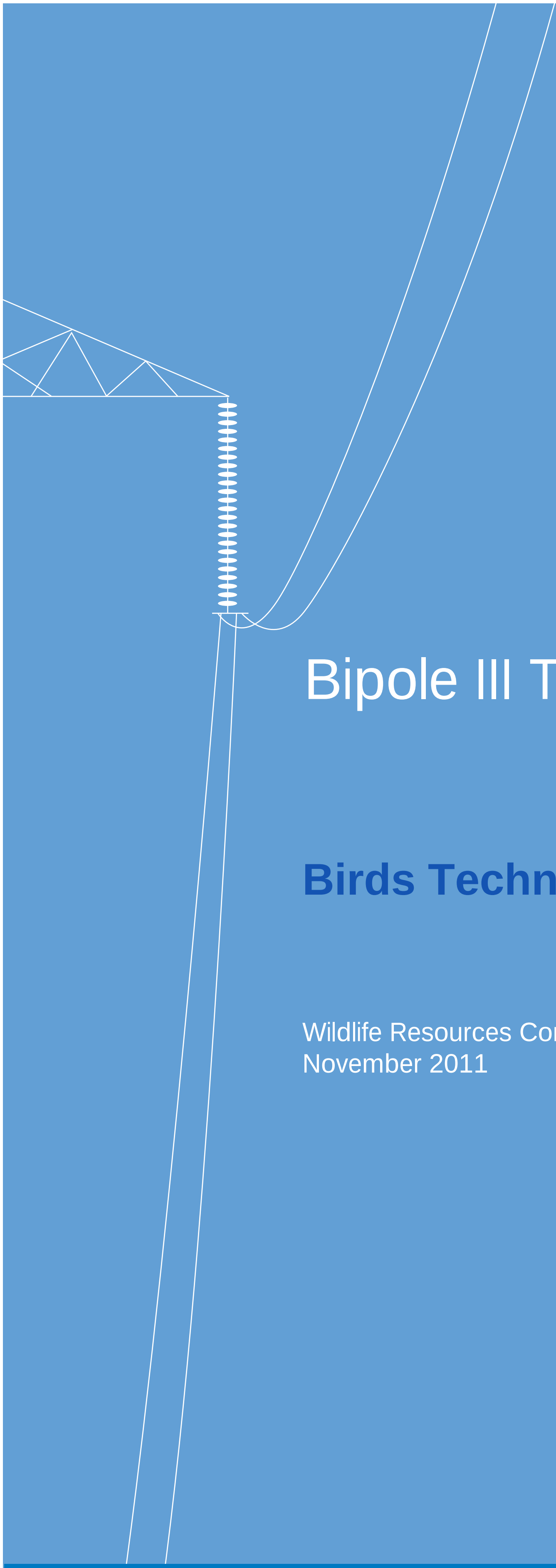

Bipole III Transmission Project

Birds Technical Report

Wildlife Resources Consulting Services MB Inc.
November 2011

Manitoba Hydro

Bipole III Birds Technical Report

Bipole III Birds
Technical Report

Report Prepared For

MMM GROUP

and

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc

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Executive Summary

Manitoba Hydro is proposing to develop a new 500 kilovolt (kV) high voltage direct current (HVdc) transmission line, known as Bipole III, on the west side of Manitoba. The proposed Project will consist of a HVdc transmission line originating at a new converter station to be located near the site of the proposed Conawapa Generating Station on the Nelson River and terminating at a second new converter station to be located at the Riel site east of Winnipeg. The proposed Project will also include new 230 kV transmission lines linking the northern converter station to the northern collector system at the existing 230 kV switchyards at the Henday Converter Station and Long Spruce Generating Station. Each of the converter stations will require a ground electrode facility connected to the station by a low voltage feeder line.

As part of the Site Selection and Environmental Assessment (SSEA), bird communities were examined and assessed within the biophysical component of the effects assessment. . Bird species play important roles in the biophysical and socio-economic environments, from the dispersion of seeds to providing food for people. Some bird species have unique habitat requirements for each stage of their life cycle (e.g., nesting, feeding), while other bird species and groups have broader habitat requirements for other stages of their life cycle (e.g., staging areas). As a group, birds require a wide range of habitats to maintain healthy populations. The sustainability of habitat is an important consideration to maintain bird populations on the landscape for future generations.

Bird studies were conducted to support predictions of possible effects of the Bipole III Project on the environment. This information is required to develop the Environmental Impact Statement for the Project. The broad objectives of the bird assessment were:

- to describe the existing environment for birds and bird communities in the Local Study Area;
- to provide data and information to assist in the biophysical description of the preferred route and Local Study Area;
- to provide data and information to assess potential adverse effects on birds and bird habitats that may result from the Project; and
- to provide avoidance and mitigation strategies to reduce and/or eliminate any adverse environmental effects.

Valued Environmental Components (VEC)

VECs were used to focus the environmental assessment. VECs were considered as aspects of the natural and socio-economic environment that are particularly notable or valued because of their ecological, scientific, resource, socio-economic, cultural, health, aesthetic, or spiritual importance, and which have a potential to be adversely affected by project development or have the potential to have an effect on the project. The VEC selection process for birds incorporated concerns provided by provincial and federal regulators, the public, Aboriginal communities, Manitoba Hydro and the multidisciplinary team and professional judgment. Bird VECs include mallard, sandhill crane, great blue heron, bald eagle, ruffed grouse, sharp-tailed grouse, and pileated woodpecker (representing broader bird groups) while least bittern, yellow rail, ferruginous hawk, burrowing owl, short-eared owl, common nighthawk, whip-poor-will, red-headed woodpecker, olive-sided flycatcher, loggerhead shrike, Sprague's pipit, golden-winged warbler, Canada warbler, and rusty blackbird were identified as species at risk VECs that had potential to be adversely affected by the Project.

Methods

The bird assessment included the selection of study areas and the development of bird habitat models for each VEC. Study area habitat data were derived using the Land Cover Classification Enhanced for Bipole (LCCEB). All Project specific environmental effects on bird community values were identified, mitigation measures prescribed, and residual effects quantified, where possible. Residual environmental effects were assessed according to Canadian Environmental Assessment Act (CEAA) guidelines. A cumulative effects assessment was incorporated into the process.

Fieldwork supported the assessment. Bird community sampling was designed to maximize the detectability of various bird species throughout the Project area, and to cover a wide range of habitat types, including those anticipated to be most sensitive to project disturbances. Surveys included, breeding bird surveys, rare bird surveys, owls surveys, colonial waterbird surveys, waterfowl surveys and bird of prey surveys.

Environmental Effects and Mitigation

The construction and operation of the Bipole III Transmission Project are predicted to have a variety of effects to bird species within the Footprint or the Local Study Area. Potential habitat and bird population effects were mitigated initially during the alternative routing process, where the route that had the least potential effects to bird species was selected. Potential effects are grouped into three major categories: morality, habitat alteration and sensory disturbance, and disruption of movements.

During the Bipole III Project construction phase, increases in bird mortality may result from nest destruction through clearing, brood parasitism, wildlife vehicle collisions, and hunting through increased access. Proposed mitigation for these effects include limiting construction and clearing activities during the nesting and brood rearing season, using setback distances from riparian areas and at species at risk nests (if encountered), and limiting hunting by workers. No mitigation is recommended for potential increases in brood parasitism.

Construction will also result in changes to habitat and temporary changes from sensory disturbances caused by the clearing of habitat, the operation of heavy machinery and blasting. Depending on the frequency of disturbances, auditory or visual stimuli from construction equipment can diminish bird communications used in the defense of territories or to attract mates, and could result, and be measured in reduced reproductive success in the Footprint, and extending into the Local Study Area. Limiting construction and clearing during the brood rearing season will mitigate the effects of these sensory disturbances, but are still anticipated to affect resident bird species.

Disruption of movement related to construction may occur from the presence of heavy machinery and other anthropogenic features, as some birds actively avoid these types of features. This effect is mitigated by limiting construction and clearing during the nesting and brood rearing period.

Project-specific features are anticipated to affect, in the majority of cases considered, much less than 5% of available VEC bird habitats located within the Local Study Area, which is less than the range of variation that may be measured in these cases. Habitat alterations considered included VEC bird habitats for the HVdc transmission lines, AC collector lines and distributions lines, borrow areas, the Keewatinoow Converter Station, the Riel Converter Station, and the northern and southern electrode sites that are features associated with the Bipole III Project.

During the operation of the project mortality effects may be measured in the form of increased predation, increased hunting opportunities, and potential bird wire collisions. Predation from birds of prey will be mitigated through the use of perching deterrents in areas where predation is problematic. Bird diverters will be placed in areas where there is a higher probability of bird-wire collisions to minimize this potential effect. Finally, hunting is a regulated activity and does not require additional mitigation measures. The decommissioning of temporary access trails are expected to minimize this potential effect.

While no additional habitat is expected to be altered during the operation of the Project, regular maintenance activities may result in localized sensory disturbances. Tall vegetation and danger trees that pose a safety risk to operations will be removed periodically. Limiting maintenance during the brood rearing period at sensitive sites such as near wetlands, known colonial waterbird colonies, and near bird of prey nests are expected to mitigate many of these disturbances. The operation of the Project is not expected to have any measureable effect on the movements of most birds found in the Local Study Area.

Environmentally Sensitive Sites

A total of 134 environmentally sensitive sites for birds were identified, including 32 point sites, (e.g., great blue heron rookery), and 101 sites extended over a wider geographic area (e.g., migration corridor). Environmentally sensitive sites for birds include areas where higher bird abundances, particularly waterfowl, colonial waterbirds, and migratory raptors, were expected, in close proximity to the Final Preferred Route (FPR), that have an increased likelihood of bird-wire collisions. Other sensitive sites include certain species at risk habitat, and other areas with bird concentrations, including leks.

The general geographic area of highest concern related to the Bipole III Project, are the bird habitats and populations located in the Red Deer Lake to Cormorant Lake region. This area was described as having two physiographic bottlenecks during the alternative route process. The FPR is located in this geographic area of interest, and it contains a relatively high number of overlapping sensitive site features for birds, including landscape sensitivity indicators (e.g., Important Bird Area, Wildlife Management Area, Provincial Park, Ecological Reserves, Designated Protected Areas), a high use area for Aboriginals and for other Socio-economic purposes such as tourism or outfitters, sensitive wetland and riparian bird habitats, a larger potential number of species at risk, the northern fringe of brown-headed cowbird range, a larger and potentially more concentrated number of waterbird colonies, and compared to other regions in Manitoba, relatively high waterfowl and other waterbird densities/abundances used for staging and nesting.

Mitigation measures for environmentally sensitive sites include construction and operation timing restrictions, the placement of bird diverters at sensitive sites where a higher risk of bird-wire collisions is expected, use of setback distances to buffer nests from disturbances and potential habitat effects, and placement of perch deterrents near sharp-tailed grouse leks to reduce predation.

Residual Effects

As measured by VECs, even though the effects of the Bipole III Transmission Project on bird communities will be present for the life of the Project, residual effects are projected to be negative and small. Although these effects are unlikely to be measurable within the range of natural variation to bird habitats, or to local populations of birds, long-term residual effects include the following:

- small decrease in productivity of some local bird populations due to brood parasitism by brown-headed cowbird;
- habitat alteration on the HVdc transmission line, AC collector lines, and the ground electrodes and lines, and at the borrow areas;
- small loss of habitat at tower footprints and the Keewatinoow Converter Station;
- small increase in nesting and foraging opportunities for some bird species; and
- sensory disturbances resulting in temporary displacement of local birds.

Residual effects on bird populations will be negative and small magnitude. Short-term, regular or continuous, and reversible effects are anticipated during construction. Long-term, sporadic or intermittent, and reversible effects are anticipated during operation. No significant Project-related residual effects are anticipated for bird populations.

Cumulative Effects

Many environmental factors play a role in affecting bird species communities alongside the development of the Bipole III transmission line. These factors could include the association of various anthropogenic practices including farming, forestry, mining and other forms of landscape development including the building of roads, clearing of land, the development of hydro-electric generating stations etc. More naturally induced changes to bird communities could happen from forest fires, flooding, insect outbreaks and climate change. When assessed against other development in Manitoba, and as described geographically in the context of ecoregions, the residual effects of the Project may only be measurable at the individual species level, and bird populations should remain within the natural range of variation over the long-term. As such, it is highly likely that cumulative effects are anticipated to be negligible as a result of the Bipole III Project. Common bird species with robust populations are expected to remain numerous and unchanged in the Project Study Area while bird species in decline will likely continue to decline, unless initiatives such as recovery strategies are implemented successfully, and these declining trends can be reversed.

Climate change is predicated to have the potential for a variety of impacts associated with the Bipole III proposed transmission route including the increased frequency of extreme weather events such as severe and extended periods of drought, more intensive and frequent thunder storms, greater variability in temperature including winter cold and summer heat, and stronger, more frequent wind events. Climate change effects on VECs could include shifts in the distribution of birds northward, increases in the abundance of brown-headed cowbirds, earlier arrival and nesting dates, and later departures dates of migratory VECs, and potentially, long-term habitat changes. Additive effects to bird VECs that may result from climate change on the FPR are manageable with follow-up and mitigation. Existing mitigation measures (e.g., bird deflectors) would be applied to any new sensitive sites that are identified over time. The timing of maintenance would be adjusted to avoid sensitive periods, especially if breeding and nesting periods become earlier as a result of climate change. Potential expansion of brood parasitism by brown-headed cowbird may require population control actions, but only if species at risk are affected further by climate change. As a result, potential cumulative effects related to the Bipole III Project with climate change should remain small.

On the existing landscape, habitat supply, refuges, and connectivity of the landscape will continue to be important to bird survival and dispersal. Many initiatives have an important role in sustaining bird populations within the Bipole III Project Area, including wetland and other habitat conservation programs, waterfowl and other bird species management partnerships, global bird monitoring networks, recovery and action working groups, and partnerships with the Federal and Provincial governments. Manitoba Hydro has active partnerships or continue to sponsor private and public agencies that address environmental sustainability issues, including those for birds (e.g., University research on Burrowing Owl, Manitoba Breeding Bird Atlas).

Follow-up/Monitoring

Follow-up and monitoring measures are important to ensure that the Bipole III Project has a minimal effect on bird species, populations, and habitats. If an adequate monitoring program is not established, it is possible that unexpected effects may occur and not be noticed until the effect is irreversible. Follow-up includes acquiring more detailed information on some sensitive sites where there is uncertainty so that appropriate mitigation measures can be applied prior to construction. Monitoring includes evaluating the effectiveness of bird diverters and set-back distances, monitoring bird mortality from wire collisions, vehicle collisions, and electrocutions, monitoring species at risk and bird colonies in proximity to the transmission line, and the monitoring of accidental spills and fire.

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1.0 INTRODUCTION

1.1 BACKGROUND

Manitoba Hydro is proposing to develop a new 500 kilovolt (kV) high voltage direct current (HVdc) transmission line, known as Bipole III, on the west side of Manitoba. The proposed Project will consist of a HVdc transmission line originating at a new converter station to be located near the site of the proposed Conawapa Generating Station on the Nelson River and terminating at a second new converter station to be located at the Riel site east of Winnipeg. The proposed Project will also include new 230 kV transmission lines linking the northern converter station to the northern collector system at the existing 230 kV switchyards at the Henday Converter Station and Long Spruce Generating Station. Each of the converter stations will require a ground electrode facility connected to the station by a low voltage feeder line. For a detailed discussion of the Bipole III transmission lines and facilities components, see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*.

Studies have concluded that a new transmission line and associated facilities would improve system reliability and reduce dependency on Dorsey Station and the existing HVdc Interlake corridor (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). The Bipole III Transmission Reliability Project would also establish a second converter station in southern Manitoba, to provide another major point of power injection into the transmission and distribution system. Bipole III will also reduce line losses on the existing Bipole I and II and provide additional transmission line capacity from north to south. Following an assessment of system reliability options and review by the Manitoba Hydro Electric Board and the Province of Manitoba, the decision was made to develop Bipole III on the west side of the province.

As part of the Site Selection and Environmental Assessment (SSEA) process (see Section 1.2), biophysical and socio-economic parameters are being examined and assessed within the Bipole III Project Study Area (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Studies are being conducted to support predictions of possible effects of the Project on the environment. This information is required in developing an Environmental Impact Statement for the Project.

Bird species play important roles in the biophysical and socio-economic environments, from the dispersion of seeds to providing food for people. Some bird species have unique habitat requirements for each stage of their life cycle (e.g., nesting, feeding), while other bird species and groups have much broader habitat requirements for other stages of their life cycle (e.g., staging areas). As a group, birds require a wide range of habitats to maintain healthy populations. The sustainability of habitat is an important consideration to maintain bird populations on the landscape for future generations. It is important to recognize further that an important element of biodiversity in Manitoba is comprised of its many bird species.

The construction and operation of overhead transmission lines, converter stations and ground electrode sites pose a potential negative impact to bird species habitat. In some cases, certain bird species may benefit from habitat alterations. In areas where habitat is of low sensitivity, or in areas where populations are broad and abundant on the landscape, transmission line construction and maintenance activities will typically have a small negative effect and therefore constitutes a low risk to bird habitats and the populations it supports. However where bird species habitats are considered highly sensitive, due to isolation or scarcity, or where bird populations are small, even a small negative effect may present a higher risk of potential effects to these species. It is therefore important to evaluate the Project Study Area from both a bird species habitat perspective, and from a population perspective to minimize the risk of effects on species of concern.

1.2 SCOPE

The Bipole III Project SSEA process includes a comprehensive multidisciplinary environmental assessment. Wildlife Resource Consulting Services MB Inc. has been retained by Manitoba Hydro to evaluate the Preferred Route for the Bipole III Transmission Project from a biophysical perspective, as it relates to the bird communities within the Project Study Area (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). The Bipole III Transmission Project encompasses the following components:

- The northern converter station (Keewatinoow), the associated ground electrode and electrode line connecting the two;
- The construction power station and workers camp;
- The construction power transmission line from Limestone generating station to the construction power station;
- Five 230 kV collector lines connecting Long Spruce generating station and Henday Converter station to the Keewatinoow converter station;
- The southern converter station (Riel), the associated ground electrode and electrode line connecting the two;
- The Bipole III 500 kV HVdc transmission line connecting Keewatinoow and Riel converter stations;
- Access routes/trails required for project construction and maintenance; and
- Borrow areas and storage/marshalling yards required for project construction purposes.

The main tasks included in the SSEA process involved: identification of the environmental issues, selecting preliminary Valued Environmental Components (VECs) to focus the assessment on relevant issues, evaluation and comparison the alternative routes using constraints and opportunities evaluation criteria, identification of a preliminary preferred route, providing recommendations for route adjustments or mitigation on the preliminary preferred route, collecting and analyzing additional data on site-specific sensitivities and provide further recommendations for route adjustments or mitigation, and finally, measure the effects on selected VECs for the final preferred route (FPR) (i.e., using **thresholds** where possible) within the context of these spatial and temporal boundaries.

An important component of the SSEA process was to identify and focus on the issues that are of greatest concern to the stakeholders and regulators. Concerns related to the Bipole III Project have been identified with input from provincial and federal regulators, and during four rounds of environmental assessment consultation process, including discussions with landowners, discussions with Aboriginal and non- Aboriginal communities (see *EIS Chapter 5 Environmental Assessment Consultation Program*), as well as communications between Manitoba Hydro and the multidisciplinary team, and from professional experience. Although the issues can vary according to the environmental component considered, bird-related issued are identified in this report. Refer to Section 5.0 for a discussion of the issues.

While much of the Bipole III Project represents previously disturbed or human-modified bird habitats (e.g., adjacent to existing rights-of-way, agricultural croplands), a substantial amount of forested lands, grasslands (i.e., both native and disturbed), riparian habitats and wetlands are found in the Project Study Area. Native vegetation tends to improve biodiversity by providing improved habitat for many bird species and therefore, potential effects on these habitats in particular, represent a potential concern for different bird communities. The relative abundance and patch sizes of native vegetation tend to increase from southern to northern Manitoba. The transition zone between forested lands, large native grasslands and urban/agricultural interface generally occurs on the west side of Lake Manitoba. This portion of the province may be of particular potential concern for habitat fragmentation effects on bird communities. Bird issues associated with these habitat types will vary considerably, as can the mitigation measures proposed.

VECs are often used to focus an environmental assessment (CEAA 1996). This environmental assessment includes VECs whose aspects of the natural and socio-economic environment that are particularly notable or valued because of their ecological, scientific, resource, socio-economic, cultural, health, aesthetic, or spiritual importance, and which have a potential to be adversely affected by project development or have the potential to have an effect on the project.

An important element of the Bipole III Project decision-making process includes the alternative routes analysis. Alternative route scenarios are provided to the multidisciplinary Study Team. By avoiding sensitive biophysical and socio-economic features (constraints) and utilizing opportunities (e.g., existing RoWs) where possible, potentially significant Project effects are avoided early in the process. Cumulative effects presented by all disciplines are considered in the selection processes. Criteria for birds are described in general (see Section 1.4), with further detail provided in Section 3.2, and in the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*.

