | S Ranking |
|---|---|---|
| American Basswood | *Tilia americana* | S3S4 |
| American Hog peanut | *Amphicarpaea bracteata* | S3S5 |
| Assiniboia sedge | *Carex assiniboinensis* | S3S4 |
| Common Milkweed | *Asclepias syriaca* | S3S4 |
| Common Moonseed | *Menispermum canadense* | S3 |
| Herbaceous Greenbrier | *Smilax lasioneura* | S3 |
| Purple Avens | *Geum rivale* | S3S4 |
| Riverbank Grape | *Vitis riparia* | S3S4 |
| Wood Nettle | *Laportea canadensis* | S3S4 |

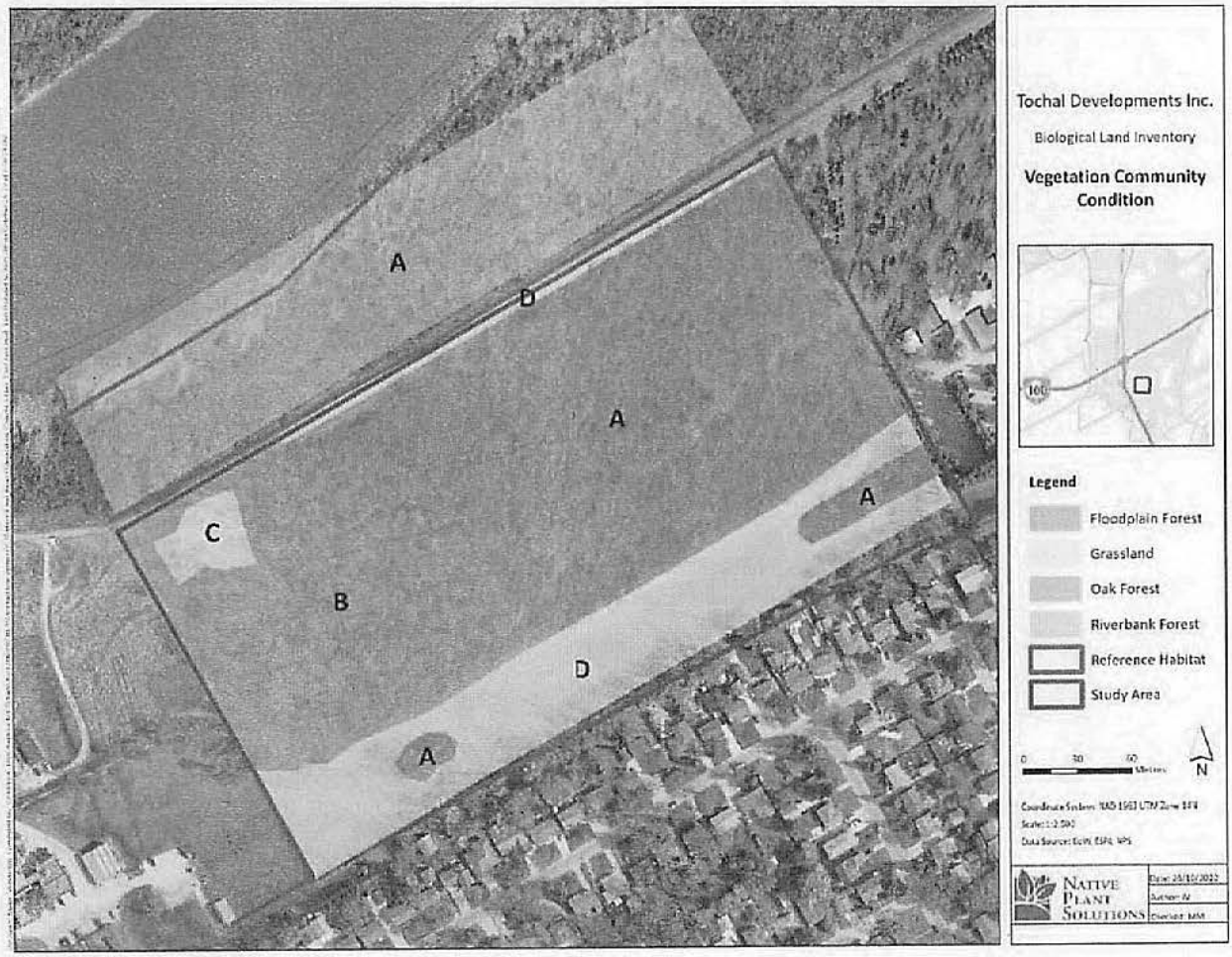


**Figure 3.** Vegetation Community Condition Rankings.

## Tree Protection

Taken from City of Winnipeg Tree Planting Details and Specifications Downtown Area and Regional Streets (City of Winnipeg 2009):

Construction activities near trees may result in injury to the trunk, limbs or roots of trees causing damage or death of the tree. In order to prevent such damage:

- Trees within or adjacent to a construction area must be protected during construction by means of a barrier surrounding a "Tree Protection Zone" (TPZ).
- Activities which are likely to injure or destroy the tree are not permitted within the TPZ.
- Tree pruning or root pruning of City of Winnipeg owned trees may only be done by a Contractor approved by the project's Qualified Tree Consultant or Urban Forestry Branch.
- No objects may be attached to trees protected by City of Winnipeg by-laws without written authorization by the City of Winnipeg.
- No City of Winnipeg tree or tree protected by a City of Winnipeg by-law may be removed without the written permission of the City of Winnipeg.

Table 11 is a chart showing optimal distances for determining a tree protection zone. Some site conditions may dictate the need for a smaller TPZ. The City of Winnipeg Urban Forestry Branch must be notified in these instances. Forestry will determine if the smaller TPZ is acceptable in the specific circumstance and advise of any additional tree protection or removal requirements.

**Table 11.** Minimum tree protection zone.

| (DBH) | Trunk Diameter Minimum Protection |
|---|---|
| <10 cm | 2.0m |
| 11-40cm | 2.4m |
| 41-50cm | 3.0m |
| 51-60cm | 3.6m |
| 61-70cm | 4.2m |
| 71-80cm | 4.8m |
| 81-90cm | 5.4m |
| 91-100 cm | 6.0m |

Trees within tree protection zones shall be protected by means of a "tree protection barrier"

meeting the following specifications:

- The required barrier is a 1.2 metre (4 ft) high orange plastic web snow fencing on 2" x 4" frame or as directed by the City of Winnipeg Urban Forestry Branch in accordance with City of Winnipeg Protection of Existing Tree Specifications. The barrier can be lowered around branches lower than 1.2 metres (4 ft). The barrier location can be adjusted to align with curbs and edges at clear path of travel zones.
- Tree strapping material will be installed on individual trees, where work will be completed within the TPZ.

## Tree Removal Guidelines

Trees were placed into three categories (Table 12) which the City of Winnipeg uses to determine whether the tree will be replaced, removed, or remain in the forest stand (City of Winnipeg 2014).

- **(0 – 10cm)** Trees can be replaced at approximately the same size. Customer pays removal cost if the Urban Forestry Branch is requested to remove trees (Cost represents the replacement costs currently $740 / tree).
- **(10 – 30cm)** Trees are not easily replaced and are valued according to the Council of Tree and Landscape Appraisal Formula.
- **(30cm +)** The position of the Urban Forestry Branch is to deny removal.

Natural stand trees growing in an "A" and "B" quality habitat are valued 1:1 ratio for those greater than 5 cm DBH. Trees greater than 10 cm DBH are valued at one replacement tree for every additional 7.5 cm of DBH (i.e., 17.5 cm DBH = 2 replacement trees @ $740 / tree = $1480). Natural stand trees growing in a "C" and "D" quality habitat shall be priced for removal.