Study parameters are provided to the multidisciplinary Study Team by Manitoba Hydro, including the spatial and temporal details of the proposed infrastructure. Ecological context for bird communities is examined at an ecozone level, ecoregion level, and occasionally at the ecodistrict level, as based on the Ecological Framework for Canada (Ecological Stratification Working Group 1995). Stand and site-level bird habitat data are derived from field studies, literature, and professional judgment. Bird habitat themes and mapping are most often expressed using the Land Cover Classification Enhanced for Bipole (LCCEB; see *The Canadian Land Cover Classification Enhanced for Bipole*).

The assessment of the Bipole III Project Components is based on:

- comparative literature and desktop analyses, including existing information on distributions and habitat requirements of bird species;
- models designed to predict potential species occurrences associated with the Project Components, based on availability of suitable habitat; and
- results of field studies conducted in 2009 and 2010, used to validate habitat models and examine species distributions within predicted suitable habitat.

1.2.1 Purpose

The purpose of the Bird Technical Report is to describe the existing environment for bird in the Bipole III Project Area, and to describe the potential effects of the Bipole III Transmission Project on the existing environment for birds. Included in this assessment are measures such as avoidance and mitigation strategies that are used to reduce and/or eliminate any adverse environmental effects. The results of this assessment are included in the *Manitoba Hydro Bipole III Transmission Project: A Major Reliability Improvement Initiative, Environmental Impact Statement* which Manitoba Hydro will submit to regulators for review and licensing.

1.3 LEGISLATION

Birds are protected by federal and provincial legislation (Appendix A), and as such, a thorough assessment of Project-related effects on bird communities, and their significance, is required, and all appropriate mitigation measures must be identified. This bird assessment report is developed with the guidance of the following legislation:

- *The Environment Act (*Manitoba)
- *The Wildlife Act* (Manitoba)
- *The Endangered Species Act* (Manitoba)
- *Canadian Environmental Assessment Act*
- *Migratory Birds Convention Act*
- *Species at Risk Act*
- *Canada Wildlife Act*

Regulations, guidelines, and references that were also considered for the assessment and protection of birds and bird habitats found in the Project Study Area included:

- Federal Government – The Federal Policy on Wetland Conservation (Government of Canada 1991)
- Manitoba Conservation – Forest Management Guidelines for Terrestrial Buffers (Manitoba Conservation 2010)

- Manitoba Conservation Forest Practices Guidebook – Forest Management Guidelines for Riparian Management Areas (Manitoba Conservation 2008)
- Manitoba Conservation Forest Practices Guidebook – Forest Management Guidelines for Brush Disposal (Manitoba Conservation 2005)
- Manitoba Conservation Forest Practices Guidebook – Forest Management Guidelines for Forestry Road Management (Manitoba Conservation 2005)
- Manitoba Conservation – Principle and Guidelines of Sustainable Development (Manitoba Conservation 2011)
- Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Manitoba Natural Resources 1996)

1.4 REPORT OUTLINE

This report focuses on the bird VECs, selected from groups including waterfowl and other waterbirds, colonial waterbirds, upland game birds, birds of prey, woodpeckers, songbirds and other birds, and federally and provincially listed species at risk. VECs are discussed separately throughout the report.

Section 1 of this report generally provides background, describes the physical components that make up the Bipole III Transmission Project and defines the geographic extent. It discusses the purpose for conducting the environmental effects assessment of the forestry environment and references technical reports previously developed in preparation for this EA.

Section 2 describes the study areas, including those used for describing the existing environment, areas used for different types of field studies, and the areas used for the effects assessment.

Section 3 describes the methods. Context is provided for the development of habitat categories used in the existing environment and effects assessment. The process for the development and selection of Valued Environmental Components is discussed. Finally, more detail is provided on characterizing and assessing project effects, introducing mitigation, defining residual effects, and the approach to be used for cumulative effects.

Section 4 is describes the existing environment for birds and bird communities within various study areas. Data sources that were used to describe the existing environment are found primarily in this section. A hierarchical classification is used to describe the existing environment that focuses on ecosystems. Important species that are found in the Bipole III Project Area are organized by bird group. Environmentally Sensitive Sites are listed in the existing environment description.

Section 5 contains the environmental effects assessment. Mitigation measures are proposed and follow up monitoring requirements identified to determine if mitigation measures were applied and effective. Residual effects following mitigation are defined and environmentally sensitive sites for inclusion in the Environmental Protection Plan (EnvPP) are specified. Follow-up and monitoring is discussed. A cumulative effects assessment is conducted and discussed for the residual project effects.

Section 6 provides the conclusions for the Bipole III Project. Section 7 contains a glossary of terms, and a list of acronyms and abbreviations. Section 8 includes references, and literature citations. Maps for the Project follow this section.

2.0 STUDY AREAS

2.1 GENERAL REGIONAL AREA DESCRIPTION

Details of Project Study Area are described in the Bipole III will originate at the Keewatinoow Converter Station site in northern Manitoba, will travel south and west of Lakes Winnipegosis and Manitoba, south and east to Winnipeg and terminate at the Riel Converter Station east of the Red River Floodway in the Rural Municipality (RM) of Springfield. The general area is approximately 1,400 km long and transects five distinct ecozones: Prairies, Boreal Plains, Boreal Shield, Taiga Shield and Hudson Plains (refer to Section 4.2 for a detailed description).

2.2 BIRD STUDY AREAS

During the initial route evaluation phase, an initial study area was selected that consisted of a general area running along the west side of the province (*Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Multidisciplinary team recommendations were made on most sensitive areas to avoid in the selection of the alternative routes. For birds, this included known critical habitat for species at risk, colonies, Important Bird Areas (IBAs), concentrations of waterfowl, and lands that are known to support higher quality bird habitats (e.g., national and provincial parks, Wildlife Management Areas (WMAs), Protected Areas Initiatives (PA's)).

The next phase of route evaluation involved the evaluation of three Bipole III alternative routes within the Project Study Area. The data used in this evaluation included all spatially available materials found within the Project Study Area that was provided by Manitoba Hydro, regulators, stakeholders, other scientific data sources, or derived data provided by each discipline. Data sources are discussed in the *Bipole III Transmission Project: Summary Report for the Alternative Routes Evaluation Birds and Southern Mammals*. { At this stage of evaluation, the alternative routes consisted of three routes with many interconnections (i.e., nodes). The bird assessment of the Bipole III Transmission Project alternative routing stage focused on selected group and species VECs within and adjacent to the alternative routes. Context was provided by ecodistrict level evaluations. Segments of the alternative routes were ranked based on these attributes. An analysis of alternative routes was initially conducted (see Appendix B). The results of the alternative routes evaluation on bird VECs and sensitive sites known at that time are summarized in Appendix B. Based on multidisciplinary team data, which included an analysis of all constraints and opportunities provided by each discipline, a Preliminary Preferred Route (PPR) was selected.

As part of the PPR and the FPR evaluation process, biophysical parameters were examined and assessed, ultimately assisting in route alignment. The FPR selected is approximately 1,400 kilometres (km) long and transects five distinct ecozones: Hudson Plains, Taiga Shield, Boreal Shield, Boreal Plains, and Prairie (Map 1 – Bipole III study areas). In composition, these ecozones represent 3%, 3%, 37%, 35%, and 23% of the Project Study Area respectively.

For bird assessment studies, the Bird Study Area was defined by about a 10 km (or six mile) wide corridor around the PPR (the region) provided in March 2010. The 10 km width was used to ensure that an adequate amount of each habitat type would be available for sampling, and to be surveyed in the most efficient manner possible, and to ensure that an adequate number of samples were available in nearby habitats, if the PPR were to be adjusted for mitigation purposes. Efficient and effective access improved site distribution to increase breeding bird data precision collected on or near the PPR. Other study areas include the Right of Way (RoW), describing the footprint for the HVdc transmission, alternating current (AC) collector, and electrode lines, and Footprint, describing the area covered by Project components including RoWs, converter station sites, ground electrodes, etc. Wherever possible, the field study sites focused on the Footprint identified when the PPR was first made available.

A number of bird studies operated outside the Bird Study Area or only in specific portions of the corridor. These surveys included **raptor** surveys, portions of the colonial waterbird surveys, waterfowl surveys, and nocturnal owl surveys. Raptor surveys were expanded outside the Bird Study Area in an effort to track migration routes that may ultimately come in contact with the PPR. Colonial waterbird surveys were located along a five km (or three-mile) corridor (i.e., the Local Study Area) within the Project Study Area, surrounding the PPR. The colonial waterbird surveys focused on areas with larger water bodies such as lakes, rivers, and creeks. Waterfowl surveys followed a similar plan but focused on areas where the density of waterfowl breeding pairs (Ducks Unlimited Canada 2010 data) were high, and where the most likely wetland **staging** habitats adjacent to the PPR were located. Nocturnal owl surveys were limited to roadside transects that often fell outside the 10 km (or six mile) wide Bird Study Area. Consequently, when access by road was not possible in a portion of the study area, surveys were conducted as close to the PPR as possible.

For the FPR evaluation phase, the following study areas are used for the effects assessment:

- Project Study Area – the area described in *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*.
- Local Study Area - the 3-mile wide corridor for the BP III transmission line and the area surrounding the project components including AC Collector transmission line RoWs, converter station, ground electrode, etc.
- Right-of-way - the project footprint for the transmission lines and electrode lines
- Footprint - the area covered by the project components including transmission and electrode lines RoW's, converter station sites, ground electrodes, construction power station, etc.

3.0 METHODOLOGY

3.1 DEVELOPMENT OF HABITAT CATEGORIES

To analyze and report upon bird habitat (and other ecological factors) found in the Project Study Area, Joro Consultants Inc. developed a GIS (Geographical Information System) layer for Manitoba Hydro (Land Cover Classification of Canada, Enhanced for Bipole - LCCEB) as part of the Bipole III Environmental Assessment Process (see *The Canadian Land Cover Classification Enhanced for Bipole*). This layer is based upon the Land Cover Classification of Canada (LCC) developed by the Canadian Forest Services (Wulder and Nelson 2003). The LCC layer is a national vector database mapping layer that has been harmonized across the major Federal Departments involved in land management or land change detection (Agriculture and Agri-Foods Canada, Canadian Forest Service, and Canadian Centre for Remote Sensing). Existing forest classifications and inventories are based primarily on aerial photography, whereas development of the LCC was done using remotely sensed imagery (Landsat data) as part of Earth Observation for Sustainable Development of Forests program. The program utilized a hybrid supervised-unsupervised classification methodology (Wulder and Nelson 2003). This approach identified unique signatures using an automated algorithm (unsupervised spectral classification) that were subsequently linked to National Forest Inventory equivalent classes (supervised classification). The enhanced version includes a further harmonization/integration of the National Stratification Working Group ecological framework database (Smith *et al.* 1998) to the ecodistrict scale and the addition of wetland features, Manitoba forest harvest layers, forest fire layers and data from the Canadian Land Inventory. This provides attribute data that define the climatological, landform and soil conditions for the Project Study Area, fire and harvest records, as well as ecological conditions for birds.

The primary attribute of the LCC is the land cover category associated with a particular polygon – these land cover types identify the primary ecological cover condition of an area. The land cover classes developed were based on those used in the National Forest Inventory, and were endorsed by the Canadian Forest Inventory Committee. All of the landscape-level habitat analysis and modeling in the Local Study Area was done using LCCEB categories including, for example, water, open, closed, shrub, wetland, herb, grassland, cropland, coniferous, broadleaf and mixedwood.

The Forest Resource Inventory (FRI) was used in part for the selection of 2009 and 2010 field sampling study design, and for exploratory stand-level habitat analysis and modeling in the Local Study Area. Like the LCCEB, the FRI classifies land cover but classifies it by species composition, cutting class, crown closure, and stand composition. Stand composition incorporates tree species as a percentage, while cutting class and crown closure take into account the size of the trees found in the stand and density of the canopy. Cutting class is often used as a surrogate for tree stand age. For a detailed description of the FRI categories see. *Bipole III Forestry Technical Report.*

3.2 IDENTIFICATION OF VALUED ENVIRONMENTAL COMPONENTS

The environmental assessment is focused on VECs, which are those aspects of the natural and socio-economic environment that are particularly notable or valued because of their ecological, scientific, resource, socio-economic, cultural, health, aesthetic, or spiritual importance, and which have a potential to be adversely affected by project development or have the potential to have an effect on the project. What this means is that a VEC must both be important and have the potential to be affected by, or to affect, the Project. The potential to be affected means there has to be some interaction, either directly or indirectly, between the environmental component and some component or activity associated with the project during planning, construction, or operation. In this way, the assessment becomes focused on the identification and management of potential adverse effects.

A VEC can be a particular habitat, an environmental feature, a particular assemblage (community) of plants or animals, a particular species of plant or animal, or an indicator of environmental health. Bird VECs were defined on the basis of their meeting one or more of the following criteria:

- Area of notable biological diversity;
- Significant habitat for locally important bird species;
- Significant habitat for uncommon, rare or unusual bird species;
- Important corridor or linkage for bird movement;
- Species at risk;
- Notable species or species groups;
- Indicator of environmental health;
- Important component to the function of other ecosystem elements or functions;
- Component is of economic or cultural significance;
- Component is of educational, scientific, or aesthetic interest; and
- Component is of provincial, national or international significance.

The bird VECs were developed in a staged process. The process included: scoping; developing an initial list of bird VECs used for the Alternative Route Assessment; reviewing and incorporating additional data as it became available to support VEC selection process; and determining the final list of bird VECs to be used in the effects assessment.

3.2.1 Scoping

The project description was reviewed (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Key elements of the Bipole III Project that have potential to adversely affect birds and bird communities included:

- electrical wires and towers associated with HVdc transmission lines, AC transmission lines, and other lines associated with ground electrodes;

- infrastructure including Keewatinoow and Riel Converter Stations and associated ground electrodes;
- construction equipment and people;
- areas needed for the project footprint including the Rights-of-Way, Converter Stations, and ground electrodes;
- areas needed to support infrastructure development including borrow areas, excavated material placement areas, roads, and access trails; and
- operations and maintenance equipment and people.

Recurrent bird species or bird group themes that were generated from scientific literature, from other similar environmental assessments conducted outside of Manitoba, and consultations with the regulators and public included:

- vulnerability of certain bird species (e.g., birds of prey, waterfowl and some species at risk) to bird-wire collision and electrocution;
- global decline of species at risk and neotropical migrants from cumulative effects, including in part, from the development of linear corridors;
- habitat loss; especially for species at risk;
- increased vulnerability of some local bird population concentrations (i.e., grouse, waterfowl, colonial waterbirds, species at risk) to disturbances;
- disruption of ecological processes and linkages where the effects to species or habitats could affect other species; and
- disruption of bird movements across fragmented landscapes.

Recent Manitoba Hydro transmission line projects (Wuskwatim, Rosser-Silver, Glenboro, and Winnipeg-Neepawa-Brandon) were reviewed for bird-related concerns, and compared to issues raised by regulators and the stakeholders in the Bipole III Project. All of these concerns tended to be similar and fell into three general categories. The issues below are described in detail, and in context to the VECs selected (see Section 5.0):

- mortality;
- habitat alteration, habitat loss, and sensory disturbance; and
- disruption of movement.

Finally, VECs are usually subsets of larger component groups that have been selected as the focus of the assessment, often because they represent a component group that is the subject of management priority, or they are particularly vulnerable to the potential effects of the Project (e.g., a subset or species of migratory birds). They can also represent the characteristics, sensitivities, or management requirements for a broad range of species, communities, landscapes and associated physical environments or processes (Altalink Management Ltd 2006). To manage the large number of potential bird species found in the Bipole III Project Study Area, the following bird groups and general associations were developed to focus the assessment:

- waterfowl and other waterbirds;
- colonial waterbirds;
- upland game birds;

- birds of prey;
- woodpeckers;
- songbirds and other birds; and
- federally and provincially listed species at risk.

3.2.2 Initial Bird VECs used for Alternative Routes

The initial selection process incorporated a review of the scientific literature, and the concerns provided by provincial and federal regulators, the public, Aboriginal communities, Manitoba Hydro and the multidisciplinary team and by using professional judgment, identified an initial list of VECs. Along with other criteria (e.g., fragmentation), the initial VECs were used to help assess the Alternative Routes.

Round 2 and 3 Public Consultation materials and meetings were reviewed for bird-related issues. Stakeholders included Community Councils and First Nations (see Section 4.4), Planning Districts, rural Municipal Councils, Cities of Winnipeg and Dauphin, Ducks Unlimited Canada, Mining Companies and Associations, The Manitoba Habitat Heritage Corporation, Manitoba Conservation (including IRMT's, Protected Area Initiative, Wildlife Branch), Manitoba Lodges and Outfitters Association, and Manitoba Naturalists Society (see *EIS Chapter 5 Environmental Assessment Consultation Program*).

The approach to selecting VECs also included review of a combination of important ecosystem components and **management species** included in the Project Study Area. Species such as the pileated woodpecker were considered as VECs to represent the broad ecological requirements of larger groupings of species that occupy similar ecological niches and can be used in environmental evaluation and effects analysis. Keystone and management species are typically species that are important from a societal perspective, may have significant commercial, recreational, or cultural importance, and may have significant regulatory implications such as being rare or endangered.

A matrix was developed for the initial selections process. Categorical variables were used to rank the potential bird species selections to determine overall relative importance. Ranking variables included species' provincial or federal status or regulations, its importance to local cultures, its ability to function as an **umbrella species**, its ability to function as an indicator species, its ability to function as a **keystone species**, information available to construct models of habitat preferences for the species, and in part, the relative influence that a transmission line may have on the species population and habitats. A minimum of one bird species was selected per group, and in some cases, a second VEC was selected for supporting the habitat evaluations over the extensive geographic region. A total of 10 VECs were selected initially as part of this process.

3.2.3 Review and Incorporate Additional Data

Round 4 Public Consultation Regional and Community Open Houses and Landowner Information Centre's materials were reviewed for any additional bird-related concerns. Stakeholder participation is found in (see *EIS Chapter 5 Environmental Assessment Consultation Program*). Although no additional bird-related topics were generated as a result of these consultations, issues identified previously in Section 3.2.1. were raised. The final bird VEC selection was made following further evaluation and updates to each species' provincial or federal status or regulations (as of May 2011), and updates to the importance for local cultures (see Section 4.4).

Field data collected in 2010 were used to validate habitat relationships, and were used further to express bird-community associations. Demonstrated relationships suggest that where a particular VECs may be affected by the Project, it was assumed that other bird species associated with its habitat could also be affected. Broad habitat categories were used to support the selection of a VEC to function further as an indicator species for the many bird communities expected over a broad range of habitat types in the Local Study Area.

3.2.4 Bird VECs Used in the Assessment

In summary, the final VECs identified (Table 3-1) included 21 bird species. The basis for these selections included review of scientific and other literature, consultations and feedback from regulatory authorities, public and aboriginal communities, biophysical field surveys, and the incorporation of ecological concerns.

Of all potential Project concerns, species at risk have the highest potential to be adversely affected by the Project development. The addition of 11 VECs to the total number selected in the initial selection process was weighted entirely for the need to assess regulations concerning all species at risk. Although the relatively large number of VECs selected may make the review process more difficult, given the large geographic extent of the Project, the variability of the bird communities expected over this geographic range, and the high number of rare species that could be encountered, the addition of these species is warranted. It is anticipated that uncertainty regarding potential project effects predictions will be reduced by using this approach.

Table 3-1. List of Valued Environmental Components Considered in the Assessment

Group	VEC	Justification for VEC	Environmental Indicators	Measurable Parameters
Waterfowl and Other Waterbirds	Mallard	Protected species (*Migratory Birds Convention Act*); Important to people (domestic and licensed hunting); Scientific importance - Indicator of wetland bird associations and community health; Connection to areas of notable biological diversity (IBAs)	Occurrence; Habitat quality and availability; Reproduction; Harvest success	No. birds killed annually by line strikes and harvest; quantity of habitat altered or lost; decreased nest success; change in access

Group	VEC	Justification for VEC	Environmental Indicators	Measurable Parameters
	Sandhill Crane	Protected species (*Migratory Birds Convention Act*); Important to people (domestic and licensed hunting); Scientific importance - Indicator of global sparsely treed black spruce or tamarack peatlands and other wetland bird associations and community health	Occurrence; Habitat quality and availability; Reproduction; Harvest success	No. birds killed annually by line strikes and harvest; quantity of habitat altered or lost; decreased nest success; change in access
Colonial Waterbirds	Great Blue Heron	Protected species (*Migratory Birds Convention Act*); Other regulatory requirements for nests; Important to people (cultural)	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
Birds of Prey	Bald Eagle	Protected species (*Wildlife Act*); Other regulatory requirements for nests; Important to people (cultural); Indicator of important corridor or linkage for bird movement; Scientific importance - Indicator of mature northern and western riparian forest community health; linkages to potential Project effects	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
Upland Game Birds	Sharp-tailed Grouse	Protected species (*The Wildlife Act*); Important to people (domestic and licensed hunting); Scientific importance - Indicator of grassland, shrubland and forest bird associations and community health	Occurrence; Habitat quality and availability; Reproduction; Harvest success	No. birds killed annually by line strikes and harvest; quantity of habitat altered or lost; decreased nest success; change in access
	Ruffed Grouse	Protected species (*The Wildlife Act*); Important to people (domestic and licensed hunting); Scientific importance - Indicator of deciduous and mixedwood forest bird associations and community health	Occurrence; Habitat quality and availability; Reproduction; Harvest success	No. birds killed annually by line strikes and harvest; quantity of habitat altered or lost; decreased nest success; change in access
Woodpeckers	Pileated Woodpecker	Protected species (*Migratory Birds Convention Act*); Scientific importance - Keystone species and indicator of mature mixedwood forest bird associations and community health	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or lost; decreased nest success
Species at Risk	Least Bittern	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
	Yellow Rail	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Special Concern); Important to people	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success

Group	VEC	Justification for VEC	Environmental Indicators	Measurable Parameters
	Ferruginous Hawk	Protected species (*Wildlife Act*); Protected species (*SARA* - Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
	Burrowing Owl	Protected species (*Wildlife Act*); Protected species (*SARA* - Endangered); Important to people	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
	Short-eared Owl	Protected species (*Wildlife Act*); Protected species (*SARA* - Special Concern - Schedule 3); Important to people	Occurrence; Habitat quality and availability; Reproduction	No. birds killed annually by line strikes; quantity of habitat altered or lost; decreased nest success
	Common Nighthawk	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or increased; decreased nest success
	Whip-poor-will	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	Presence/absence; quantity of habitat altered or lost; decreased nest success
	Red-headed Woodpecker	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	Presence/absence; quantity of habitat altered or lost; decreased nest success
Species at Risk	Olive-sided Flycatcher	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people; Scientific importance - Indicator of northern and western wetland and burn bird associations and community health	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or lost; increase in cowbird parasitism; decreased nest success
	Loggerhead Shrike	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Endangered/Threatened); Important to people	Occurrence; Habitat quality and availability; Reproduction	Presence/absence; quantity of habitat altered or increased; decreased nest success
	Sprague's Pipit	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people; Scientific importance - Indicator of southern and western dry native grassland bird associations and community health	Occurrence; Habitat quality and availability; Reproduction	Presence/absence; quantity of habitat altered or lost; increase in cowbird parasitism; decreased nest success

Group	VEC	Justification for VEC	Environmental Indicators	Measurable Parameters
	Golden-winged Warbler	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people; Scientific importance - Indicator of shrubland and shelterbelt bird associations and community health	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or increased; increase in cowbird parasitism; decreased nest success
	Canada Warbler	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Threatened); Important to people; Scientific importance - Indicator of southern and western mature deciduous dominated bird associations and community health	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or lost; increase in cowbird parasitism; decreased nest success
	Rusty Blackbird	Protected species (*Migratory Birds Convention Act*); Protected species (*SARA* - Special Concern); Important to people	Occurrence; Habitat quality and availability; Reproduction	Change in abundance; presence or absence; quantity of habitat altered or lost; decreased nest success
Note: Although all species at risk were considered, important for the assessment, species were limited to breeding locations, the presence of adequate habitat within the Local Study Area near the FPR, and a high probability of Project overlap. Species at risk removed from VEC considerations include red knot, Ross's gull, whooping crane, piping plover, peregrine falcon, chimney swift, Baird’s sparrow and yellow-breasted chat. Chestnut-collared longspur and bobolink have recommended 'Threatened' status (not scheduled and no status to date), and horned grebe have recommended 'Special Concern' status (not scheduled and no status to date). Although they are not VEC's, these species are considered in the assessment.				

3.3 FIELDWORK

Field studies were conducted in both 2009 and 2010. Bird studies consisted of breeding bird, rare bird, colonial waterbird, waterfowl, nocturnal owl, and raptor surveys. The 2009 reconnaissance studies, and data used to support the Alternative Route selection process are outlined in Appendix B. The 2010 field studies that were used to support the environmental assessment are outlined below.

The sampling design for different bird species was based on maximizing the detectability of various bird species throughout Manitoba, and consequently a number of studies were used (Table 3-2). Breeding bird and rare bird surveys were conducted early mornings during the breeding season, when most bird species are most vocal. Nocturnal owl surveys were conducted after dusk during the breeding season as this is when owls are most vocal. The rare bird survey was considered a specialty survey. It was conducted to detect early-arriving species at risk in the two most southern ecoregions. Other regular arrivals, including other rare bird species, were sampled during the breeding bird survey. Colonial waterbird surveys were conducted from the air during the breeding season, when birds were expected to be found actively nesting in the colony. Both waterfowl and raptor surveys were conducted during migration as this is when birds are most concentrated. Waterfowl surveys were conducted from the air and in all ecoregions while raptor surveys were from the ground during the day and only in the southern two ecoregions.

Table 3-2. Range of 2010 Bird Surveys Conducted Based on Ecoregion and Ecozone

Ecoregion	Ecozone	Survey					
		Breeding Bird	Rare Bird	Colonial Waterbird	Waterfowl	Nocturnal Owl	Raptor
Lake Manitoba Plain	Prairies Ecozone	✓	✓	✓	✓	✓	✓
Interlake Plain	Boreal Plains	✓	✓	✓	✓	✓	✓
Mid-Boreal Lowland	Boreal Plains	✓		✓	✓	✓	
Churchill River Upland	Boreal Shield	✓		✓	✓	✓	
Hayes River Upland	Boreal Shield	✓		✓	✓	✓	
Hudson Bay Lowland	Hudson Plain	✓		✓		✓	

3.3.1 Bird of Prey Surveys

3.3.1.1 Nocturnal Owl Surveys

As all birds of prey are affected both positively and negatively (Harness *et al.* 2001) by the introduction of a transmission line, it was important to identify the species in the Project Study Area and their habitats. A total of 45 nocturnal owl survey (NOS) sites were sampled twice along the proposed Bipole III HVdc transmission line route in order to assess the migratory timing, range, and presence of owl species (Map Series 100 – Location of 2010 nocturnal owl surveys). Surveys were conducted from March 25 to April 6, 2010 and were initially conducted northward along the route. Sites were sampled a second time southward to Winnipeg, to maximize the detection of owl species migrating and establishing territories. All survey routes were located on roads and trails that could be accessed by vehicles in order to permit a larger and more efficient sampling effort. In addition to easy access, nocturnal owl surveys were limited to the road system because travel along the FPR at night over substantive distances is difficult and dangerous during late March and early April.

Sample protocols were consistent with the Manitoba Nocturnal Owl Survey (Duncan 2010a). Surveys were initiated at least 30 minutes after sunset. The exact start time was at the discretion of the observer and varied depending on environmental conditions, including weather and level of ambient twilight. Surveys were conducted on nights with minimal wind and little to no rain in order to minimize noise disturbances that would limit the ability of an observer to detect owls.

Each survey transect was comprised of 10 sample points spaced at approximately one mile intervals (1.6 km). At each sample point, the surveyor turned off his vehicle and moved a minimum of 20 metres (m) from the vehicle to minimize ambient noise from the cooling engine. Sample points were then subject to a two minute auditory survey, in which the observer identified owl calls and recorded the species, direction, distance, and number of individual owls. Where possible, the observer identified owls already recorded at other points in order to prevent double-counting of individuals. Noise levels, weather, and the number of vehicles that passed through the sample location were recorded during the two-minute sample period. A sample of the nocturnal owl survey datasheet can be found in Appendix C, Data Sheet C-1.

An additional eight NOS sites were sampled near the proposed Riel southern electrode site on April 19 and 20, 2010. Protocols were similar to earlier surveys but sample points varied from two to 10 points per transect depending on the habitat type in which they were situated as well as the ability to access locations.

3.3.1.2 Raptor Migration Surveys

The creation of transmission lines has the potential to positively or negatively affect raptor populations (Steenhof 1993; Harness *et al.* 2001; Lehman 2001). Three established sites in Manitoba, including one in the Project Survey Area along the Red River near St. Adolphe, have been monitored for hawk, falcon and eagle migration by independent naturalists. In order to adequately describe raptor populations and migration within the Project area, raptor surveys were developed to survey as much of the Project area as possible. Survey design focused on geographic features such as rivers and valleys that can funnel raptor migration. Additionally, because of large geographic features such as the boreal forest, large areas in the central and northern sections of the Project area were not surveyed, and with few exceptions, as the boreal forest essentially dissipates raptors into breeding territories, making large concentrations of raptors less obvious (Figure 3-1).

The 2009 raptor survey was completed towards the peak of raptor migration in southern Manitoba from April 6 to April 22. The survey was located within the Project Study Area between The Pas and Winnipeg in areas that have characteristics consistent with other bird of prey migration corridors. These characteristics included north-south running corridors, valleys, ridges and river systems. As the FPR or alternative routes were not yet identified at the time of the raptor survey, survey sites were located throughout the Project Study Area.

In 2010, a total of 185 locations were surveyed for raptors over two sessions, March 19 to 31 and April 3 to 12 (Map Series 200 – Location of 2010 raptor migration surveys). Locations were selected in the Bird Study Area, ranging from 2.5 km west of Dufrense to 8.9 km west of Langruth. Survey locations were selected to centre on stream and river crossings, as these are typically points of high-density raptor migrations.

Each survey location was sampled for 30 minutes. Observations were made with binoculars and referenced to a global positioning system (GPS) waypoint. Observers recorded information on species, sex, habitat, direction of travel, and number of individuals. All sites were visited twice daily, in the same order, to account for raptors migrating through during different periods. Incidental observations of species at risk and stick nests were also recorded. A sample of the raptor migration survey datasheet can be found in Appendix C, Data Sheet C-2.

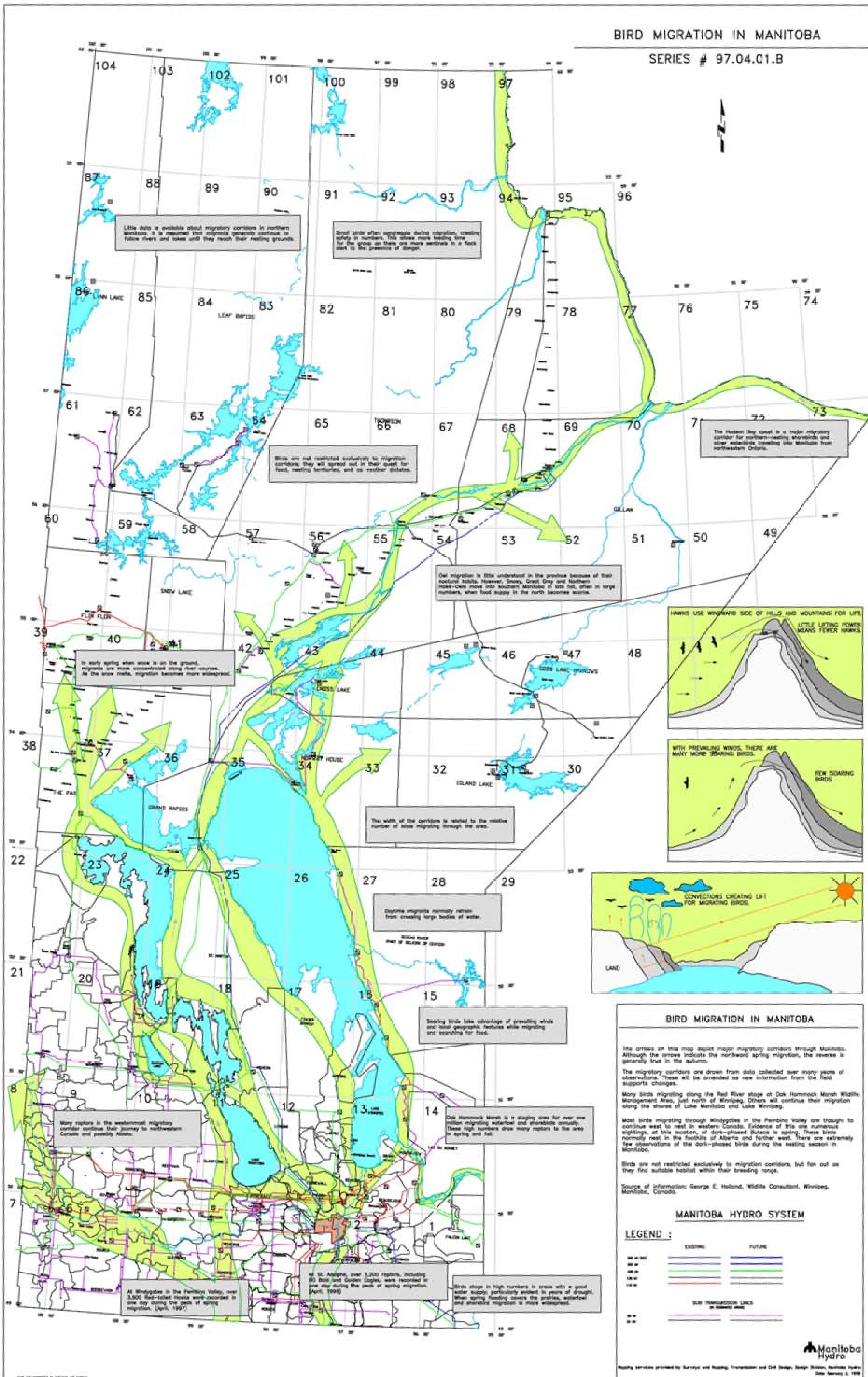

Figure 3-1. Bird Migration Corridors Found Throughout the Province of Manitoba

3.3.2 Colonial Waterbird Surveys

As with all migratory bird groups in the Project Study Area, transmission lines have the potential to affect migratory bird populations, so it was important to identify migration corridors and breeding sites along the FPR (Stout 1976; Anderson 1978; Malcolm 1982; Faanes 1987). Further, it is important to identify colonial waterbird sites as **setbacks** are often used with species such as great blue heron to buffer these sensitive species from resource use activities (Manitoba Conservation 2010a). The primary region of interest for higher expected concentrations of nesting colonial waterbirds (CWB) was generally between The Pas and Gladstone. All known sites, provided by the Manitoba Conservation Data Centre and Ducks Unlimited, and potential sites, identified from other studies, as well as LCCEB habitat data, were included in the sample plan. The 2009 CWB survey was conducted between June 29 and July 2, 2009.

The colonial waterbird survey route was flown within 500 m of the FPR in the Local Study Area. Areas of interest including large lakes and rivers were surveyed in detail when they were encountered. The survey was conducted via a Bell Jet Ranger helicopter containing a navigator and two observers. Each survey site was approached cautiously in order to minimize any disturbance to birds. Where possible, a 400 m buffer was established to prevent escape responses. Binoculars were used to determine whether a colony was present. Species, number of individuals, age, and sex were recorded where possible. New colonies were also identified and surveyed opportunistically.

Preliminary location data with recommended buffer sizes were submitted to Manitoba Hydro to be used in the alternative routing process. Incidental observation of gulls, terns, waterfowl, and other wildlife were included in the surveys.

The 2010 CWB survey occurred in the Local Study Area from July 15 to 18, 2010. Previously observed colonies along the route were visited to determine if they were still active. New colonies were identified as waterbodies adjacent to the FPR were more intensively surveyed due to a reduced study area. Other methods employed were identical to the 2009 CWB survey. A sample of the colonial waterbird survey datasheet can be found in Appendix C, Data Sheet C-3.

3.3.3 Waterfowl Surveys

As transmission lines have the potential to affect waterfowl populations and habitats, it was important to identify and where known, validate waterfowl migration corridors and staging areas along the FPR (Stout 1976; Anderson 1978; Malcolm 1982; Faanes 1987). A waterfowl fall staging survey was conducted from a Bell Jet Ranger helicopter from September 15 to 18, 2010. The survey route was flown within 500 m of the FPR in the Local Study Area. The survey ranged from Winnipeg to Orr Lake in northern Manitoba in order to survey a high proportion of Ducks Unlimited Canada waterfowl hotspots in close relation to the FPR or in cases where the FPR is located between two hotspots. These sites were sampled from southern to northern Manitoba to validate habitat and high waterfowl densities. The survey was completed at Orr Lake due to the lack of expected waterfowl hot spots in close relation to the FPR. Data are available from the region not surveyed, including regional waterfowl surveys completed for the Keeyask Generating Station (GS) and the Conawapa GS environmental studies. The survey crew consisted of two observers and one data recorder. One of the observers also acted as the navigator. The survey covered approximately 3,311 km by helicopter.

Fifteen survey sites were identified along predetermined routes that were selected based on paired waterfowl density data, Ducks Unlimited Canada hotspots, and habitat data from the LCCEB and FRI layers. Small areas of interest such as ponds were scanned in passing. Larger areas required a flight around the perimeter and over the centre of the water body in order to identify all species and conduct a count. Surveys began at sunrise and lasted until sunset, with breaks only to refuel.

When birds were observed, each individual or group was documented and referenced with a GPS waypoint. Where possible, species and sex was identified and group size was estimated. Where species could not be determined a group type was identified, and birds were categorized as dabblers, divers, or grebes. Incidental wildlife information (observations, trails, etc.), cabins, and sensitive habitat sites were also recorded. A sample of the waterfowl survey datasheet can be found in Appendix C, Data Sheet C-4.

3.3.4 Breeding Bird and Species at Risk Surveys

The construction and operation of transmission lines has the potential to affect migratory birds such as **Neotropical migrants** in a number of ways, both positively and negatively (Maurer *et al.* 1981). In order to assess the occurrence and distribution near the preferred Bipole III HVdc transmission line route, bird point counts were conducted in 2009 and 2010 using three different survey methods:

- point-count survey methods involving biologists identifying birds by sight, songs and calls in the field;
- biologists identifying birds by songs and calls recorded on Tascam DR-100 audio recorders; and
- biologists identifying birds by songs and calls using remote recording equipment.

Point counts are traditionally used to inventory and to monitor breeding bird populations. Generally following Canadian Wildlife Service breeding bird survey protocols, Elzinga *et al.* (2001), and United States Environmental Protection Agency (USEPA 2002), unlimited distance point counts were used to sample the bird populations in the Project Study Area. Point count recording methods are tailored after Hasselmayer and Quinn (2000) and Hobson *et al.* (2002).

In total, point counts were conducted at approximately 760 plots in 2009, which were more regional in distribution, and at 3,400 plots focused near the FPR in 2010 (Map Series 300 – Location of 2009 breeding bird surveys and Map Series 400 – Location of 2010 breeding bird surveys). Of the plots surveyed in 2010, 2,139 were surveyed by traditional point count survey methods, 1,248 were surveyed by handheld audio recorders and 12 by remote recorders. All plots were surveyed in the Bird Study Area between May 25 and July 6, which includes the optimal time to conduct these types of surveys. The Bird Study Area was categorized by ecozones, which were further divided into proportional sub-zones for geographic replication purposes. Plots were divided between 14 sub-zones based on the size of the sub-zone and the habitat available in proximity to the location of the proposed transmission line. Plots were placed a minimum of 250 m from adjacent plots to avoid double counting individuals. ArcMap 9.2 software was used to analyze habitat within a 125 m radius of each point.

Plot locations were determined based on habitat types according to FRI data on both crown and private lands. Vegetation cover data were converted to a broader classification and then grouped into habitat communities. This helped determine the type of habitat most often frequented by birds and therefore the location best suited for each plot. The reclassified habitats were divided into categories including: softwood (black spruce (BS) pure, jack pine (JP) pure, white spruce (WS) pure, tamarack (TL) pure), hardwood (broadleaf pure, all other broadleaf), mixedwood (BS mixed, JP mixed, coniferous mixed, broadleaf mixed), grassland (dry prairie, wet prairie, grassland), wetland (wetland treed, wetland shrub, wetland herbaceous (herb), mud/salt flats), shrubland (shrub). The proportion of each habitat available determined the number of point counts to be conducted. Particular emphasis was placed on range and habitat of federally or provincially listed species at risk adjacent to the proposed transmission line route.

Surveys began approximately a half hour before sunrise and continued until 10:00 a.m. Each observer used a GPS to locate the pre-determined position of the point and waited for the birds to settle into normal behaviours after being disturbed before beginning the survey. The birds were observed and recorded for a period of 10 minutes at each point.

Biologists completing point-count surveys noted all bird songs and calls, behaviours such as carrying food and woodpeckers foraging, and any nests observed. The number of individuals, their approximate distance from the observer and any movements were recorded, to further prevent double-counting errors. The time and location of the survey were also recorded. A sample of the point count datasheet can be found in Appendix C, Data Sheet C-5.

At each plot where handheld recorders were used, audio recorders were set up and oriented upwards. Bird songs and calls were recorded for a period of 10 minutes and were later amplified and filtered of ambient noise using Adobe Audition 2.0. Professional biologists identified each species and individual by listening to the recordings of bird songs and calls using high fidelity equipment.

Remote recording equipment was used to detect rare species that can be particularly hard to locate. Remote units were programmed to record for certain peak activity periods when species are most active (e.g., dusk or at night for common nighthawks) and were captured within a 150 m radius. Units were left in place for several days to ensure that weather did not interfere with detection.