**Table 12.** Trees documented in the Tochal study area (Total plot area = 594.52 $m^2$).

| Species | Size Class | | | |
|---|---|---|---|---|
| | Number of Trees and Small Shrubs Surveyed | 0-10 cm DBH | 10-30 cm DBH | 30 cm + DBH |
| *American Basswood* | **9** | 1 | 4 | 4 |
| *American Elm* | **22** | 13 | 7 | 2 |
| *Bur Oak* | **49** | 23 | 12 | 14 |
| *Green Ash* | **40** | 11 | 9 | 20 |
| *Manitoba Maple* | **12** | 9 | 3 | 0 |
| *Trembling Aspen* | **2** | 0 | 2 | 0 |
| ***Total Documented Trees*** | **134** | **57** | **37** | 40 |

Table 13 uses the collected data from all plots and study area size of 70,274.90 $m^2$ to extrapolate a population based on the density of species found at Tochal. Trees were estimated using the density observed by the survey data and multiplying it by the study area. The total number of trees is a best estimate, as not every tree within the study area was sampled.

**Table 13.** Estimated total population of tree species at Tochal.

| Species | 0-10 cm DBH | 10-30 cm DBH | 30 cm + DBH | Total Number of Trees |
|---|---|---|---|---|
| ***American Basswood*** | 155 | 621 | *409* | 1185 |
| ***American Elm*** | 2018 | 1086 | *205* | 3309 |
| ***Bur Oak*** | 3570 | 1862 | *1433* | 6865 |
| ***Green Ash*** | 1707 | 1397 | *2047* | 5151 |
| ***Manitoba Maple*** | 1397 | 776 | *0* | 2173 |
| ***Trembling Aspen*** | 0 | 310 | *0* | 310 |
| ***Totals*** | 8847 | 6053 | *4094* | 18994 |

The values calculated in Table 14 have been determined using the known population of trees, and the known size of the study area. Recording each tree in the sample area was not feasible, therefore these costs are only an estimate and may not reflect the true cost.

Table 14. Estimated cost for removal of all trees >10 cm DBH.

| DBH Category (cm) | *American Basswood* | *American Elm* | *Bur Oak* | *Green Ash* | *Manitoba Maple* | *Trembling Aspen* | Tree Density | Estimated number of Trees | Cost/Tree | Estimated Tree Value |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-17.5 | 2 | 6 | 10 | 6 | 6 | 2 | 0.0853 | 5996.8 | $ 740.00 | $ 4,437,626.32 |
| 17.5-25 | 1 | 2 | | 5 | 2 | | 0.0267 | 1874.0 | $ 1,480.00 | $ 2,773,516.45 |
| 25-32.5 | 2 | | | 3 | 1 | | 0.0160 | 1124.4 | $ 2,220.00 | $2,496,164.80 |
| 32.5-40 | 1 | | | 1 | | | 0.0034 | 236.4 | $ 2,960.00 | $ 699,770.35 |
| 40-47.5 | | | | 5 | | | 0.0084 | 591.0 | $ 3,700.00 | $ 2,186,782.34 |
| 47.5-55 | 1 | | 2 | 5 | | | 0.0135 | 945.6 | $ 4,440.00 | $ 4,198,622.09 |
| 55-62.5 | | | 3 | 1 | | | 0.0067 | 472.8 | $ 5,180.00 | $ 2,449,196.22 |
| 62.5-70 | | | 1 | | | | 0.0017 | 118.2 | $ 5,920.00 | $ 699,770.35 |
| 70-77.5 | | | 1 | | | | 0.0017 | 118.2 | $6,660.00 | $ 787,241.64 |
| 77.5-85 | | | | | | | 0.0000 | 0.0 | $ 7,400.00 | $0.00 |
| 85-92.5 | | 1 | | | | | 0.0017 | 118.2 | $ 8,140.00 | $ 962,184.23 |
| 92.5-100 | | | | | | | 0.0000 | 0.0 | $8,880.00 | $0.00 |
| Total Trees | 7 | 9 | 17 | 26 | 9 | 2 | | | Total | $21,690,874.77 |

## Conclusion

The estimated cost for removal of all trees >10 cm DBH would be $21,690,874.77 Based on the quality and condition of the >30 cm DBH trees, it is our recommendation that these trees be preserved. The cost for removal of trees with a DBH of 10-30 cm is estimated to be $9,707,307.57. The ecological services provided by the mature trees found in the study area are extensive. Reduction in ambient air temperature, soil stabilization, carbon sequestration, and creation of wildlife habitat is not easily measured in dollars, but they are worthy none the less.