Species area curves were used to assess the relative success of breeding bird survey results in the identification of species within sampled ecoregions i.e., species richness. Species area curves demonstrate the calculated change in species identified over multiple survey attempts. It is expected that during area-wide accounts of species diversity, initial surveys of sites will be very successful in identifying 'new' species but later surveys will have diminishing results. This is attributable to the more abundant species being detected and identified rather easily but with subsequent species potentially being more rare/dispersed and possibly requiring alternate sampling considerations.

Calculation of species area curves took place in PC-ORD (McCune and Mefford 2006). Breeding bird survey species IDs were assessed as to the total number of species seen, rare birds included, with calculated estimates on how many species were likely undetected. This allowed a determination of the rigour of search techniques in finding all available bird species and where monitoring efforts can be refined to meet sampling challenges associated with the Project Study Area.

Bird density estimates were calculated through dividing the number of sampled birds in each sampling area by total area sampled. Bird sampling information used was limited to the breeding bird survey and those instances recorded directly by biologists where the estimated distance from birder to sampled birds was ≤ 100 m. Calculations were specific to each ecoregion, habitat class and a combination of these. Habitat based density estimates were based on habitat found at precisely point count locations rather than the mosaic of habitats potentially present in the 100 m radius sampling circle. Calculated density estimates were based on number of birds by hectare and was done specific to valued environmental components used in this study.

3.4 ABORIGINAL TRADITIONAL KNOWLEDGE

Tangible ATK and Local Knowledge data were obtained from the following communities (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*), and *Bipole III Aboriginal Traditional Knowledge Technical Report* and incorporated into the assessment:

- Baden
- Barrows
- Camperville
- Chemawawin
- Cormorant
- Dakota Plains
- Dakota Tipi
- Dawson Bay
- Duck Bay
- Fox Lake
- Herb Lake
- Long Plain
- Manitoba Metis Federation
- National Mills
- Pelican Rapids
- Pikwitonei
- Pine Creek

- Powell
- Red Deer Lake
- Split Lake
- Thicket Portage
- Waywayseecappo
- Westgate

Once collected, maps and interview survey data and self-directed studies were reviewed for species location information, species composition and important features pertaining to the VECs and to other bird species. The locations of important sites such as hunting and gathering locations and bird habitats were also noted, especially in relation to the Bipole III Footprint. Intangible ATK is discussed in detail in *Assessing Potential Effects of the Bipole III Transmission Project: A Major Reliability Improvement Initiative on Aboriginal Traditional Knowledge (ATK)*. Although only a limited number of references were included concerning groups such as songbirds, all wildlife species are considered as important to First Nations.

3.5 ENVIRONMENTAL ASSESSMENT

Manitoba Hydro transmission projects utilize the SSEA process to better understand the potential issues and concerns associated with the routing and sitting of the transmission line and components, to assess the potential for adverse effects and identify appropriate mitigation measures to manage the overall effect of the proposed Project on the environment. This process was undertaken for the Bipole III transmission line project.

The specific objectives of the SSEA process were to:

- provide a description of the proposed transmission facilities to all stakeholders and the public;
- select alternate routes and sites for transmission lines and associated facilities in a technically, economically, and environmentally sound manner;
- assess the potential effects of the proposed transmission line and its associated facilities;
- conduct the SSEA process with consideration of local input from potentially affected First Nations and other aboriginal communities, other communities and municipalities, land and resource users, interest groups, resource managers, and the public at large, in a responsive, documented and accountable fashion;
- find practical ways to mitigate potential negative effects and enhance benefits; and
- prepare an Environmental Impact Statement (EIS) that documents the results of the SSEA process.

Through study area characterization, the locations of sensitive biophysical, socio-economic and cultural features, and technical (engineering) and cost considerations for transmission line routing were identified. The SSEA process utilized data from existing published sources, was supplemented by field studies, and incorporated feedback from public and government consultation, including aboriginal traditional and local knowledge.

Through the SSEA process, three alternative route corridors were identified. These alternative routes were selected to avoid significant sensitivities where possible, and to minimize potential effects where avoidance was not possible or practical. A route selection matrix was developed to facilitate the evaluation of alternative routes on a segment-by-segment basis (see Appendix B). The alternate routes were separated into 13 segments and evaluated and compared, by segment, considering geographic features, potential opportunities, technical considerations, and professional judgement. During the course of the route selection process, several adjustments were made to the original alternative route segments based on additional input provided by the Environmental Assessment study team and various stakeholders (e.g., mining and agricultural interests).

A total of 28 factors were identified to evaluate the alternative routes. These factors included a full range of biophysical, socio-economic, land use, technical and stakeholder considerations. Evaluation criteria were identified for each factor that would facilitate three-tier (high, medium and low) ranking. Biophysical, socio-economic and land use rankings were based on the degree to which the factor is affected. Technical rankings were based on the degree to which the factor is a constraint while stakeholder rankings were based on the nature and degree of response. A four-tier ranking (very high, high, medium and low) was used for several biophysical factors where potentially significant implications on protected species and habitats were identified.

Stakeholder factors were applied to the segment rankings after ratings were determined. Stakeholder response criteria were based on a numeric count and a general expert assessment of the negative or positive commentary provided for certain segments. General commentary provided (e.g., diagonal routes are not preferred) was considered in the evaluation of relevant segments. The objective of the stakeholder evaluation was to select route segments with the lowest level of concerns or most favoured as expressed by Aboriginal groups, municipal governments, stakeholder groups, and the general public. A three-tier ranking system (fair, good, or poor) was based on numeric counts of comments provided plus expert assessment of feedback from all sources.

3.6 ASSESSMENT OF PROJECT EFFECTS

The overall assessment of Project-related effects on each VEC involved:

- a characterization of Project-related effects;
- identification of component-specific mitigation measures; and
- description of all residual effects.

Project and environmental component interactions were identified, measured against the baseline case or management objectives (when applicable), and were characterized to identify the extent of the effect on VECs. VECs are general associations of birds that tend to share similar characteristics or habitats. Potential Project-related effects on valued environmental components were also selected to focus the assessment. By determining the significance of the Project on VECs, those bird communities associated with these species and their corresponding habitats were also assessed in each phase of the Project.

All site-specific mitigation measures expected to reduce effects were also identified. If any remaining effects (residual effects) were identified after mitigation, they were then assessed to identify their significance in the EIS.

3.6.1 Characterization of Project Effects

The assessment approach is structured to address the categories and types of environmental effects that may potentially occur during different phases of the Project: construction that includes the clearing of the HVdc right-of-way (RoW), erecting towers and stringing lines, the operation and maintenance phase, and finally, decommissioning. Clearing of a RoW, construction of an HVdc transmission line and its operation could have different effects on birds and their habitats. Other Project components, 230 kV transmission line interconnections, northern and southern electrodes, converter stations and ground electrode – converter station interconnections also have the potential to affect bird communities. Project effects are detailed for valued environmental components. These potential effects are expected to be similar for the other bird species in a group, or for those bird species that use similar habitat types. Three main effects of the Project on birds are identified:

- mortality;
- habitat alteration, habitat loss and sensory disturbance; and
- disruption of movement.

For certain types of potential effects to occur, there must be either spatial or temporal overlap with the Bipole III project. Most bird species in Manitoba are migratory, and the large majority of these species have nesting periods beginning in May and June, and most young are fledged by late July, and most species leave the province by September. As such, many potential project effects are not anticipated if clearing and construction for the Project occur during the winter period. Exceptions can include gray jay, which nests as early as February (Walley 2003), resident owl species such as great grey owl nesting as early as March (Walley 2003), white-winged crossbill and red crossbill, which can nest at any time of year, including winter (Holland and Taylor 2003a; Holland and Taylor 2003b), and late nesters such as American goldfinch, whose nesting season corresponds with seed production of thistles, usually beginning in July and August (Parsons 2003). Other exceptions may include large-bodied bird species such as birds of prey, which have prolonged brood-rearing periods, and where fledging may occur as late as August (Carey et al. 2003).

3.6.1.1 Mortality

The Project may contribute to bird mortality in several ways. Construction activities could damage or destroy bird nests if conducted during spring and summer. Access trails and the cleared RoW could provide improved access into areas formerly unreachable by hunters, resulting in increased harvest mortality of waterfowl, other waterbirds, and upland game birds. Collisions with trucks and other construction equipment may result for upland game birds and other large birds that do not manoeuvre easily. These larger species, including waterfowl and other waterbirds, colonial waterbirds, and upland game birds are also more vulnerable to collisions with wires than other bird species. Flight heights, density of passage and movements, and weather are examples of important variables in the consideration of potential effects on individuals and populations. **Passerines**, which are generally smaller and more manoeuvrable, are less likely to collide with wires, but may be more susceptible to mortality during the nesting season from construction activities. Increased predation mortality may result as birds of prey may improve hunting efficacy, especially on upland game birds, by using transmission line towers as hunting perches.

3.6.1.2 Habitat Alteration and Sensory Disturbance

Alteration or loss of bird habitat will occur in the Bipole III Project area, and are anticipated to occur particularly in the northern and west-central regions of the route. Habitat alteration may be beneficial for some species of raptors, upland game birds, and passerines, particularly those that utilize shrub or edge habitats. Other species may be adversely affected, as cleared habitat may no longer be suitable for their life cycle. Those that are particularly vulnerable to habitat alteration are usually forest-dwelling birds and bird **guilds** that require tall and dense vertical vegetation structure for nesting and perching. Where the transmission line RoW returns the vegetation community to an earlier stage of succession (i.e., grassland or shrubland) and creates edge habitat, some bird species become more susceptible to predation or **brood (nest) parasitism** by brown-headed cowbirds. Changes to plant communities, including the introduction of invasive plants, can also affect some bird species. Habitat loss can occur at converter station sites, tower sites, and work areas.

Habitat fragmentation is the process of reducing habitat into patches that are smaller and farther apart. With enough fragmentation on the landscape, the needs of some species that require larger and more contiguous habitat patches may not be met to maintain their life cycle. Fragmentation effects tend to persist and lead to reduced population viability. Wide-ranging species requiring large home ranges are particularly sensitive to broad-scale fragmentation effects.

Clearing and construction will create temporary noise disturbance in the Footprint. Line maintenance activities during operation will create localized, temporary disturbances to birds in the vicinity. Maintenance of the RoW will create temporary noise disturbances, and may alter habitat if trees and shrubs are cleared periodically. Sensory disturbance may result in the avoidance or abandonment of otherwise suitable habitat. Responses to disturbance will vary depending on species' tolerance for human activity.

3.6.1.3 Disruption of Movements

Movements of some species may be disrupted, as the cleared transmission line could create a barrier to local movement. Forest-dwelling bird species can be more vulnerable to movement disruptions where openings are created by a transmission line RoW. Seasonal movements such as migration are not expected to be affected to the same extent. As potential effects are evaluated, mitigation measures such as the maintenance of a tall shrub plant community in forested environments are considered to lessen Project-related effects on bird communities.

3.6.2 Environmentally Sensitive Sites

A number of data sources were selected to aid in the identification of environmentally sensitive sites. Ducks Unlimited Canada waterfowl pair density estimates, IBAs, and waterfowl hotspots provided information on areas with high concentrations of waterfowl, which typically occur in high densities. Data from colonial waterbird and waterfowl surveys were used to identify areas with high concentrations of birds, including colonies and staging lakes. Known raptor migration routes (see Figure 3-1) and raptor survey data were used to identify areas with high concentration of raptors.

All data from several sources were overlaid onto ortho imagery using ArcMap 9.2. The FPR was reviewed for major and minor river crossings as well as for sections of the FPR passing within 300 m of areas with moderate to high pair density, IBAs, or colonies, or areas with high raptor concentrations. Areas with major river crossings, known migration routes, or staging areas, or where the FPR passed over water bodies in IBAs were considered environmentally sensitive sites. Sections of the FPR crossed smaller rivers and creeks associated with IBAs or areas with moderate to high pair densities were also considered to have a high degree of environmental sensitivity. Finally, where the FPR crossed smaller creeks or wetlands but not associated with other features were considered to have a moderate level of environmental sensitivity.

3.6.3 Mitigation Measures

Minimization of effects was considered during selection of the FPR. Sites such as national and provincial parks, wetlands, and known bird colonies were identified during the assessment of alternate routes, and were avoided during the selection of the FPR. Further to avoidance, other mitigation measures are important for minimizing Project-related effects. Manitoba Hydro is experienced in applying many types of mitigation methods to other transmission line projects in northern (e.g., Wuskwatim Transmission Line) and in southern (e.g., Rosser-Silver Transmission Line) Manitoba. Mitigation measures along the FPR are discussed in detail in Section 5.2, and may include the following:

- accepted practices and standards developed by provincial, federal and industry sources;
- avoidance or re-location of large stick nests (also referred to as multi-generational stick nests);
- placement of perch deterrents on towers near known sharp-tailed grouse **leks** to prevent raptor from predating these species excessively;
- small alterations to the FPR to avoid additional sensitive sites;
- installation of bird diverters on conductors or ground wires near areas with frequent bird activity, such as in IBAs and environmentally sensitive sites;
- timing of clearing, construction, and maintenance activities to avoid sensitive periods such as breeding and nesting; and
- maintenance of natural buffers in sensitive areas such as wetlands.

3.6.4 Residual Project Effects

The environmental effects assessment is guided by the Canadian Environmental Assessment Act (CEAA) Reference Guide: Determining Whether a Project is Likely to cause Significant Adverse Environmental Effects (CEAA 1994).

The determination of the significance of any potential effects of the project on VECs is conducted after the application of all proposed mitigation measures. The mitigation measures to be applied to this project have been integrated into the project design; consequently, it is only the residual effects of the project which require assessment. Residual Project effects are the resultant change in the environment after the application of mitigation measures. If mitigation measures are expected to be effective, the potential effect will likely be avoided or alleviated. If mitigation measures are likely to be only partially successful, a residual Project effect is predicted and further evaluation of significance of the expected Project effect is required. Residual effects on each VEC are characterized using the following descriptors (Table 3.-3).

Table 3-3. Residual Effects Attributes Definitions

Criteria	Definition
Direction	
Positive	-Beneficial or desirable change in the environment.
Negligible	-No detectable or measureable change in the environment.
Negative	-Adverse or undesirable change in the environment.
Magnitude	
Large	-Effect on a population in sufficient magnitude to cause a decline in abundance and or change in distribution lasting several generations. -Effect can be easily observed, measured and described, and may be widespread.
Medium	-Effect on part of a population/community that result in a short-term change in abundance and/or distribution over one or more generations. -Effect can be measured with a well-designed monitoring program.
Small	-Effect on a group of individuals within a population/community or stock over one generation or less; similar to random changes in the population. -No measurable effect on a population as a whole.
Ecological Importance	
High	-Protected species or habitat (i.e., threatened). -Fragile area, ecosystem or habitat. -Important ecological function or relationships. -Important to scientific investigation (i.e., ongoing research/study).
Moderate	-Moderately rare, unique or fragile. -Seasonally fragile environmental component. -Somewhat important to ecosystem function or relationships. -Some importance to scientific investigations.
Low	-Not rare or unique (i.e., common). -Resilient environmental component.

Criteria	Definition
	-Minor ecosystem importance. -Limited scientific importance (i.e., no research/study).
Geographic Extent	
Regional Assessment Area	-Effect extends into regional study area -Area where indirect of cumulative effects may occur
Local Assessment Area	-Effect extends beyond the project footprint into the surrounding areas, including potentially affected communities within a ~5 km wide corridor of the route (i.e., ~2.5 km) on either side of the RoW and around other project components. -Area where direct and indirect effects may occur.
Project Site/Footprint	-Effect confined to the footprint for all project components (RoW 66m). Effects would be limited to directly affected environmental components. -Area where direct effects would occur.
Duration	
Long-term	-Effect is greater than 50 years.
Medium-term	-Effect extends throughout the construction and operation phases of the project (up to 50 years).
Short-term	-Effect occurs during the site-preparation or construction phase of the project (i.e., one to five years).
Frequency	
Regular/Continuous	-Effect may occur continuously or periodically during the life of the project or more than once per day.
Sporadic/Intermittent	-Effect may occur without any predictable pattern during the life of the project (e.g., wildlife-vehicle collisions) or less than once per week.
Infrequent	-Effect may occur only once during the life of the project or less than once per year (e.g., clearing).
Reversibility	
Irreversible	-A long-term effect that is permanent (i.e., remains indefinite as a residual effect).
Reversible	Effect is reversible during the life of the project.
Uncertainty	
Low	Estimate of residual effect is not certain – effect may or may not occur; magnitude cannot be estimated with confidence due to incomplete understanding of future conditions or response of component. Requires monitoring and contingency plans for mitigation, in the event that prediction is not correct.
Moderate	Estimated residual effect is somewhat certain – magnitude cannot be estimated with confidence. Monitoring is required to confirm magnitude/spatial extent/temporal duration of effect.
High	Estimate of residual effect is quite certain – predictive methods are well established and closely resemble area to be affected by Project.
Probability of Occurrence	
Low	Individuals are sparse, at the fringe of its range, or distributed at low

Criteria	Definition
	irregular densities.
Moderate	Individuals are uncommon, or seasonally distributed, or at low but regular densities, or occurring in clusters.
High	Individuals are common, or occur year-round, or are widely distributed or occur at high densities.

Adapted from CEAA (1994), Manitoba Hydro (2003), and AltaLink Management Ltd. (2006).

3.7 ASSESSMENT OF CUMULATIVE EFFECTS

Cumulative effects assessment is important for determining the impact of anthropogenic and environmental factors on the long-term viability of the environment and its function as an ecosystem. Cumulative environmental effects can result when the environmental effects of a project are combined with the effects of other past, present and future projects or activities. While causal links can often be drawn between actions and consequences using the results of scientific studies and anecdotal reports, the consequences of multiple actions on the environment can be difficult to interpret. This is due to additive costs of cumulative actions as well as possible synergistic effects where resulting consequences can be relatively unique. In studying ecosystems this is often the case where varied aspects require consideration including past and present resource management regimes, species interactions, climactic conditions, variability based on geographic location, etc.

The proposed Bipole III Transmission Project is a very large project with many components including transmission lines, converter stations, ground electrode facilities, construction camps and power, marshalling yards, etc. Each Project component may have environmental effects that may act cumulatively with the effects of other components as well as the effects of other projects and activities in the assessment area. The cumulative effects assessment conducted examines the potential impacts of Bipole III development on avian fauna alongside other residual environmental effects of other projects, development actions, and environmental considerations. This is done to determine potential end costs to bird species and the viability of species into the future. In conducting this assessment, selected bird species were used as surrogates in identifying habitat needs which can then be extended in the consideration of larger bird communities. Alongside these valued environmental components, species at risk listed under the federal *Species at Risk Act* and *The Manitoba Endangered Species Act* were also considered as VECs. In considering the large geographic scale for Bipole III, cumulative effects are discussed at the ecoregion level. Where future projects or activities are considered, potential cumulative effects are considered for those projects and activities planned to occur within the next 30 years, which is generally the initial planning horizon for species at risk recovery strategies (e.g., burrowing owl).

4.0 EXISTING ENVIRONMENT

4.1 DATA/INFORMATION SOURCES

4.1.1 Major Sources

The majority of data was collected through surveys completed during the 2010 field season. The field surveys included bird of prey surveys, waterfowl surveys, colonial waterbird surveys and breeding bird surveys. Relevant data from the United States Fish and Wildlife Service Waterfowl Surveys, North American Breeding Bird Survey (NA BBS) and Ducks Unlimited Canada Hotspots, Ducks Unlimited Canada paired density estimates, Manitoba Conservation Data Centre (MBCDC) data, other non-governmental and crown corporation conservation program data, and Aboriginal Traditional Knowledge were also used to describe the existing environment.

4.1.1.1 Canadian Land Cover Classification Enhanced for Bipole Habitat Data

The primary habitat layer used for analysis throughout this report is The Canadian Land Cover Classification Enhanced for Bipole (see *The Canadian Land Cover Classification Enhanced for Bipole*). This habitat layer is an enhancement of the Federal governments Land Cover Classification including integration with the National Stratification Working Group ecological framework database, including wetland features, fire history, and harvest information from the Canadian Land Inventory. Vegetation cover types in the ecoregions of the Local Study Area are listed in Table 4-1.

Table 4-1. LCCEB Covertypes and Their Representation (%) by Ecoregion in the Local Study Area

Covertype	Ecozone:	Prairie	Boreal Plain		Boreal Shield		Hudson Plain & Taiga Shield
	Ecoregion:	Aspen Parkland & Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland & Selwyn Lake Upland
Water		1.48	1.86	2.90	10.48	5.43	3.49
Exposed Land		0.41	2.47	1.56	0.05	0.85	0.40
Developed		6.09	0.81	0.14	0.00	0	0
Shrubland		0.12	0	0	0.00	0	0
Shrub-Tall		0.32	0.53	5.00	1.76	2.10	2.66
Wetland		0.55	0	0	0	0	0.00
Wetland Treed		0.03	3.88	14.70	15.83	13.63	5.12
Wetland Shrub		9.38	10.17	16.84	22.30	13.18	20.70
Wetland Herb		8.08	6.36	10.63	14.19	8.80	16.65
Herb		11.54	11.06	1.11	0	0	0
Grassland		19.19	6.07	0.54	0	0	0
Annual Crops		9.73	2.38	0.15	0	0	0
Perennial Crops and Pasture		3.43	4.58	0.43	0	0	0
Coniferous Dense		0	5.27	17.37	17.27	21.48	11.53
Coniferous Open		0.03	4.60	18.58	14.67	14.66	21.14
Coniferous Sparse		0	0.01	0.55	2.20	16.26	18.31
Broadleaf		5.42	0	0	0	0.00	0
Broadleaf Dense		11.58	23.55	4.90	0.34	0.61	0
Broadleaf Open		12.48	8.66	0	0	0	0
Broadleaf Sparse		0.01	0.03	0.02	0	0	0
Mixedwood Dense		0.10	7.68	4.40	0.89	2.99	0
Mixedwood Open		0	0.03	0	0	0	0

4.1.1.2 Ducks Unlimited Canada Waterfowl Hotspots

A number of waterfowl hotspots have been identified by Ducks Unlimited Canada throughout Manitoba and are areas where high concentrations of waterfowl can be found, particularly during the migration seasons. Many of the lakes in these areas are important staging lakes and consequently there is an increased likelihood of bird wire strikes during the migration season, as high concentrations of waterfowl move through the area. A list of the number of waterfowl hotspots by in the ecoregions of the Project Study Area can be found in Table 4-2.

Table 4-2. Ducks Unlimited Canada Waterfowl Hotspots by Ecoregion

Ecoregion	Number of Waterfowl Hotspots
Lake Manitoba Plain	1
Interlake Plain	2
Mid-boreal Lowland	5
Churchill River Upland	6
Hayes River Upland	8
Hudson Bay Lowland	0

4.1.1.3 Ducks Unlimited Canada Paired Density Estimates

Paired density estimates are a categorical estimate of the density of waterfowl breeding pairs in a given area. Ducks Unlimited Canada has generated these estimates from Portage la Prairie west to the Manitoba border and North to Snow Lake. Depending on the expected paired density, areas are given a categorical variable of either low, medium or high. These estimates were used in study design for waterfowl and colonial water bird surveys as well as in the selection of potential environmentally sensitive sites.

4.1.1.4 Important Bird Areas

In Canada, an IBA is defined as areas that *"contain threatened species, endemic species, species representative of a biome, or highly exceptional concentrations of birds. As a network, IBAs are strategic building blocks for global conservation planning"* (IBA Canada 2010a).

The goal of the IBA program is to:

- identify a network of sites that illustrate and conserve the natural diversity of Canadian bird species and are critical to the long-term viability of naturally occurring bird populations;
- determine the type of protection or stewardship required for each site, and ensure the conservation of sites through partnerships between local stakeholder groups who develop and implement appropriate on-the-ground conservation plans; and
- establish ongoing local involvement in site protection and monitoring (Birdlife 2011).

In order for a site to be given an IBA designation, the site must meet at least one of the following internationally agreed upon criteria:

1. Hold significant numbers of one or more globally threatened species;
2. Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species; or
3. Have exceptionally large numbers of migratory or congregating species (Birdlife 2011).

There are a total of 5 IBAs in the vicinity of the proposed route, 3 in the Lake Manitoba Plain Ecoregion, 1 in the Interlake Plain Ecoregion, and 1 in the Manitoba Lowlands Ecoregion. Table 4-3 illustrates the location of these IBAs by ecoregions, as well as outlines the justification for each, based on the above criteria. All IBAs are avoided by the FPR, with the exception of The Pas & Surrounding Area IBA (i.e., The Pas - Saskatchewan River Delta). This IBA extends from the Manitoba border east to Moose and Cedar Lakes. Important components of this IBA include the Tom Lamb and Saskeram Wildlife Management areas and the Carrot River Triangle. The Manitoba portion is bordered to the west by the Saskatchewan border although the delta proper does extend into Saskatchewan. Major rivers and deltas in the IBA are the Saskatchewan, Carrot and Pasquia Rivers, and the Saskatchewan River Delta (Lindgren 2001). Other important features in this area include Clearwater Lake Provincial Park. This area was considered a project bottleneck and consequently it could not be avoided during the alternative routes process.

Table 4-3. Important Bird Areas Near the Proposed Final Preferred Route

Name	Ecoregion	Criteria
Big Grass Marsh	Lake Manitoba Plain	*Globally Significant:* Waterfowl Concentrations, *Continentally Significant:* Congregating Species, Wading Bird Concentrations
Sandy Bay Marshes	Lake Manitoba Plain	*Nationally Significant:* Congregating Species
Kinosota-Leifur	Lake Manitoba Plain	*Nationally Significant:* Threatened Species
Sagemace and Coleman Bay Island	Interlake Plain	*Nationally Significant:* Congregating Species, Wading Bird Concentrations
The Pas - Saskatchewan River Delta	Manitoba Lowlands	*Globally Significant:* Waterfowl Concentrations

(IBA 2010b)

4.1.1.5 Manitoba Conservation Data Centre Data

The MBCDC is a central repository for information on Manitoba flora and fauna and is charged with assigning a conservation status rank for each species based on how rare it is in Manitoba. (MBCDC n.d.). Data from rare species is collected and entered into a community database, along with geographic locations.

A GIS shapefile of all known rare bird observations in the Bipole III Study Area was accessed. A total of 354 bird observations of 12 species were provided, however only 5 points (4 red-headed woodpeckers and 1 yellow rail) were located inside the 10 kilometre (six-mile) bird study area corridor.

4.1.1.6 Other Non-Governmental and Crown Corporation Conservation Programs

Other important bird population and habitat features were sourced (see *Bipole III Reliability Improvement Project: Land Use Technical Report*) from four principal non-government conservation agencies and Crown Corporations working to identify and manage lands for habitat conservation in the study area: Ducks Unlimited Canada (DUC), Manitoba Habitat Heritage Corporation, the Manitoba Wildlife Federation and Nature Conservancy of Canada. All Non-Governmental and Crown Corporation Conservation Program lands were avoided by the FPR, with two exceptions: the Saskatchewan River Delta (see Section 4.1.1.4) and the Portia Marsh complex.

The Portia Marsh complex is a series of lakes and wetlands located in an area north of Alonsa, Manitoba. Of particular concern is for potential impacts to waterfowl and other wetland birds using the high value wetland habitat. Some of these wetlands (and others) are also known to have botulism outbreaks, which may be exacerbated by potential bird-wire collisions occurring in these wetlands. As such, DUC offered an alternative route to the west to avoid this wetland complex and to avoid other potentially sensitive sites in the area (e.g., Big Grass Marsh). Although bird habitat associated with this line segment had a high site sensitivity for birds, among the alternative routes that were generated and reviewed, land-use conflicts prevented the avoidance of this segment. Site-specific mitigation for birds, including waterfowl and other VECs are required at this location along the FPR.

4.1.1.7 United States Fish and Wildlife Service Waterfowl Surveys

The United States Fish and Wildlife Service (USFWS) conducted a waterfowl breeding population survey of Northern Manitoba from May 15 to June 8, 2008 (USFWS 2008). The survey stratum area encompassed 214 880 square kilometres (82,966 square miles) of which 1328 square kilometres (513 square miles) were sampled near Gillam, Lynn Lake, and Thompson. The 2008 duck population estimate was 852.6 thousand. Of this, there were 364.5 thousand dabblers, 377.6 thousand divers, and 110.6 thousand miscellaneous ducks. Mallards made up 52.9% (192.8 thousand) of the dabblers (USFWS 2008).

The Canadian Wildlife Service (CWS) and The United States Fish and Wildlife Service conducted a waterfowl breeding population survey of Southern Manitoba from May 8 to May 23, 2008 (USFWS and CWS 2008). The survey stratum area was 19,797 square kilometres (7,644 square miles) of which 350 square kilometres (135 square miles) were sampled near The Pas, Dauphin, Brandon, Pilot Mound, and Portage La Prairie, Winnipeg, and Gimli. The 2008 duck population estimate was 1503.9 thousand. Of this, there were 1043.5 thousand dabblers, 396.7 thousand divers, and 63.6 thousand miscellaneous ducks. Mallards made up 42% (438.1 thousand) of the dabblers indicating a decline of 2.9% since 2007 and 11.9% decline over the past 10 years, while total duck populations decreased by 10.2% and 18.4% respectively (USFWS and CWS 2008).

4.1.1.8 North American Breeding Bird Survey

Supplemental surveys of bird species in the Interlake Plain Ecoregion (in the Boreal Plains Ecozone) and Lake Manitoba Plain Ecoregion (in the Prairies Ecozone) occurred through examination of results from the North American Breeding Bird Survey (NA BBS). While the NA BBS uses a considerable number of routes in surveying bird species in Manitoba, only a handful of available routes bisect the Bird Study Area. As species counts and trends are only available based on route, and not individual stops along the route, observations of species for specific routes were treated as being present at all stops. The number of sightings for each species was calculated for the Bird Study Area based on the total number of observations seen over a route and adjusted based on the portion of route within the study area. Estimates of bird counts were rounded up.

Surveys of routes did not occur in Lenswood in 2000 (Interlake Plain Ecoregion), the Delta Beach and Westbourne routes in 2006 and Crane River in 2009 (Lake Manitoba Plain Ecoregion). Table 4-4 indicates the NA BBS routes considered in this study and the portion of them inside the delineated Bird Study Area.

Table 4-4. Breakdown of North American Breeding Bird Survey Routes Used in Identifying Bird Species Present in the Bird Study Area

Ecoregion	Route Number	Route Name	Number of Route Stops	Number Stops in BPIII Route	% Stops in BPIII Route
Interlake Plain	49	Lenswood	50	9	18
Lake Manitoba Plain	2	Dufresne	50	23	46
	5	Jordan	50	15	30
	22	Crane River	50	14	28
	102	Grunthal	50	8	16
	116	Delta Beach	50	11	22
	216	Westbourne	50	21	42

INTERLAKE PLAIN ECOREGION

Using route information for those surveys conducted in the Local Study Area, 105 bird species were observed in the Interlake Plain Ecoregion. These species were identified through the observation of 938 individual birds and followed the protocols outlined by the NA BBS (Sauer *et al.* 2011).

Observations of waterfowl during the 2001 to 2010 NA BBS indicated the presence of seven species in the Interlake Plain Ecoregion in the Bird Study Area. These species were recorded a combined 46 times and included mallard (n = 39), Canada goose (n = 2), and sandhill crane (n = 1). One species, wood duck, was identified that was not recorded during the 2010 bird surveys. Observations of mallards from 2001 to 2010 were varied with none from 2001 to 2003. Mallard observations have not been extensive in this area, ranging from about 25 in 2004 to a low of 1 in 2007.

Four colonial waterbird species were observed during the 2001 to 2010 NA BBS, possibly within the Local Study Area. These included American white pelican (n = 1), Franklin's gull (n = 18), ring-billed gull (n = 18), and great blue heron (n = 1); all of which were also recorded during the 2010 Bipole III bird surveys. An additional eight species were also observed. Identifying changes in great blue heron demographics is of potential interest in indicating changing habitat suitability for this species; however the low number of sightings in this study for it (n = 1) makes predicting demographic trends difficult.

Four shorebird species were recorded during the 2001 to 2010 NA BBS in the Interlake Plain Ecoregion including killdeer (n = 8), spotted sandpiper (n = 1), and marbled godwit (n = 3). All four of these species were also observed during the 2010 Bipole III bird surveys. An additional six species were identified in this ecoregion during the bird surveys for Bipole III.

From 2001 to 2010, eight bird of prey species were identified in the NA BBS including red-tailed hawk (n = 8), American kestrel (n = 4), and turkey vulture (n = 2). Two bird of prey species observed during the NA BBS were not recorded during the 2010 Bipole III bird surveys, sharp-shinned hawk (n = 1) and merlin (n = 1). No occurrences of bald eagles were recorded during the 2001 to 2010 NA BBS. One owl species, great horned owl (n = 1), was observed.

Three species of upland game bird were observed in the Interlake Plain Ecoregion from 2001 to 2010: gray partridge (n = 1), ruffed grouse (n = 1) and sharp-tailed grouse (n = 1). Monitoring of ruffed grouse and sharp-tailed grouse, which are valued environmental components, is of importance but the low number of observations makes these data difficult to extrapolate. Gray partridge was observed during the NA BBS but not during the 2010 Bipole III bird surveys.

Five woodpecker species were observed during the 2001 to 2010 NA BBS. These included red-headed woodpecker (n = 1), yellow-bellied sapsucker (n = 1), downy woodpecker (n = 1), hairy woodpecker (n = 1), and pileated woodpecker (n = 1). All but one of these species was recorded during the 2010 Bipole III bird surveys in this ecoregion. Red-head woodpecker, a species listed as threatened under the *Species at Risk Act* (SARA), was not observed. In the NA BBS the occurrence of a red-headed woodpecker was in 2010. A low occurrence of annually recorded woodpecker species in the NA BBS makes monitoring difficult; including for pileated woodpecker.

From 2001 to 2010, 74 passerine species were identified a combined total of 830 times. The most commonly observed species included savannah sparrow (n = 127), clay-colored sparrow (n = 114) and song sparrow (n = 93). Of the 74 species, three were listed as threatened under SARA including Canada warbler (n = 1), golden-winged warbler (n = 1) and Sprague's pipit (n = 1); the latter of which is also listed as threatened under *The Endangered Species Act* of Manitoba (MESA). Sprague's pipit was recorded twice in 2002, golden-wing warbler was identified once in 2009 and 2010, and Canada warbler was observed a single time in 2004. Of the 74 species identified through the NA BBS, six were not recorded during the combined 2010 Bipole III bird surveys including grasshopper sparrow (n = 1), house finch (n = 1) and rock pigeon (n = 8).

LAKE MANITOBA PLAIN ECOREGION

Six NA BBS routes overlapping the Bird Study Area were surveyed in the Lake Manitoba Plain Ecoregion from 2000 to 2010. A total of 175 species were identified.

Twenty-four waterfowl species were observed 1,394 times during the 2000 to 2010 NA BBS. Commonly seen species included Canada goose (n = 673), mallard (n = 348) and blue-winged teal (n = 185). One species at risk was observed. Yellow rails (n = 6) are listed as special concern under SARA. Three species were observed during the NA BBS that were not recorded during the 2010 Bipole III bird surveys, American black duck (n = 1), ruddy duck (n = 1), and hooded merganser (n = 2). While somewhat variable ranging from about 12 to 50 birds, observations of mallards would indicate a relatively stable local population for this species within the Local Study Area.

Fourteen colonial waterbird species were identified during the 2000 to 2010 NA BBS a combined total of 517 times. Common colonial species included Franklin's gull (n = 329), ring-billed gull (n = 119) and American bittern (n = 29). Eighteen species were observed 1,093 times during the 2010 Bipole III bird surveys. Eared grebe was recorded during the NA BBS but not during the 2010 Bipole III bird surveys. Counts of great blue heron during the NA BBS indicate uniformly low sampling numbers, making the detection of demographic trends difficult.

Ten shorebird species were identified a combined 491 times during the 2000 to 2010 NA BBS for the routes overlapping the FPR. This is in contrast with the 11 shorebird species recorded 724 times during the 2010 Bipole III bird surveys. Species commonly observed during the NA BBS included killdeer (n = 283), Wilson's snipe (n = 139) and marbled godwit (n = 33). One species, solitary sandpiper (n = 1), was observed during the NA BBS but not during the 2010 Bipole III bird surveys, whereas American avocet and American woodcock were identified during the bird surveys and not during the NA BBS.

During the 2000 to 2010 NA BBS, 15 raptor and owl species were identified a combined 108 times. In comparison, 21 species were identified 544 times during the 2010 Bipole III bird surveys. Species commonly recorded during the 2000 to 2010 NA BBS included red-tailed hawk (n = 42), American kestrel (n = 27) and northern harrier (n = 17). Sightings also included one peregrine falcon observed in 2008 on the Westbourne route; a species listed as endangered under MESA and threatened under SARA. This species and Swainson's hawk (n = 8) were the only species to be observed during the NA BBS that were not also recorded during the 2010 Bipole III bird surveys. Recorded observations of bald eagle were minimal with only one observation from 2000 to 2010.

Five species of upland game birds were recorded a combined 17 times during the 2000 to 2010 NA BBS surveys. Ruffed grouse (n = 5), wild turkey (n = 5), gray partridge (n = 4), sharp-tailed grouse (n = 3) and ring-necked pheasant (n = 1) were observed. Gray partridge and ring-necked pheasant were not observed during the 2010 Bipole III bird studies. Ruffed and sharp-tailed grouse sightings are of potential importance in monitoring these valued environmental components, but were limited in the Local Study Area.

Five woodpecker species were identified during the 2000 to 2010 NA BBS. The same five species were also observed during the 2010 Bipole III bird surveys: pileated woodpecker (n = 3), downy woodpecker (n = 9), hairy woodpecker (n = 18), yellow-bellied sapsucker (n = 21) and red-headed woodpecker (n = 8). The latter is listed as threatened under SARA and was recorded on four of the six routes surveyed. Yearly trends of pileated woodpecker varied considerably with no sightings occurring in five of 10 sampling years.

A total of 13,458 observations of 102 passerine species were made during the 2000 to 2010 NA BBS. Commonly recorded species included red-wing blackbird (n = 2,200), savannah sparrow (n = 1,266) and western meadowlark (n = 690). Several species listed as threatened under SARA were identified: golden-winged warbler, chimney swift, olive-sided flycatcher, and loggerhead shrike (n = 1 for each). The loggerhead shrike is also listed as endangered under MESA. Other relatively rare bird species identified for this region during the NA BBS, but not recorded during the 2010 Bipole III bird surveys, were American pipit (n = 1), dickcissel (n = 1), and indigo bunting (n = 1). Orchard oriole (n = 1) was recorded incidentally in the town of Winnipegosis (Berger, *pers. comm.* 2010).

4.1.1.9 Manitoba Nocturnal Owls Survey

The Manitoba Nocturnal Owl survey, which occurs on routes in southern Manitoba, began in 1991 (Froese and Duncan 2006). From 2005 to 2010, northern saw-whet owls and great horned owls were consistently the most frequently recorded owl species (Duncan 2005; Froese and Duncan 2006; Duncan 2007; Duncan 2008; Duncan 2009; Duncan 2010b). Other species detected during the six-year period were boreal owl, long-eared owl, northern hawk owl, barred owl, great gray owl, eastern screech-owl, short-eared owl, and snowy owl. Snowy owls were only observed in 2005. No barn owls or burrowing owls were recorded during these surveys.

4.1.1.10 Manitoba Breeding Bird Atlas

Although data were not available in time for this assessment, the Manitoba Breeding Bird Atlas is an ambitious five-year project that began in 2010 to engage citizens in documenting the distribution and abundance of all breeding birds throughout the entire province of Manitoba. This important initiative is a collaboration of many partners, including Bird Studies Canada, Environment Canada, Manitoba Conservation, Nature Manitoba, The Manitoba Museum, Manitoba Hydro and Nature Conservancy Canada, who share a passion for environmental monitoring. Future Manitoba Hydro projects will consider this data source for transmission line developments.

4.1.2 Data / Information Gaps / Deficiencies

An important part of the environmental assessment process is recognizing any gaps or deficiencies in the studies. Gaps may exist for any number of reasons, including changes in the scope of the project, logistical difficulties, or a lack of available information. A number of gaps/deficiencies have been identified for the Bipole III bird effects assessment.

Manitoba data, including literature, is limited for Threatened and Endangered bird species that may be located along the FPR. As the project proceeds, species at risk and their habitats are still highly likely to be discovered along the FPR. Although regional populations, habitats and distributions are better understood, and local habitats and individual occurrences are considered where known, more information would improve the existing environment description and the assessment.

New sections of alternative routes were identified after the bird studies had been conducted. In particular, this included a re-routing of the PPR to avoid the Thompson mineral belt area, and moved the FPR south of Setting Lake. The lack of data at these new locations for a portion of the route is considered a gap for the bird assessment. The use of a 10 kilometre (six mile) breeding Bird Study Area allowed flexibility for routing purposes within an area surveyed for breeding birds and consequently some sections of the newly routed portions have been surveyed as they still fell within the six mile corridor.

Another factor that has resulted in data gaps relates to site access along the FPR. There were two types of access-related issues. Permission was required to access privately owned land, which was not always granted. Secondly, some remotely located sites could not be accessed effectively for assessment purposes. The largest gap related to access to privately owned land occurred along the southern portion of the route, from Winnipeg to the Assiniboine River and was primarily related to the breeding bird surveys. Landowner permission was sought for a number of properties, however due to difficulties in reaching landowners and the time sensitivity of the study, only a small portion of privately owned land was surveyed.

The nocturnal owl surveys were conducted along roadsides at night. Remote site access at night was not practical or safe. Consequently, sections along the FPR without road access were not surveyed for owls. This resulted in gap for owl distribution along the FPR, primarily in the portions north of The Pas. In addition, some species such as short-eared owl and whip-poor-will cannot be effectively inventoried using conventional methods and require specialty surveys. These surveys were not conducted.