## References

City of Winnipeg. 2004. Public Works Department, Urban Forestry Branch. Tree Removal Guidelines. [Online]. Available: https://winnipeg.ca/publicworks/parksOpenSpace/UrbanForestry/PDF/2014_Tree_Removal_Guidelines.pdf (Accessed: October 25, 2020)

City of Winnipeg. 2009. Public Works Department, Urban Forestry Branch. Tree Planting Details & Specifications Downtown Area and Regional Streets. [Online]. Available: https://winnipeg.ca/publicworks/parksOpenSpace/UrbanForestry/PDF/Principles_and_Guidelines.pdf. (Accessed: October 25, 2020)

## Appendix D. Definitions of Provincial Conservation Rankings

The following table provides definitions of the provincial rankings as defined by NatureServe (NatureServe 2020).

| Rank | Definition |
|---|---|
| SX | **Presumed Extirpated**—Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. [equivalent to "Regionally Extinct" in IUCN Red List terminology] |
| SH | **Possibly Extirpated** – Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching and/or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction. |
| S1 | **Critically Imperiled**— At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors. |
| S2 | **Imperiled**— At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. |
| S3 | **Vulnerable**— At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors. |
| S4 | **Apparently Secure**— At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors. |
| S5 | **Secure**— At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats. |
| S# | **Range Rank** —A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4). |
| SU | **Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. |
| SNR | **Unranked**—National or subnational conservation status not yet assessed. |
| SNA | **Not Applicable** —A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities (e.g., long distance aerial and aquatic migrants, hybrids without conservation value, and non-native species or ecosystems. |

| | |
|---|---|
| B | **Breeding**—Conservation status refers to the breeding population of the species in the nation or state/province. |
| N | **Non-breeding**—Conservation status refers to the non-breeding population of the species in the nation or state/province. |
| M | **Migrant**—Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province. |

## Appendix E. Vegetation Master Species List

The following table provides a comprehensive list of all vegetation species identified within the Tochal study area and reference area including results from the spring flowering surveys, comprehensive vegetation surveys and incidental observations. An introduced species (I) is defined as a foreign species non-native to Manitoba, that is only present due to human intervention. A native species (N) is a species that is indigenous to Manitoba as a result of natural processes. See Appendix D for provincial ranking definitions.

| Species Common Name | Scientific Name | Provincial Ranking | Native or Introduced |
|---|---|---|---|
| Alfalfa | *Medicago sativa* | SNA | I |
| Alsike Clover | *Trifolium hybridum* | SNA | I |
| American Basswood | *Tilia americana* | S3S4 | N |
| American Elm | *Ulmus americana* | S4S5 | N |
| American Hog Peanut | *Amphicarpaea bracteata* | S3S5 | N |
| American Vetch | *Vicia americana* | S5 | N |
| Assiniboia Sedge | *Carex assiniboinensis* | S3S4 | N |
| Beggars Tick | *Bidens frondosa* | S4 | N |
| Blue-joint Reedgrass | *Calamagrostis canadensis* | S5 | N |
| Bur Oak | *Quercus macrocarpa* | S5 | N |
| Canada Anemone | *Anemone canadensis* | S5 | N |
| Canada Mayflower | *Maianthemum canadense* | S5 | N |
| Canada Thistle | *Cirsium arvense* | SNA | I |
| Caragana | *Caragana arborescens* | SNA | I |
| Chicken of the Woods | *Laetiporus huroniensis* | NSR | N |
| Choke Cherry | *Prunus virginiana* | S5 | N |
| Common Bird Vetch | *Vicia cracca* | SNA | I |
| Common Burdock | *Arctium minus* | SNA | I |
| Common Milkweed | *Asclepias syriaca* | S3S4 | N |
| Common Moonseed | *Menispermum canadense* | S3 | N |
| Common Snowberry | *Symphoricarpos albus* | S4S5 | N |
| Common Timothy | *Phleum pratense* | SNA | I |
| Creamy Peavine | *Lathyrus ochroleucus* | S5 | N |
| Dandelion | *Taraxacum officinale* | SNR | I |
| Downy Arrowwood | *Viburnum rafinesquianum* | S4S5 | N |
| Downy Yellow Violet | *Viola pubescens* | S4 | N |
| Early Blue Violet | *Viola adunca* | S5 | N |
| Early Meadow Rue | *Thalictrum dioicum* | S5 | N |
| European Buckthorn | *Rhamnus cathartica* | SNA | I |
| Field Chickweed | *Cerastium arvense* | S5 | I |
| Fowl Bluegrass | *Poa palustris* | S5 | N |
| Garden Asparagus | *Asparagus officinalis* | SNR | I |