The identification of sharp-tailed grouse leks and large stick nests along the RoW are additional gaps in this study, particularly in relation to sensitive sites along the FPR. Site-specific mitigation measures are required for both. Surveys for these features were not conducted as they are very site specific, time-sensitive, and require a more intensive survey effort than was feasible in the Bird Study Area.

Many of the sensitive sites that are currently listed as waterfowl movement corridors were not validated in the field. It is possible that some of these sites may not have high frequency movements, and do not require mitigation measures such as bird deflectors that could be used to minimize bird-wire collisions.

Expert models were validated using presence/absence information from sampled species locations relative to modelled habitat areas. Some models performed better than others however no steps have been taken to improve models, in part due to a lack of fine-scale habitat information that was not available at the time of this assessment. This is particularly important in considering mallard and common nighthawk habitat; models which could not be validated. It should be noted however, that models are not used as a standalone technique for evaluating potential effects. In addition, bird abundance field data, literature, tangible TK, other data, and professional judgement were all used in the Bipole III effects assessment.

LCCEB information provided a broad, and in most cases, a stand level of interpretation for bird habitats across the landscape in the Project Study Area. While habitat mapping data are sufficient at a coarse scale, and are applicable for broad scale habitat modelling purposes for many bird species, finer scale habitat information would improve habitat suitability modelling particularly species at risk, and especially for potential habitat and geographic areas that could be validated. As this information may be subject to some error, uncertainty in the effects predictions might be higher than anticipated.

4.1.3 Implications of Gaps/Deficiencies

There is a moderate level of uncertainty related to understanding site-specific occurrences of Threatened and Endangered bird species that may be located along the preferred Bipole III route. Standard construction and operating practises, along with many of the mitigation prescriptions proposed in the effects assessment are expected to reduce or eliminate most of the potential Project effects. If however, unknown Threatened or Endangered population concentrations, or site-specific sensitive habitats, or critical habitats are not discovered, and there are no further opportunities to offer site-specific mitigation measures at these sites, potential Project effects could be higher than anticipated.

The implications for gaps related to rerouting sections of the preferred route are considered to be minor for three reasons; proposed timing of clearing and construction for the Project Components, the use of pre-construction surveys, and finally, the application of models that are used to increase certainty concerning the effects predictions. In northern environments, clearing and construction will occur during winter, which avoids the breeding and nesting season. In the southern environments, and where species at risk are anticipated, pre-construction surveys should allow for the identification of any additional sensitive sites or habitats that may be present along any existing or rerouted sections and the implementation of any needed additional mitigation measures. Where habitats were modeled, sensitive sites were not readily apparent in the areas that were not field sampled.

The gaps related to private land access are considered minor, as they occur on privately owned land, a large portion of which is agricultural, and where the habitat on these lands are most often found to be disturbance-associated bird communities. In most cases, bird communities found in disturbed habitats are not expected to be affected by the construction and operation of the Project. Secondly, other roadside data were used to improve the understanding of bird populations and habitat relationships on private lands. These data included the North American Breeding Bird Surveys.

Gaps in the nocturnal owl survey are a minor concern but there is no practical means of addressing field collections in the Local Study Area. It should be noted however, that many owl species also occupy habitat types that are common throughout the Local Study Area, and used by many other bird species. In addition, the only listed owl species in Manitoba is the burrowing owl, the presence of which would most likely have been detected during bird surveys. Some species such as short-eared owl could not be inventoried effectively. However, these species likely occupy habitat types that are relatively common and the alteration of potential habitats can potentially be measured using other bird population or habitat indicators.

The level of uncertainty for the effects assessment regarding grouse leks and stick nests, and more specifically, where to mitigate for these potential effects, is currently moderate. Surveys for leks and large stick nests must be conducted prior to the clearing of the RoW to improve certainty, and if conducted, the gaps would be considered as minor.

Many of the sensitive sites that are currently listed as waterfowl movement corridors were not validated in the field. It is possible that some of these sites may not have high frequency movements, and do not require bird deflectors.

In deriving habitat models using coarse scale habitat information there is the possibility of fine scale habitat features not being given the consideration likely required in meeting the specific habitat needs of species, particularly species at risk. For example, common nighthawk habitat use could not be delineated at a statistically significant level through available sampling information; in part due to the specific habitat requirements of this species not being available. Additional fine-scale habitat information could also be used in drawing further inferences on habitat use by bird species not indicated through using only a coarser scale of habitat information in analysis, or with the collection of additional field data.

4.1.4 Actions Taken / to be Taken

To improve the level of certainty concerning Project effects, pre-Project construction activities will be required to identify sensitive sites, confirm and improve understanding of known sites, and most importantly, provide opportunities for prescribing site-specific mitigation recommendations where they are currently unknown. In most cases, additional pre-Project site investigations are required, and include:

- threatened and endangered (rare) breeding bird surveys in selected habitats to increase certainty in the effects assessment, and improve understanding of fine scale species at risk occurrences and habitat selection along the FPR (i.e., at the stand and site-level);
- breeding bird surveys at locations where the route has changed;
- specialized surveys for short-eared owl and whip-poor-will where feasible;
- sharp-tailed grouse lek surveys;
- large stick nest surveys; and
- validation surveys at identified sensitive sites that include waterfowl movements surveys.

As may be required, short-eared owl surveys should begin at least one hour before sunset and end no later than half an hour after sunset (Schmelzer 2005). Whip-poor-will surveys are ideally conducted at night when more than 50% of the moon face is illuminated (Cooper 1981; Mills 1986; Wilson and Watts 2006). As such, these few species were not targeted during the breeding bird, rare bird, or nocturnal owl surveys. In order to determine their presence on the FPR, specialized surveys would be required.

4.2 EXISTING ENVIRONMENT DESCRIPTION

4.2.1 Overview

The Local Study Area is approximately 1,400 km long and transects five distinct ecozones: Prairies, Boreal Plains, Boreal Shield, Taiga Shield and Hudson Plains (see Map 1 - Bipole III study areas), with compositions of 23%, 35%, 37%, 3% and 3% respectively. For a detailed description of the ecosystems and effects assessment, refer to the *Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project*).

4.2.2 Prairies Ecozone

The Prairies Ecozone is made up mostly of agricultural lands including crops, haylands, and pastures, with small pockets of forested habitats located along rivers, shelterbelts, homesteads and various protected areas in the southwestern corner of the province. Approximately 9% of Manitoba's total landscape is comprised of Prairies Ecozone.

The Prairies Ecozone climate is characterized by short, warm summers and long, cold winters (Smith *et al.* 1998). There is relatively little precipitation, which is often in the form of heavy storms in summer, and approximately 25 percent of which falls as snow (Smith *et al.* 1998). Mean temperatures range from -12.5 degrees Celsius (°C) to 16°C, with mean annual temperatures from 1.5°C to 3.5°C (Smith *et al.* 1998). There are three ecoregions in this ecozone: Aspen Parkland, Lake Manitoba Plain, and Southwest Manitoba Uplands (Smith *et al.* 1998). All are included in the Project Study Area.

Historically, a large portion of the Prairies Ecozone consisted of tall-grass prairie; however the majority of it has been converted to cropland or otherwise altered (Smith *et al.* 1998). Trembling aspen and balsam poplar are found throughout, and this ecozone also contains significant concentrations of wetlands located in the Neepawa area and adjacent to major water bodies such as Lake Manitoba (Smith *et al.* 1998). Additionally, these wetlands provide excellent nesting and staging habitat for waterfowl. This ecozone has potential for the highest number of listed bird species to occur in the Project Study Area. Ferruginous hawk and American avocet (Appendix F-1) can be found throughout the ecozone, although in reduced numbers due to habitat loss (Smith *et al.* 1998; Carey *et al.* 2003).

4.2.3 Boreal Plains Ecozone

The Boreal Plains Ecozone extends from the south Interlake to north Interlake and west to the Saskatchewan border, comprising approximately 15% of Manitoba's landscape. In contrast to the Boreal Shield (Section 5.3.4), this ecozone is not dominated by bedrock and has fewer lakes. Although mainly forested, a considerable amount of land has been converted to agriculture including crops, haylands and pasture (Smith *et al.* 1998). The landscape is generally level or with gently rolling plains (Smith *et al.* 1998). Wetlands and peatlands cover up to 50% of the ecozone (Smith *et al.* 1998). There are four ecoregions in this ecozone (Smith *et al.* 1998). The Project Study Area includes the Mid-Boreal Lowland, Boreal Transition, Mid-Boreal Uplands, and Interlake Plain Ecoregions.

Winters are typically cold and summers moderately warm (Smith *et al.* 1998). Mean annual temperature is from -2 °C to 2.5 °C, and mean annual precipitation is 600 millimetres (mm) in Manitoba (Smith *et al.* 1998). White black spruce, jack pine, and tamarack are common conifer species, with northern sections of the ecozone dominated by black spruce and tamarack. White birch, trembling aspen, and balsam poplar are characteristic broadleaf species (Smith *et al.* 1998). Boreal owl, great horned owl, red-tailed hawk, blue jay, rose-breasted grosbeak, evening grosbeak, Franklin's gull, and brown-headed cowbird are bird species representative of the ecozone (Smith *et al.* 1998; Carey *et al.* 2003).

4.2.4 Boreal Shield Ecozone

The Boreal Shield Ecozone is the largest in Canada, extending from the southeastern corner of the province to just south of Brochet near the Manitoba-Saskatchewan border. It is dominated by bedrock and is covered with lakes, and covers the greatest proportion of Manitoba (Smith *et al.* 1998). Land use is dominated by resource development and recreation (Smith *et al.* 1998). There are four ecoregions in this ecozone (Smith *et al.* 1998). Three, the Churchill River Upland, Hayes River Upland, and Lake of the Woods Ecoregions are included in the Project Study Area.

Winters are long and cold and summers are short and cool; mean annual temperature is -4°C and mean annual precipitation is 400 mm in the west (Smith *et al.* 1998). Bog and fen peatlands are common throughout the ecozone, with small black spruce trees and Labrador tea and sphagnum moss ground cover (Smith *et al.* 1998). A mosaic of stands of uneven-aged trees is created by wildfire, which in an important component of the ecosystem (Smith *et al.* 1998). Jack pine commonly colonizes recently burned areas, and black spruce regenerates after some time (Smith *et al.* 1998). Characteristic birds are boreal owl, blue jay, white-throated sparrow, and evening grosbeak (Smith *et al.* 1998; Carey *et al.* 2003).

4.2.5 Taiga Shield Ecozone

The Taiga Shield Ecozone is comprised mainly of stunted conifer dominated forests, Precambrian shield and lakes, and makes up approximately 19% of Manitoba's landscape. Proceeding north through this ecozone, trees become sparse and the terrain resembles the Southern Arctic Ecozone. Black spruce and tamarack are common, and dwarf birch, willows, Labrador tea, mosses, and lichens cover the ground (Smith *et al.* 1998). Within the Project Study Area the Taiga Shield Ecozone contains mostly stunted conifer stands with significant amounts of shrubs (Smith *et al.* 1998). Of the two ecozones in this ecoregion (Smith *et al.* 1998), only Selwyn Lake Upland is included in the Project Study Area.

The subarctic climate of this ecozone is typified by short summers with long periods of daylight, and long, cold winters (Smith *et al.* 1998). Mean annual temperature is -9.0°C, and mean precipitation ranges from 200 to 500 mm per year in Manitoba (Smith *et al.* 1998). Birds common to the Taiga Shield Ecozone include Pacific loon, red-throated loon, red-necked phalarope, northern shrike, osprey, tree sparrow, common raven, spruce grouse, and gray-cheeked thrush (Smith *et al.* 1998; Carey *et al.* 2003).

4.2.6 Hudson Plains Ecozone

The Hudson Plains Ecozone makes up approximately 20% of Manitoba's landscape and is comprised mainly of fens and bogs. Permafrost is widespread throughout this ecozone; however the areas found within the Project Study Area are comprised mainly of shrubs with significant amounts of conifer (70.4%, 10.0%, and 16.1% respectively; Smith *et al.* 1998). Hudson Bay Lowland, one of two ecoregions in this ecozone (Smith *et al.* 1998), is included in the Project Study Area.

As the Manitoba portion of the Hudson Plains Ecozone lies on the south coast of Hudson Bay, its climate is strongly affected by Hudson Bay Low and Polar High air masses (Smith *et al.* 1998). Mean annual temperatures in Manitoba can reach -7°C, and 30% to 50% of the average precipitation of 400 mm falls as snow (Smith *et al.* 1998). Summers are short and cool and winters are long and very cold (Smith *et al.* 1998). Unvegetated lowlands are common near the coast, and peatlands increase in depth with increasing distance from it (Smith *et al.* 1998). Black and white spruce and shrubs, mosses, and lichens grow in areas not covered by peat (Smith *et al.* 1998). Common bird species in this ecozone are snow goose, Canada goose, willow ptarmigan, rock ptarmigan, and many migratory species, including shorebirds (Smith *et al.* 1998; Carey *et al.* 2003).

4.3 ENVIRONMENTAL COMPONENTS

Of the approximately 400 species of birds found in the province of Manitoba, 371 species have ranges that overlap the Local Study Area (Appendix F-1) (Farrand 1983; Robbins *et al.* 1983; Carey *et al.* 2003). Most of the bird species in Manitoba found in the Project Study Area are migratory, including 46 short-distance migrants and 133 long-distance migrants (or Neotropical migrants). The Project Study Area has about 43 resident species that do not migrate, or tend to migrate within the province. There are about 117 bird species that are regular migrants and pass through the Project Study Area on the way to more northerly breeding grounds, occasional visitors, rare migrants or visitors, extra-limital in records, or regular winter residents that arrive in the Project Study Area from breeding grounds in the north.

Of the 371 species potentially found in the Local Study Area, approximately 356 are found in the Prairies Ecozone, approximately 344 are found in the Boreal Plains Ecozone, approximately 306 are found in the Boreal Shield Ecozone, approximately 156 are found in the Taiga Shield Ecozone and approximately 161 are found in the Hudson Plains Ecozone (Carey *et al.* 2003).

Approximately 218 species are known or expected to nest within the Project Study Area. Of the species potentially found in the Project Study Area, 35 are federally or provincially listed as Extirpated, Endangered, Threatened, and/or Species of Special Concern. Fourteen of the species are known or expected to nest within the Local Study Area (and up to 19 species known to breed in the Local Study Area or nearby), are listed under the federal Species at Risk Act (SARA), The Endangered Species Act of Manitoba (MESA), or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), with the majority of these species occurring in southern and central Manitoba (MESA 1998; SARA 2002; COSEWIC 2010a).

4.3.1 Baseline

4.3.1.1 Waterfowl Surveys

Twenty-seven species of waterfowl and other waterbirds were observed during the 2010 waterfowl survey (Appendix F-2). Mallards were most frequently observed (n = 6,350). Fewer than five common loons, ruddy ducks, and American black ducks were observed. No sandhill cranes were observed. Waterfowl species were observed incidentally during the colonial waterbird surveys and the raptor survey (Appendix F-3). Canada geese were most frequently observed during both surveys (n = 23 and n = 161, respectively). In all, 14 waterfowl species, plus greater and lesser scaup (and unidentified scaup species) and swans, were recorded.

4.3.1.2 Colonial Waterbird Surveys

Eight species (1,533 individuals) of colonial waterbirds were observed during the 2010 aerial survey (Appendix F-4). Ring-billed gulls were the most commonly observed species (n = 784) followed by Franklin's gull (n = 349). Common terns were the least frequently observed species (n = 15). A total of 117 colonial waterbirds were observed incidentally during the waterfowl survey, and 23 were observed during the raptor survey (Appendix F-5). In all, 13 species were identified incidentally.

4.3.1.3 Bird of Prey Surveys

RAPTOR MIGRATON SURVEYS

A total of 535 raptors from 11 species were recorded, including 28 unidentified individuals, during the raptor migration surveys in 2010 (Appendix F-6). Red-tailed hawks were the most commonly observed species (n = 311) followed by bald eagle (n = 79). Northern goshawk was the least commonly observed (n = 3). Eight raptor species were observed incidentally during the colonial waterbird, nocturnal owl, and waterfowl surveys (Appendix F-7)

NOCTURNAL OWL SURVEYS

Nine species of owl were identified during the nocturnal owl surveys in 2010 (Appendix F-8). Boreal owls were the most commonly recorded species (n = 228) followed by great horned owl (n = 64). A single eastern screech owl[1] was heard. This species was reported north of its northern-most range, and the sighting could not be confirmed. Four owl species were observed incidentally during the colonial waterbird, nocturnal owl, and water fowl surveys (Appendix F-7).

4.3.1.4 Breeding Bird Surveys

In the Bird Study Area, 194 bird species were observed a total of 40,079 times at 3,404 locations. On average 11.1 birds were observed at each plot where between one and 250 birds were observed. The most commonly observed species in the Bird Study Area were white-throated sparrow (n = 2,308), Tennessee warbler (n = 1,529) and common yellowthroat (n = 1,319). Over the entire Bird Study Area, 12 species were recorded a single time including bufflehead, western kingbird, red-headed woodpecker, herring gull and double-crested cormorant. Calculated species diversity for the Local Study Area using Shannon's index was 4.3, which provides a point of reference for the diversity of species in each Ecoregion. Species are listed by Ecoregion results (Appendix F-9 to F-14).

In the combined Lake Manitoba Plain and Aspen Parkland Ecoregions 146 bird species were observed 9,901 times at 527 locations. On average 9.5 birds were recorded at each plot where between one and 120 birds were observed. In these combined ecoregions, the most commonly sampled species were red-winged blackbird (n = 795) yellow warbler (n = 468) and least flycatcher (n = 432). Seventeen bird species were recorded a single time including red-headed woodpecker, black-throated green warbler, yellow-bellied flycatcher, willow flycatcher, and bald eagle. Using Shannon's index to estimate species diversity an estimate of 4.0 was calculated (Appendix F-9).

In the Interlake Plain Ecoregion 153 bird species were observed a total of 9,678 times at 632 locations. On average 14.2 birds were recorded at each plot where between one and 94 birds had been sampled. The most commonly sampled bird species were white-throated sparrow (n = 716), common yellowthroat (n = 492) and red-eyed vireo (n = 443). Sixteen bird species were recorded a single time including common nighthawk, northern saw-whet owl, brown thrasher, pine grosbeak,

[1] Species unverified; northern record.

and western kingbird. Calculated species diversity for the Interlake Plain Ecoregion using Shannon's index was 4.1, indicating that this ecoregion had the greatest species diversity relative to the others (Appendix F-10).

In the Mid-Boreal Lowland Ecoregion 135 bird species were recorded a total of 6,966 times at 683 locations. On average 9.5 birds were recorded at each plot with the number of birds at each ranging between one and 250 (234 of which were Canada goose). The next highest number of birds at a sampling site was 45. The most commonly recorded bird species were common yellowthroat (n = 395), white-throated sparrow (n = 384), and Canada goose (n = 350). Fifteen bird species were recorded a single time including house wren, bald eagle, American wigeon, and western wood-peewee. Calculated species diversity for the Mid-Boreal Lowland Ecoregion using Shannon's index was 4.0 (Appendix F-11).

Surveys of the Churchill River Upland Ecoregion resulted in a total of 80 bird species identified 1,908 times at 246 locations. An average of 7.6 birds was recorded at each plot where between one and 41 birds were observed. Commonly sampled bird species were Tennessee warbler (n = 196), white-throated sparrow (n = 183) and unidentified dark-eyed junco (n = 113). Ten bird species were recorded a single time including common yellowthroat, ovenbird, black-capped chickadee, bay-breasted warbler, and American kestrel. Calculated species diversity for the Churchill River Upland Ecoregion using Shannon's index was 3.6, with low species diversity relative to the other ecoregions (Appendix F-12).

The Hayes River Upland Ecoregion had 109 bird species sampled 6,890 times at 814 locations. An average of 8.1 birds was recorded at each plot where between one and 38 birds were seen. Commonly recorded bird species were Tennessee warbler (n = 511), white-throated sparrow (n = 497) and unidentified dark-eyed junco (n = 364). Nineteen bird species were recorded a single time including common grackle, bufflehead, herring gull, downy woodpecker, and barred owl. Calculated species diversity using Shannon's index for the Hayes River Upland Ecoregion was 3.8 (Appendix F-13).

Surveys of the Hudson Bay Lowland Ecoregion yielded 92 bird species observed 4,736 times at 502 locations. On average 9.1 birds were recorded at each plot where the number of birds ranged from one to 30. In the Hayes River Upland Ecoregion, the most commonly recorded bird species were white-throated sparrow (n = 403), fox sparrow (n = 387) and Lincoln's sparrow (n = 327). Fourteen bird species were sampled a single time including blue-winged teal, belted kingfisher, common merganser, spruce grouse and broad-winged hawk. Calculated species diversity for the Hayes River Upland Ecoregion using Shannon's index was 3.5, the lowest species diversity of the ecoregions (Appendix F-14).

4.3.1.5 Rare Bird Surveys

No threatened and endangered birds were recorded during the rare bird survey[2] conducted over 209 plots in the combined Aspen Parkland, Interlake Plain and Lake Manitoba Plain ecoregions. One species listed by SARA as special concern was observed; a single rusty blackbird was recorded in the Lake Manitoba Plain Ecoregion.