| Species Common Name | Scientific Name | Provincial Ranking | Native or Introduced |
|---|---|---|---|
| Graceful Sedge | *Carex praegracilis* | S4 | N |
| Green Ash | *Fraxinus pennsylvanica* | S4S5 | N |
| Ground Ivy | *Glechoma hederacea* | SNA | I |
| Herbaceous Greenbrier | *Smilax lasioneura* | S3 | N |
| Inland Sedge | *Carex interior* | S4? | N |
| Kentucky Bluegrass | *Poa pratensis* | S5 | I |
| Manitoba Maple | *Acer negundo* | S5 | N |
| Maple-leaved Goosefoot | *Chenopodium simplex* | S5 | N |
| Meadow Goat's-Beard | *Tragopogon dubius* | SNR | I |
| Nannyberry | *Viburnum lentago* | S4 | N |
| Nodding Trillium | *Trillium cernuum* | S4S5 | N |
| Northern Bedstraw | *Galium boreale* | S5 | N |
| Northern Black Currant | *Ribes hudsonianum* | S5 | N |
| Northern Stickseed | *Hackelia deflexa* | S4S5 | N |
| Peck's Sedge | *Carex peckii* | S5 | N |
| Pincherry | *Prunus pensylvanica* | S5 | N |
| Poison Ivy | *Toxicodenron radicans* | S5 | N |
| Purple Avens | *Geum rivale* | S3S4 | N |
| Purple Oat Grass | *Schizachne purpurascens* | S5 | N |
| Quack Grass | *elymus repens* | SNA | I |
| Raspberry | *Rubus idaeus* | S5 | N |
| Red Baneberry | *Actaea rubra* | S5 | N |
| Red Clover | *Trifolium pratense* | SNA | I |
| Red-osier Dogwood | *Cornus sericea* | SNR | N |
| Reed Canary Grass | *Phalaris arundinacea* | S5 | N |
| Riverbank Grape | *Vitis riparia* | S3S4 | N |
| Roughfruit Fairybells | *Prosartes trachycarpa* | S4 | N |
| Roughleaf Rice Grass | *Oryzopsis asperifolia* | S5 | N |
| Saskatoon | *Amelanchier alnifolia* | S5 | N |
| Sedge species | *Carex sp.* | - | N |
| Small Flower buttercup | *Ranunculus parviflorus* | SNA | N |
| Smooth Bromegrass | *Bromus inermis* | SNR | I |
| Sow Thistle | *Sonchus arvensis* | SNR | I |
| Spreading Sweet Cicely | *Myrrhis odorata* | SNR | I |
| Star Flowered False Solomon's Seal | *Maianthemum stellatum* | S5 | N |
| Sweet Scented Bedstraw | *Galium triflorum* | S5 | N |
| Tall Meadow Rue | *Thalictrum dasycarpum* | S5 | N |
| Tatarian Honeysuckle | *Lonicera tatarica* | SNA | I |
| Three-leaf Solomon's Plume | *Maianthemum trifolium* | S5 | N |

| Species Common Name | Scientific Name | Provincial Ranking | Native or Introduced |
|---|---|---|---|
| Timothy | *Phleum pratense* | SNA | I |
| Trembling Aspen | *Populus tremuloides* | S5 | N |
| Tufted Loostrife | *Lysimachia thrysiflora* | S5 | N |
| Veiny Meadow Rue | *Thalictrum venulosum* | S5 | N |
| Virginia Creeper | *Parthenocissus quinquefolia* | SNR | N |
| Virginia Wild Rye | *Elymus virginicus* | SNR | I |
| Wild Red Currant | *Ribes triste* | S5 | N |
| Wood Nettle | Laportea canadensis | S3S4 | N |
| Wood Rose | *Rosa woodsii* | S4 | N |

## Appendix F. Tochal Study Area and Reference Area Photos

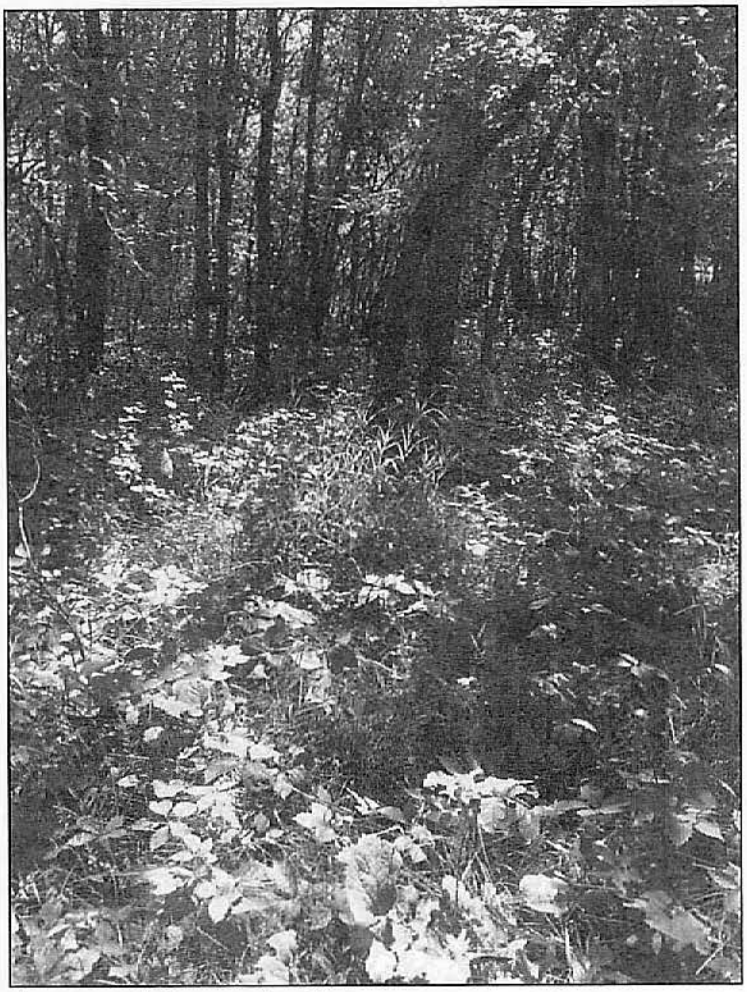

**Photo 1**. Oak forest - plot F1.

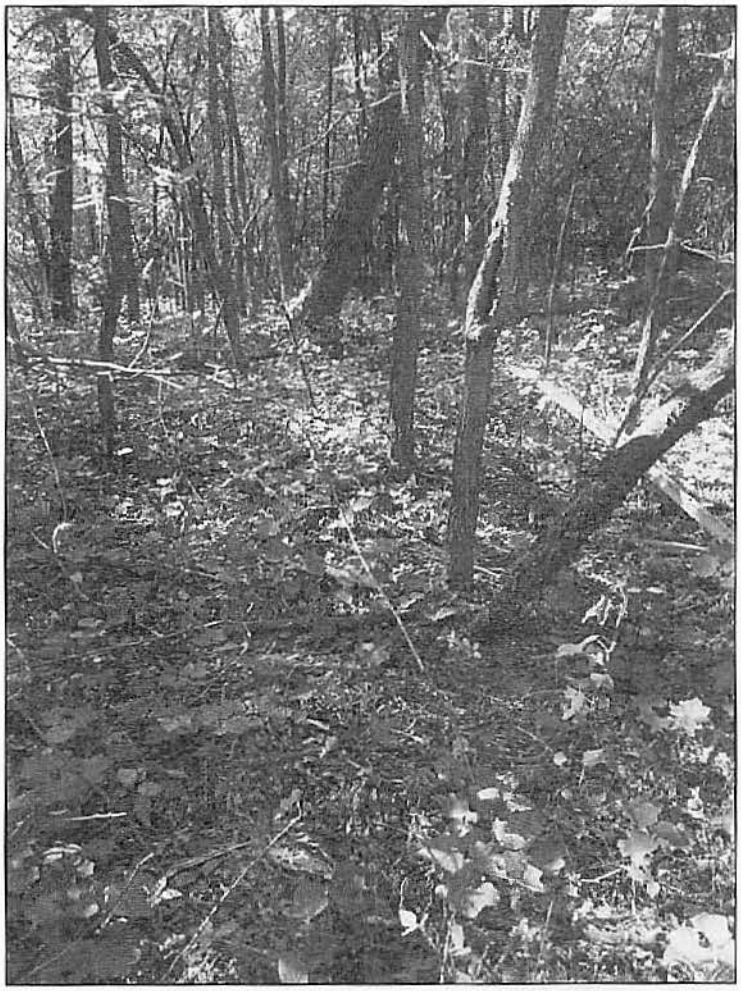

**Photo 2.** Oak forest – plot F2.

**Photo 3**. Oak Forest – plot F3.

**Photo 4.** Riverbank forest – plot R2.

**Photo 5**. Riverbank forest – plot R2

**Photo 6**. Floodplain forest – plot F5

**Photo 7**. Floodplain forest – plot F6

**Photo 8.** Floodplain forest – plot F7.

**Photo 9.** Floodplain forest – plot F10

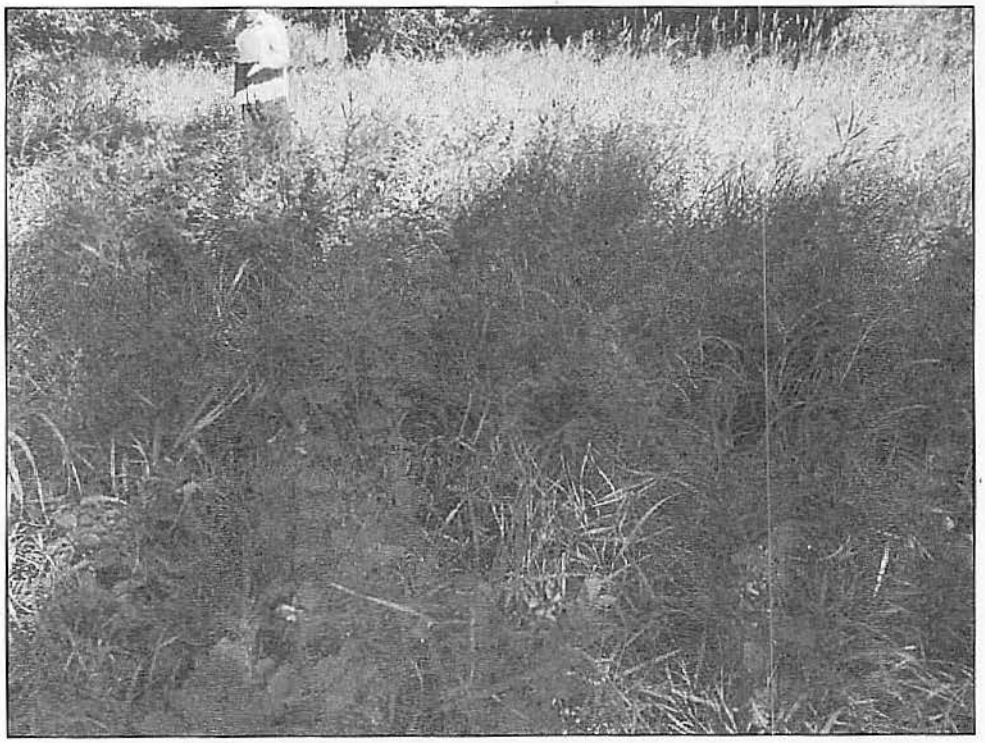