A total of 104 species were observed 3,583 times in all combined ecoregions. An average of 17.1 birds was observed at each plot with between one and 274 birds observed at each. The most commonly observed species included ring-billed gull (n = 499), red-winged blackbird (n = 494), western meadowlark (n = 189), Canada goose (n = 173), and song sparrow (n = 162). Twenty-three bird species were seen a single time and included brown creeper, hermit thrush, bald eagle, sharp-shinned hawk, great blue heron, Cooper's hawk, and great-crested flycatcher.

Forty-one species were recorded 340 times at 18 plots in the Interlake Plain Ecoregion. The number of birds seen at each plot ranged from four to 70 and averaged 18.9. Commonly sampled birds included ring-billed gull (n = 53), green-winged teal (n = 49), red-winged blackbird (n = 45), Canada goose (n = 18), and American redstart (n = 16). Nine bird species were recorded a single time and included belted kingfisher, willet, Cooper's hawk, northern harrier, Brewer's blackbird, and downy woodpecker.

Sampling of the combined Aspen Parkland and Lake Manitoba Plain ecoregions indicated 102 species recorded 3,243 times over 181 varied sampling sites. The average number of birds observed at each site was 16.9 and ranged from one to 274 birds. The most commonly seen species included red-winged blackbird (n = 449), ring-billed gull (n = 446), western meadowlark (n = 183), Brewer's blackbird (n = 156), and Canada goose (n = 155). Twenty-two species were recorded once and included pied-billed grebe, rusty blackbird (a species of special concern under SARA), yellow-headed blackbird, chipping sparrow, great crested flycatcher, red-breasted nuthatch, and American woodcock.

4.3.2 Ecozone Descriptions

4.3.2.1 Prairies Ecozone

ASPEN PARKLAND AND LAKE MANITOBA PLAIN ECOREGIONS

The most observations of waterfowl species in 2010 were in the combined Lake Manitoba Plain and Aspen Parkland ecoregions with 1,625 observations of 29 species (47% of total waterfowl observations across all ecoregions; Appendix F-15). The most frequently recorded waterfowl species included Canada goose (n = 561), mallard (n = 320), sora (n = 234), sandhill crane (n = 230) and blue-winged teal (n = 54); all of which were observed during multiple surveys. Based on

[2] This survey was conducted early in the year (i.e., prior to the arrival of other breeding birds in southern Manitoba) to improve detection for early arrivals, and species at risk such as loggerhead shrike and burrowing owl.

breeding bird survey data, selected habitat characteristics by sandhill crane included wet prairie (n = 18), wetland herb (n = 14), grassland (n = 12), broadleaf pure (n = 6), and shrub (n = 6). Habitat selection of mallard based on habitat information from the breeding bird survey, indicated some variability with wetland herb (n = 46), grassland (n = 36), wet prairie (n = 34), shrub (n = 5), and other broadleaf (n = 2) habitats selected for (Appendix F-9). The only noted occurrences of greater white-fronted goose[3] and wood duck in 2010 were in the Lake Manitoba Plain Ecoregion.

In the 2010 sampling of colonial waterbirds in all ecoregions, over half of all birds recorded (61%) were from the combined Lake Manitoba Plain and Aspen Parkland ecoregions. This resulted in the identification of 18 waterfowl species for this area. The most commonly recorded species included ring-billed gull (n = 541), black tern (n = 160), American bittern (n = 129), Franklin's gull (n = 113), and pied-billed grebe (n = 51). Seven observations of great blue heron were also recorded; although none occurred during the breeding bird survey where more detailed habitat-use information was available. Within this ecoregion were the only recorded instances of least bittern (n = 4), a species listed as threatened under SARA.

Eleven shorebird species were recorded during the 2010 breeding bird and rare bird surveys and incidentally during the 2010 colonial waterbird and raptors surveys. Wilson's snipe (n = 435), killdeer (n = 159), and marbled godwit (n = 62) were most commonly observed. Within these combined ecoregions were the only recorded occurrences of upland sandpiper (n = 2) in all ecoregions surveyed in 2010.

By far the most observations of bird of prey species were in the combined Aspen Parkland and Lake Manitoba Plain ecoregions with roughly half (48%) of all bird of prey sightings occurring here. In addition, of the 25 bird of prey species identified, 21 (88%) were recorded within this ecoregion. Occurrences of bald eagles were highest during the raptor survey (62 observations) in comparison with all other survey types for this ecoregion (10 observations combined). The one bald eagle recorded in the 2010 breeding bird survey for this ecoregion was in a habitat area classified as wetland herb.

In conducting the 2010 breeding bird and rare bird surveys in the combined Aspen Parkland and Lake Manitoba Plain ecoregions, 153 observations of upland game bird species were reported. A large number of these observations were of ruffed grouse during the breeding bird survey (n = 111) and rare bird surveys (n = 25). Other species recorded during the rare bird surveys were sharp-tailed grouse (n = 9) and wild turkey (n = 8). Relative to other sampled ecoregions, this combined ecoregion had the highest occurrence of ruffed grouse (n = 136), sharp-tailed grouse (n = 9), and wild turkey (n = 8). In percentages, these observations accounted for 60%, 53%, and 89% of all observations of these species over all 2010 surveys, respectively. This is of particular importance in considering habitat suitable to valued environmental components: ruffed and sharp-tailed grouse. Indications of habitat use, through the 2010 breeding bird survey, showed ruffed grouse using varying habitats, including: broadleaf pure (n = 58), shrub (n = 19) and wet prairie (n = 16). As sharp-tailed grouse were not recorded during the breeding bird survey habitat information at this spatial scale is not available.

[3] Migrant that breeds in the arctic

For the combined Lake Manitoba Plain and Aspen Parkland Ecoregions the breeding bird and rare bird surveys yielded 104 and 109 woodpecker observations, respectively. Five species were identified including one sighting of a red-headed woodpecker, a species listed as threatened under SARA. The other four species observed included downy woodpecker (n = 28), hairy woodpecker (n = 22), yellow-bellied sapsucker (n = 129) and pileated woodpecker (n = 22). Based on the results of the breeding bird survey for this ecoregion, the occurrence of pileated woodpecker can further be analyzed by habitat. Observations were made in five of the six available habitat types and including broadleaf pure (n = 1), grassland (n = 1), other broadleaf (n = 3), shrub (n = 3), and wet prairie (n = 2). No pileated woodpeckers were observed in 'wetland herb.'

The combined Lake Manitoba Plain and Aspen Parkland ecoregions contained the highest number of passerines in 2010. A total of 9,270 (27%) observations of passerines led to the identification of 107 species. The most commonly observed passerine species included red-winged blackbird (n = 1,264), yellow warbler (n = 461), least flycatcher (n = 422), clay-colored sparrow (n = 403), and song sparrow (n = 399). This ecoregion also had the only occurrences of the American tree sparrow (n = 3), grasshopper sparrow (n = 1), horned lark (n = 23), Lapland longspur (n = 3), house finch (n = 1), rock dove (n = 7) and willow flycatcher (n = 1). It also had 21 out of 22 occurrences of snow bunting (95%), 15 out of 16 (94%) occurrences of brown thrasher, 18 out 19 occurrences of house sparrow (95%), 80 out of 83 vesper sparrow occurrences (96%), and 263 of 282 western meadowlark occurrences (93%).

A number of the passerine species identified are listed under SARA. These included common nighthawk (n = 4), olive-sided flycatcher (n = 3), and Canada warbler (n = 6), listed as threatened, and a species of special concern, rusty blackbird (n = 1).

4.3.2.2 Boreal Plains Ecozone

INTERLAKE PLAIN AND MID-BOREAL UPLANDS ECOREGIONS

Twenty-six waterfowl species were identified in the combined Interlake Plain and Mid-Boreal Uplands ecoregions. These species were recorded on 623 occasions during the breeding bird, rare bird, and waterfowl surveys and incidentally during the colonial waterbird and raptor surveys. Commonly observed species included Canada goose (n = 196), sora (n = 77), mallard (n = 76), sandhill crane (n = 74) and green-winged teal (n = 49). Mallard was seen in multiple habitat types but was most commonly seen, in the duration of the breeding bird survey, in wetland herb (n = 18), wet prairie (n = 10), grassland (n = 8) and broadleaf mixed (n = 3) habitats (Appendix F-10). Sandhill crane was also seen in multiple habitat classes including wetland herb (n = 29), wetland treed (n = 16), black spruce mixed (n = 9), black spruce pure (n = 9) and shrub (n = 6). The only noted occurrences of ruddy duck (n = 2) during the 2010 sampling year was in the Interlake Plain Ecoregion.

In the combined Interlake Plain and Mid-Boreal Uplands ecoregions 12 colonial waterbird species were recorded a total of 284 times. The most commonly recorded colonial species and other waterbird species included ring-billed gull (n = 104), American bittern (n = 48), and black tern (n = 40). In addition, 27 observations of great blue heron were recorded. All observations of great blue heron during the 2010 breeding bird survey were in wetland herb habitat (n = 6). The only recorded instance of cattle egret (n = 1) within all ecoregions surveyed in 2010 was in the combined Interlake Plain and Mid-Boreal Uplands ecoregions.

A total of 245 shorebird observations in the combined Interlake Plain and Mid-Boreal Upland ecoregions resulted in the identification of 10 distinct species. Among the shorebird species and other similar species types (e.g., American woodcock) were Wilson's snipe (n = 192), killdeer (n = 20), and marbled godwit (n = 10). American avocet, American woodcock, and willet were each recorded a single time.

Six bird of prey species were identified in the combined Interlake Plains and Mid-Boreal Uplands ecoregions during the 2010 breeding bird survey. An additional 11 species were observed during the colonial waterbird, nocturnal owl, rare bird, raptor, and waterfowl surveys. Of 141 observations of bird of prey species, 12 were of bald eagles (8%); none of which were observed during the breeding bird survey where habitat use could be analyzed. Within the combined Interlake Plains and Mid-Boreal Uplands ecoregions were the only 2010 sightings of barred owl (n = 10). This is also one of the two areas where short-eared owl (n = 2), listed as special concern under SARA*,* was observed.

Two upland game bird species were recorded in the combined Interlake Plains and Mid-Boreal Uplands ecoregions. Ruffed grouse was recorded on 71 occasions during the 2010 breeding bird and rare bird surveys. There was one incidental report of a sharp-tailed grouse during the colonial waterbirds survey in this ecoregion. Delineation of habitat use was limited as it was not observed during the breeding bird survey, where detailed habitat information was collected. Ruffed grouse were associated with varying habitat types including: broadleaf mixed (n = 18), broadleaf pure (n = 15), shrub (n = 10) and wet prairie (n = 7) during the breeding bird survey.

Woodpecker species were observed during multiple surveys in the combined Interlake Plains and Mid-Boreal Uplands ecoregions. This included 113 observations of woodpeckers during the 2010 breeding bird survey and nine observations during the colonial waterbird (n = 2) and rare bird (n = 7) surveys. Six species were identified. The most commonly observed species was pileated woodpecker, which represented 32% of woodpecker sightings. During the breeding bird survey, where detailed habitat information was also collected, pileated woodpecker occurrences were varied and included broadleaf mixed (n = 9), broadleaf pure (n = 6), shrub (n = 4), and wet prairie (n = 3) habitats.

The combined Interlake Plain and Mid-Boreal Uplands ecoregions contained the second highest number of observed passerines during 2010 surveys. A total of 8,079 (23%) recorded instances of passerines led to the identification of 104 species. The most commonly identified species were white-throated sparrow (n = 601), common yellowthroat (n = 463), red-eyed vireo (n = 414), alder flycatcher (n = 388), and ovenbird (n = 377). The only occurrences of scarlet tanager (n = 4) and western kingbird (n = 1) for all 2010 surveys were in these combined ecoregions.

Also within these combined ecoregions were the only documented occurrences of golden-winged warbler (n = 23), listed as threatened under SARA. Other SARA-listed species included common nighthawk (n = 1), olive-sided flycatcher (n = 11), Canada warbler (n = 36), and golden-winged warbler (n = 23), which are listed as threatened, and a species of special concern, rusty blackbird (n = 2).

MID-BOREAL LOWLAND ECOREGION

Waterfowl species in the Mid-Boreal Lowland Ecoregion were observed during the 2010 breeding bird and waterfowl surveys with incidental recordings during the 2010 colonial waterbirds survey. Twenty-eight waterfowl species were identified with over half (61%) of all observations made during the breeding bird survey. Over all surveys, the most frequently recorded species included Canada goose (n = 323), sandhill crane (n = 126), and mallard (n = 71). During the breeding bird survey, habitat characteristics were recorded at sample plots (Appendix F-11). This allowed some indication of habitat use by mallards and sandhill cranes, which are valued environmental components. Most mallards (16 of 24) were found in wetland herb, wetland shrub and wetland treed habitats and most sandhill cranes were found in wetland shrub habitat (n = 16). The only observation of American black duck in 2010 occurred in this ecoregion also (n = 1).

Sampling of the Mid-Boreal Lowland Ecoregion yielded 172 observations of 14 colonial waterbird species. Commonly recorded species included ring-billed gull (n = 39), Bonaparte's gull (n = 38), and great blue heron (n = 21). Habitat use by great blue herons was limited to wetland herb areas (n = 2) based on the 2010 breeding bird survey.

Eight shorebird species were sampled in the Mid-Boreal Lowland, primarily during the 2010 breeding bird survey. Of 316 recorded occurrences of shorebird species in this ecoregion, the most common were greater yellowlegs (n = 176), Wilson's snipe (n = 96), and lesser yellowlegs (n = 22). Other observed species included Wilson's phalarope (n = 4), short-billed dowitcher (n = 2), and marbled godwit (n = 2).

Seven bird of prey species were observed during the 2010 breeding bird survey and an additional eight species were observed during the colonial water bird, nocturnal owl, and waterfowl surveys. Of these eight species, five were observed a single time and included long-eared owl, northern goshawk, northern saw-whet owl, osprey, and short-eared owl (listed as special concern under SARA). Ninety-three of the 228 boreal owls (41%) observed during all 2010 surveys were recorded during the nocturnal owl survey of this region.

Four upland game bird species were recorded during the 2010 breeding bird and waterfowl surveys. In the former survey, one species, ruffed grouse, was observed on 12 occasions. In the latter survey, three species - spruce grouse, sharp-tailed grouse, and wild turkey were observed on one, four and one occasions, respectively. Evaluation of ruffed grouse based on habitat sampled during the breeding bird survey indicated it was present primarily in broadleaf mixed (n = 5), jack pine pure (n = 2) and white spruce pure (n = 3) habitat. As sharp-tailed grouse was not observed during the breeding bird surveys its habitat characteristics could not be delineated.

Forty-four woodpeckers were recorded during the 2010 breeding bird survey. These were black-backed woodpecker (n = 4), downy woodpecker (n = 2), hairy woodpecker (n = 15), pileated woodpecker (n = 18), and yellow-bellied sapsucker (n = 5). In addition, one pileated woodpecker was noted during the 2010 waterfowl survey. Habitat characteristics where pileated woodpeckers were recorded varied and included broadleaf mixed (n = 3), shrub (n = 3), jack pine mixed (n = 2), jack pine pure (n = 2) and coniferous mixed (n = 2) areas.

The fourth-highest number of passerines observed during the 2010 surveys was in the Mid-Boreal Lowland Ecoregion. Observations were made of 5,390 (16% of total) passerines from 83 species. The most common species included white-throated sparrow (n = 316), chipping sparrow (n = 300), common yellowthroat (n = 300), alder flycatcher (n = 251), and swamp sparrow (n = 233). Three species at risk were found in this ecoregion including olive-sided flycatcher (n = 55) and Canada warbler (n = 35), listed as threatened, and rusty blackbird (n = 62), a species of special concern.

4.3.2.3 Boreal Shield Ecozone

CHURCHILL RIVER UPLAND ECOREGION

Waterfowl were observed in the Churchill River Upland Ecoregion during the 2010 breeding bird survey, colonial waterbird survey, and waterfowl survey. Seven waterfowl species were identified during the breeding bird survey including mallard (n = 1) and sandhill crane (n = 7). Habitat use by these valued environmental components represents general habitat suitability for other waterfowl species. Based on the 2010 breeding bird survey, the single mallard was observed in tamarack pure habitat (n = 1) (Appendix F-12). Sandhill cranes were recorded in black spruce mixed (n = 3) but were also seen in jack pine mixed, jack pine pure, tamarack pure, and wetland treed areas (n = 1 for each) habitat. Other waterfowl species observed in the Churchill River Upland Ecoregion included Canada goose (n = 21), common loon (n = 18), common merganser (n = 2), a species of scaup (n = 1), and sora (n = 1).

Seven colonial waterbird species were recorded in the Churchill River Upland Ecoregion during the 2010 breeding bird and colonial waterbird surveys. Species included Bonaparte's gull (n = 20), ring-billed gull (n = 17), American white pelican (n = 8), and pied-billed grebe (n = 4). Three additional colonial waterbird species were recorded a single time: American bittern, common tern, and Franklin's gull. No observations of great blue heron suggests general ecosystem suitability for use by colonial waterbird species, were recorded in this region.

Four shorebird species were observed 80 times in the Churchill River Upland Ecoregion during the 2010 breeding bird survey and incidentally during the colonial waterbird survey. Species identified included greater yellowlegs (n = 38), lesser yellowlegs (n = 7), sora (n = 9), and Wilson's snipe (n = 26). The fewest shorebird species were identified in this ecoregion.

Birds of prey were observed during the 2010 breeding bird and nocturnal owl surveys, and incidentally during the colonial waterbirds survey. For these three survey types, 6, 22, and 7 observations of bird of prey species were recorded, respectively. Seven bird of prey species were identified in total, three of which were observed a single time: American kestrel, great gray owl, and sharp-shinned hawk. More frequently recorded bird of prey species included boreal owl (n = 22), red-tailed hawk (n = 6) and turkey vulture (n = 2). During the colonial waterbird survey, three observations of bald eagles were made.

One upland game bird species, spruce grouse, was observed twice in the Churchill River Upland Ecoregion during the breeding bird survey. These sightings occurred in black spruce mixed (n = 1) and jack pine mixed (n = 1) habitat. Neither of the valued environmental components for upland game birds was recorded in this ecoregion in 2010.

Observations of woodpecker species in the Churchill River Upland Ecoregion occurred during the breeding bird survey. Four woodpecker species were recorded a total of 21 times. Species included black-backed woodpecker (n = 14), hairy woodpecker (n = 2), pileated woodpecker (n = 3) and yellow-bellied sapsucker (n = 2). Pileated woodpecker, was observed in various forest habitats including broadleaf pure (n = 2), black-spruce mixed (n = 1), black-spruce pure (n = 1), and jack pine mixed (n = 1).

The Churchill River Upland Ecoregion contained the fewest passerine species of any ecoregion surveyed in 2010 where 1,693 observations led to the identification of 59 species. Commonly recorded species included Tennessee warbler (n = 192), white-throated sparrow (n = 180), unidentified dark-eyed junco (n = 105), hermit thrush (n = 105) and ruby-crowned kinglet (n = 96). In addition, three species at risk were observed including common nighthawk (n = 1) and olive-sided flycatcher (n = 27), listed as threatened, and a species of special concern, rusty blackbird (n = 22).

HAYES RIVER UPLAND ECOREGION

Waterfowl species were recorded in the Hayes River Upland during the 2010 breeding bird, colonial waterbird, and waterfowl surveys, where 113, 47 and 171 observations were recorded, respectively. Twenty-two species were identified during the three surveys. Seven species were recorded once including American green-winged teal, bufflehead, and hooded merganser. Among species recorded multiples times, valued environmental components mallard and sandhill crane were observed 74 and 21 times respectively. Habitat usage for mallards observed during the breeding bird survey indicated a preference for black spruce pure (n = 11) relative to wetland herb (n = 1) and wetland treed (n = 1) (Appendix F-13). Alternately, sandhill cranes were identified in 10 habitat types including tamarack pure (n = 6), wetland shrub (n = 3), black spruce mixed (n = 2), and broadleaf mixed (n = 2).

Thirteen colonial waterbird species were observed a total of 114 times during the 2010 breeding bird and colonial waterbird surveys in The Hayes River Upland Ecoregion. There were 33 incidental reports during the 2010 waterfowl survey. Commonly recorded colonial waterbird species included Bonaparte's gull (n = 65), ring-billed gull (n = 32), American white pelican (n = 13) and double-crested cormorant (n = 10). Nine occurrences of great blue heron were also recorded; only one of which was during the breeding bird survey. Tamarack pure habitat was used. The only recorded sighting of black-crowned night heron during 2010 surveys was in this ecoregion.

Six shorebird species were identified in the Hayes River Upland Ecoregion during the 2010 breeding bird survey and incidentally during the 2010 colonial waterbirds survey. These species were recorded a combined 333 times with greater yellowlegs (n = 129), Wilson's snipe (n = 112), lesser yellowlegs (n = 54), and sora (n = 36) most frequently encountered. Other shorebird species were recorded a single time including spotted sandpiper and least sandpiper.