**Photo 10.** Grassland – plot G1

**Photo 11**. Grassland – plot G3.

**Photo 12**. Grassland – plot G4

## Appendix G. Wildlife Master Species List

The following table provides a comprehensive list of all wildlife species identified within the Tochal study area and reference area including results from the nocturnal owl surveys, breeding bird surveys, amphibian surveys, arthropod surveys, incidental mammal observations and any other incidental species observed throughout the biological inventory. See Appendix D for provincial ranking definitions.

| Species Common Name | Scientific Name | Provincial Ranking | COWEWIC Ranking |
|---|---|---|---|
| **Breeding Bird Species** | | | |
| American crow | *Corvus brachyrhynchos* | S5B, S2S3N | |
| American goldfinch | *Spinus tristis* | S5B | |
| American redstart | *Setophaga ruticilla* | S5B | |
| American robin | *Turdus migratorius* | S5B | |
| black-capped chickadee | *Poecile atricapillus* | S5 | |
| Canada warbler | *Cardellina canadensis* | S3B | Threatened |
| cedar waxwing | *Bombycilla cedrorum* | S5B | |
| chipping sparrow | *Spizella passerina* | S5B | |
| clay-coloured sparrow | *Spizella pallida* | S5B | |
| common yellowthroat | *Geothylpis trichas* | S5B | |
| Eastern phoebe | *Sayornis phoebe* | S5B | |
| Eastern wood pewee | *Contopus virens* | S3B | Special Concern |
| great crested flycatcher | *Myiarchus crinitus* | S4B | |
| gull Species | - | - | |
| hairy woodpecker | *Picoides villosus* | S5 | |
| indigo bunting | *Passerina cyanea* | S4B | |
| least flycatcher | *Empidonax minimus* | S5B | |
| magnolia warbler | *Setophaga magnolia* | S5B | |
| ovenbird | *Seiurus aurocapillus* | S5B | |
| pileated woodpecker | *Dryocopus pileatus* | S5 | |
| red-winged blackbird | *Agelaius phoeniceus* | S5B | |
| song sparrow | *Melospiza melodia* | S5B | |
| white-breasted nuthatch | *Sitta carolinensis* | S5 | |
| yellow warbler | *Setophaga petechia* | S5B | |
| woodpecker species | - | - | |
| downy woodpecker | *Picoides pubescens* | S5 | |
| **Nocturnal Owl Species** | | | |
| barred owl | *Strix varia* | S3S4 | |
| **Mammal Species** | | | |
| American mink | *Vison vison* | S5 | |
| Little brown mat | *Myotis lucifugus* | S2N | Endangered |

| Species Common Name | Scientific Name | Provincial Ranking | COWEWIC Ranking |
|---|---|---|---|
| North American red squirrel | *Tamiasiurus hudsonicus* | S5 | |
| raccoon | *Procyon lotor* | S5 | |
| white-tailed deer | *Odocoileus virginianus* | S5 | |
| **Arthropod Species** | | | |
| tri-coloured bumblebee | *Bombus ternarius* | S5 | |
| yellow-banded bumblebee | *Bombus terricola* | S4S5 | |