Six bird of prey species were identified in the Hayes River Upland Ecoregion during the 2010 breeding bird survey. During nocturnal owl surveys an additional four species were observed including boreal owl, eastern screech-owl, great gray owl, and great horned owl. With the exception of boreal owl sightings during the nocturnal owl surveys, the most commonly observed bird of prey species was bald eagle, accounting for 86 of 212 sightings (41%). Of the three bald eagle sightings during the 2010 breeding bird survey, two were in habitat types described as shrub and one was in habitat described as wetland treed. Within this ecoregion was the only 2010 documented sighting of the eastern screech-owl, during the nocturnal owl survey.

Breeding bird surveys in the Hayes River Upland Ecoregion in 2010 yielded nine observations of two upland game bird species ruffed grouse (n = 7) and spruce grouse (n = 2). Ruffed grouse was observed in various habitat types including broadleaf mixed (n = 2), broadleaf pure (n = 1), black spruce mixed (n = 1), coniferous mixed (n = 2), and wetland treed (n = 1). Spruce grouse was observed in other habitats, including jack pine mixed (n =1), and black spruce pure (n = 1).

Woodpeckers were identified in the Hayes River Upland during the 2010 breeding breed survey. Ninety observations of six woodpecker species were made. Downy woodpecker was observed once and three-toed woodpeckers were observed twice. Pileated woodpecker was observed 12 times in a range of habitat types including broadleaf pure, black spruce mixed, black spruce pure, coniferous mixed and tamarack pure.

Of the ecoregions surveyed, the third greatest number (5,937) of passerines was recorded in Hayes River Uplands (17% of all passerine observations). Seventy species were identified including Tennessee warbler (n = 477), white-throated sparrow (n = 455), unidentified dark-eyed junco (n = 336), hermit thrush (n = 105), and ruby-crowned kinglet (n = 96). Within the Hayes River Upland Ecoregion was the only recorded occurrence of the western tanager (n = 2) in 2010. In addition, there were a number species at risk including common nighthawk (n = 1), olive-sided flycatcher (n = 75) and Canada warbler (n = 1), listed as threatened, and a species of special concern, rusty blackbird (n = 36).

4.3.2.4 Taiga Shield and Hudson Plains Ecozones

SELWYN LAKE UPLAND AND HUDSON BAY LOWLAND ECOREGIONS

Five waterfowl species were identified during the 2010 breeding bird survey in the combined Selwyn Lake and Hudson Bay Lowland ecoregions, the lowest number of waterfowl species identified in any ecoregion, and the smallest number of observations (28). Observed species included sandhill crane (n = 18), common loon (n = 6), mallard (n = 2), blue-winged teal (n = 1), and common merganser (n = 1). Habitat usage by valued environmental components, based on the 2010 breeding bird survey, was shrub (n = 1) and wetland shrub (n = 1) for mallards and black spruce pure (n = 9), shrub (n = 3), wetland herb (n = 3), wetland shrub (n = 2), and wetland treed (n = 1) for sandhill cranes (Appendix F-14).

In total, four colonial waterbird species were recorded in the combined Selwyn Lake and Hudson Bay Lowland ecoregions during the 2010 breeding bird and colonial waterbird surveys. Bonaparte's gull (n = 31), common tern (n = 4), ring-billed gull (n = 4), and arctic tern (n = 2) were identified. Within these ecoregions were the only sightings of arctic tern in 2010. The lowest number of colonial waterbird species was recorded in these combined ecoregions.

All shorebird species in the combined Hudson Bay Lowland and Selwyn Lake ecoregions were recorded during the 2010 breeding bird survey. Ten shorebird species were identified including greater yellowlegs (n = 127), Wilson's snipe (n = 70), lesser yellowlegs (n = 68), and sora (n = 36). Within these combined ecoregions was the only noted occurrence of Hudsonian godwit (n = 3) during 2010 surveys. Thirteen of the 14 (93%) least sandpiper observations during 2010 surveys were made in these ecoregions.

Four bird of prey species were identified in the combined Selwyn Lake and Hudson Bay Lowland Ecoregions during the 2010 breeding bird and nocturnal owl surveys. Nine observations of these species, including boreal owl, broad-winged hawk, northern harrier, and red-tailed hawk, were made. No bald eagles were observed. The lowest number of birds of prey was observed in these combined ecoregions.

Only four observations of upland game bird species were recorded for the Hudson Bay Lowland Ecoregion during all 2010 bird surveys. Spruce grouse and sharp-tailed groused were observed on one and three occasions, respectively. Occurrences of these two species took were in particular habitats; shrub habitat for spruce grouse (n = 1) and wetland shrub habitat for sharp-tailed grouse (n = 3).

Observations of woodpeckers in the combined Selwyn Lake and Hudson Bay Lowland ecoregions were limited to the 2010 breeding bird survey. Four woodpecker species were observed a total of 20 times and included black-backed woodpecker (n = 8), hairy woodpecker (n = 8), three-toed woodpecker (n = 3), and yellow-bellied sapsucker (n = 1).

The Hudson Bay Lowland Ecoregion contained the fifth highest number of occurrences for passerine species of the ecoregions surveyed in 2010. A total of 4,158 (12%) observations of passerines led to the identification of 64 species. Commonly sampled species included white-throated sparrow (n = 388), fox sparrow (n = 376), Lincoln's sparrow (n = 319), hermit thrush (n = 285), and Tennessee warbler (n = 273). This ecoregion also contained all observations of Harris's sparrow and six of seven (86%) gray-cheeked thrush sightings. In addition, a number of SARA-listed species were recorded including common nighthawk (n = 1) and olive-sided flycatcher (n = 27), listed as threatened, and rusty blackbird (n = 62), a species of special concern.

4.3.3 Valued Environmental Components

4.3.3.1 Other Model Validations for VECs

The validation of expert models using sampled bird data indicated a good degree of accuracy in estimating the presence of most species at the $p \leq 0.05$ level for bald eagle, ruffed grouse, great blue heron, and sandhill crane and species at risk including Canada warbler, golden-winged warbler, olive-sided flycatcher, rusty blackbird, and yellow rail (Table 4-5). Pileated woodpecker and sharp-tailed grouse are alternately only considered significant at the $p \leq 0.10$ level, when considering modeled habitat areas, as well as for the whip-poor-will, a species at risk.

Other modeled species at risk could not be validated completely because some species were not encountered at all or with enough frequency during bird surveys. Examples of these species included burrowing owl, ferruginous hawk, least bittern, loggerhead shrike, short-eared owl, and Sprague's pipit. Species where expert models were not found to explain species presence at a statistically significant level include mallard ($p = 0.46$) and common nighthawk ($p = 0.11$), a species at risk. Reasons for unsuccessful modelling attempts could include a high number of sightings due to flyover, in the case of mallards, spatial selection issues, spatial inaccuracies, and specific habitat requirements that were difficult to monitor geographically, such as in the case of the common nighthawk.

Table 4-5. Model Validation of Constructed Expert Models Using Bird Surveys of Habitat

VEC	Presence		Absence		Analysis		Map series
	Inside	Outside	Inside	Outside	X^2	p-value	
Mallard	42	69	701	1178	0.01	0.46	1200
Sandhill crane	66	65	546	1313	25.37	$2.4 * 10^{-07}$	1300
Great blue heron	9	22	341	1618	2.85	0.05	1400
Bald eagle	2	50	22	1916	3.12	0.04	1500
Ruffed grouse	30	44	244	1672	46.40	$4.8 * 10^{-12}$	1600
Sharp-tailed grouse	3	3	456	1528	2.46	0.06	1700
Pileated woodpecker	5	34	140	1811	1.80	0.09	1800
Least bittern	0	0	69	1921	-	-	1900
Yellow rail	18	9	240	1723	69.95	$3.0 *10^{-17}$	2000
Ferruginous hawk	0	0	34	1956	-	-	2100
Burrowing owl	0	0	32	1958	-	-	2200
Short-eared owl	0	0	567	1423	-	-	2300
Common nighthawk	3	1	879	1107	1.53	0.11	2400
Whip-poor-will	0	9	17	1964	2.46	0.06	2500
Red-headed woodpecker	0	0	108	1882	-	-	2600
Olive-sided flycatcher	44	25	795	1126	13.69	$1.0 * 10^{-4}$	2700
Loggerhead shrike	0	0	222	1768	-	-	2800
Sprague's pipit	0	0	152	1838	-	-	2900
Golden-winged warbler	3	1	439	1547	6.46	0.01	3000
Canada warbler	11	12	121	1846	63.75	$7.0 * 10^{-16}$	3100
Rusty blackbird	35	10	524	1421	56.27	$3.2 *10^{-14}$	3200

4.3.3.2 Waterfowl and Other Waterbirds (Mallard and Sandhill Crane)

For the purposes of analysis, waterfowl includes ducks, geese, swans, loons, coots, rails, and cranes. These birds are migrants, nesting in Manitoba in spring and wintering in the south. Waterfowl occupy a range of habitats, primarily water bodies and wetlands. Mallard and sandhill crane have been selected as the VEC to represent this group.

The northern boreal forest provides waterfowl with fairly constant long-term environmental conditions in wetlands for feeding, nesting, and raising of young (Bethke and Nudds 1993). These northern boreal wetlands become increasingly important breeding grounds for waterfowl species (e.g., mallard, green-winged teal, blue-winged teal, and northern shoveler) when their preferred breeding habitat (the prairie pothole wetlands) is negatively affected by drought (Johnson and Grier 1988). The predictable environment of the wetlands and water bodies in the boreal region are most often associated with diving waterfowl (Johnson and Grier 1988). In waterfowl species that exhibit a strong homing tendency (e.g., redhead, canvasback, and mallard), the predictable wetlands found in the boreal region may be a significant factor in nest productivity (Johnson and Grier 1988).

The loons found in the boreal region prefer nesting and foraging habitat of permanent water bodies as a result of the adaptation towards swimming by the positioning of their legs far back on the body (Brinkley and Humann 2001a). Loons also require large water bodies in order to become airborne (Brinkley and Humann 2001b), as they need plenty of space to take off from the water.

The prairie pothole regions are important migratory habitat for boreal waterfowl that utilize these areas during migration to their typical breeding grounds in the north (Sorenson *et al.* 1998). The highest densities of breeding waterfowl have been found in southwestern Manitoba and southeastern Saskatchewan (Johnson and Grier 1988). Many dabbling duck species nest on the periphery of these wetlands or in the upland areas in the vicinity of wetlands (Weller 2001).

At the end of the breeding season males (and females that may have had unsuccessful nests) form large groups and congregate on large and deeper productive water bodies in order to safely **moult** and build up stores of energy from rich food sources (Weller 2001).

Waterfowl and other waterbirds were observed and documented during aerial surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 to 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Waterfowl and other waterbird species were identified during point count surveys in various terrestrial habitats and more abundantly during aerial surveys along the Nelson River System, where this bird group made up a significant proportion of the birds identified.

A reduction in harvested ducks from the mid-1980s to mid-1990s (from 400,000 to 200,000) has been attributed to a decline in duck availability and hunter effort (State of the Environment Report for Manitoba 1997). The annual harvest of geese remained stable for the same period, at approximately 175,000 (State of the Environment Report for Manitoba 1997). A total of 35 species of waterfowl have been documented in the Local Study Area, and 21 are known to breed there (see Appendix F-1; Farrand 1983; Robbins *et al.* 1983; Carey *et al.* 2003). None of the waterfowl and other waterbird species in the Local Study Area are currently listed, with the exception of trumpeter swan, an occasional migrant that has been designated as an **extirpated** species in the province of Manitoba, and yellow rail, which is listed as a species of special concern by SARA.

In 2010, waterfowl were found the entire length of the survey area from Winnipeg to Orr Lake with clusters of higher concentrations along the route. Approximately 24,385 individuals and 26 species were observed. Mallards were the most frequently observed, followed by snow geese, Canada geese, canvasbacks, scaups, and blue-winged teals (see Appendix F-2). The locations of all waterfowl and other waterbird species identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys corresponded with all known ranges and distributions of these species (Carey *et al.* 2003).

As expected, Canada geese were found in large numbers occupying potholes between Elm Creek and Rathwell. Concentrated numbers of ruddy ducks and mallards were found south of Ebb and Flow Lake. Tamarack Lake was good habitat for buffleheads, mallards, blue winged teals, Canada geese, and canvasbacks. Another cluster of buffleheads, canvasbacks, and mallards was found in the area of Lottie Lake and McCann. The area of Cowan and Spence lakes contained another cluster of scaups, mallards, grebes, and Canada geese.

Swan Lake and Swan River were excellent staging areas for Canada geese, tundra swans, mallards, common mergansers, western grebes, buffleheads, blue winged teals, scaups, green- winged teals, snow geese, and northern shovelers. Red Deer Lake also had high species diversity and density with snow geese, mallards, ruddy ducks, Canada geese, canvasbacks, tundra swans, scaups, common mergansers, American coots, northern shovelers, western grebes, and pied-billed grebes.

North of Overflowing Bay (Lake Winnipegosis) and west of Highway 10 mallards, canvasbacks, common goldeneyes, pied-billed grebes, western snipes, buffleheads, common mergansers, ruddy ducks, snow geese, and red necked grebes were observed. The region from Kelsey Lake to North Moose Lake was an excellent staging area for all waterfowl.

Setting Lake, Wabowden, and Halfway Lake also had major clusters of all waterfowl species observed during the waterfowl survey due to excellent habitat for staging. Finally, the region of Paint Lake extending to Grass River and Partridge Crop Lake was a great staging area with clusters of all waterfowl except northern shovelers, grebes, and redheads.

Large numbers of Canada geese were observed in fields along Highway 75 south of Ste. Agathe. Farm fields west of Swan Lake and east of Swan River also harboured thousands of snow geese and Canada geese. Wetland complexes and fields with potholes south and west of Lake Manitoba held various duck species and large numbers of Canada geese.

The West side of Dauphin Lake proved to be a hub for waterfowl with a large concentration of canvasbacks (~2,000) and mallards staging in the wetlands adjacent to the lake and farm fields. Snow geese and Canada geese were also observed in fields.

Large numbers of mallards were staging on the south and west shores of Lake Winnipegosis; blue-winged teals were also present in large numbers. Most ducks were found in two large ponds south of the lake and near Volga marsh, an excellent staging area (see Map Series 500 - Areas of high waterfowl concentration from the 2010 waterfowl survey).

Waterfowl species were observed incidentally during colonial waterbird and raptor surveys. Nineteen tundra swans and 18 snow geese were recorded. A total of 184 Canada geese were recorded, most during the raptor survey (see Appendix F-3). In all, 48 waterfowl were observed during colonial waterbird surveys, and 214 were observed during the raptor surveys.

MALLARD

Mallards are abundant and breed throughout much of Manitoba (Newman *et al.* 2000), although they are much more common in the prairie pothole region of the province, arriving in the early spring and departing in late fall, occasionally remaining in the province into December depending upon conditions (Baydack and Taylor 2003). Mallards utilize water bodies for breeding and however they show no preference for permanent water bodies over semi-permanent wetlands (Rotella and

Ratti 1992). Boreal forest wetlands in Canada and Manitoba are important secondary breeding grounds for mallards (Drilling *et al.* 2002). In forested areas mallards tend to nest under low-growing shrubs, fallen logs, dead treetops, at the base of hollow trees, and in abandoned crow or raptor nests (Drilling *et al.* 2002).

Mallard clutch size generally ranges from five to 14 eggs with the female incubating the eggs for approximately 26 to 30 days (NatureServe 2010). Mallards are re-nesters and will lay another clutch of eggs if the first fails (Baydack and Taylor 2003). Mallard population recruitment is heavily influenced by fledgling survivorship, which is largely affected by the productivity (measured as large numbers of aquatic invertebrates) of wetlands in which the young are raised (Cox *et al.* 1998).

The size of the home range of mallards varies by sex and habitat type; in forested areas of northern Minnesota females' average home range was 210 hectares (ha) and 240 ha for males (Gilmer *et al.* 1975). In the prairie pothole region of Minnedosa, Manitoba Titman (1983) found the average size to be 9.2 ha, with habitat size dependant on the density of the mallard population in the area.

Male mallards' use of wetlands shifts to lakes and large marshes in late June and large flocks begin forming on these water bodies in August (Baydack and Taylor 2003). Migration begins in the late fall and is usually due to weather conditions (Drilling *et al.* 2002).

Mallards were the most commonly detected bird during the waterfowl staging areas survey and were distributed in clusters along the entire length of the route. Areas of particular interest included the areas around Clearwater Lake, Dauphin Lake, Red Deer Lake, and Halfway Lake. Mallards were commonly observed along the FPR north to Thompson (Map 2 – Extent of mallard observations in or bordering the Local Study Area). Northeast of Thompson, fewer observations were made. Clusters of observations were denser in areas south of Swan River and north of Gladstone, highlighting the importance of prairie pothole country. A total of 6,849 individuals were observed during all the bird surveys completed in 2010, of which all correspond with all known ranges and distributions of this species (Drilling *et al.* 2002; Carey *et al.* 2003).

Mallards were observed and documented during aerial surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 to 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Mallards were identified during point count surveys in various terrestrial habitats and more abundantly during aerial surveys along the Nelson River System, where it made up a small proportion of the birds identified (up to 611 individuals from any particular survey).

SANDHILL CRANE

Sandhill cranes are common migrants and breeders in the agricultural-forest transition areas of Manitoba as well as the far north of the province (Holland *et al.* 2003b). During the spring migration sandhill cranes favour habitat with grain fields interspersed with shallow wetlands for roosting (Iverson *et al.* 1987). Tacha *et al.* (1992) identified areas of tall vegetation adjacent to sloughs, and sedge marshes in otherwise wooded areas as favoured sandhill crane nesting habitat. During the fall migration sandhill cranes roost in shallow water bodies near agricultural fields for feeding

(Tacha *et al.* 1992). In Manitoba, sandhill cranes concentrate in the southeast of the province (Holland *et al.* 2003b). Flocks congregate on agricultural fields to feed on young crops in spring and on stubble in fall (Holland *et al.* 2003b). Non-breeding birds are sometimes observed in large numbers on fields in summer (Holland *et al.* 2003b).

Nesting begins in early May and clutch size is usually two eggs, with incubation by both the male and female lasting approximately 28 to 30 days (NatureServe 2010). The nesting success of sandhill cranes is largely dependent on warm spring temperatures combined with water depths of 50 to 80 centimetres (cm), while predation does not appear to strongly influence nest success (Ivey and Dugger 2008). Nesting and rearing of young in Manitoba has been predominately observed in fens with nests built of emergent vegetation on the surface of hummocks (Holland *et al.* 2003b). The boreal forest and aspen parkland ecosystems are the favoured breeding ground of sandhill cranes in Manitoba and central-western Canada (Johnson and Stewart 1973). Although sandhill cranes may be found throughout Manitoba they are rarely found in contiguous forest or highly intensive agricultural areas (Holland *et al.* 2003b).

During the waterfowl survey, 133 sandhill cranes were spotted, grouped predominantly east of Clearwater Lake and 24 km west of Swan Lake (Map 3 – Extent of sandhill crane observations in or bordering the Local Study Area). A number of sandhill cranes were observed during raptor surveys. In all, 188 individuals were counted, mostly in the rural municipality (RM) of North Norfolk, in areas southwest of Portage la Prairie. Sandhill cranes were common in all portions of the Local Study Area, with the exception of agricultural lands south of Gladstone and west of Winnipeg.

A total of 764 sandhill cranes were observed during 2010 bird surveys. Most were recorded during breeding bird surveys, and none were observed during the nocturnal owl survey, at a time of year too early for their arrival in northern Manitoba. The locations of all sandhill cranes identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Tacha *et al.* 1992; Carey *et al.* 2003).

Sandhill cranes were documented in relatively low numbers (0 to 22 individuals) during aerial surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Sandhill cranes were identified during point count surveys in various terrestrial habitats and more abundantly during aerial surveys along the Nelson River System, where this species made up a very small proportion of the birds identified.

4.3.3.3 Colonial Waterbirds (Great Blue Heron)

Birds that form groups to breed and nest are termed colonial birds (Parnell *et al.* 1988). For the purposes of analysis, this group includes gulls, terns, grebes, pelicans, cormorants, herons, bitterns, and shorebirds. Great blue heron has been selected as the VEC to represent this group.

The breeding and foraging habitat commonly utilized by colonial water birds consists of islands, swamps, marshes, tree stands (in and/or adjacent to marshes) and steep cliffs (Parnell *et al.* 1988).

Great blue heron nesting colonies are closely associated with nearby foraging habitats, which contain an abundant food source of aquatic vertebrates (Gibbs and Kinkel 1997).

The dependence on wetland habitat by species of colonial water birds makes them a useful indicator of the health of these important ecosystems (Parnell *et al.* 1988). Significant declines in many colonial water bird species are a result of loss and degradation of nesting and feeding habitat (Parnell *et al.* 1988).

The formation of colonies results in species' susceptibility to drastic population declines in the event of severe weather, competition, predation, habitat degradation or loss, and human disturbance (Parnell *et al.* 1988). Responses by a bird colony to disturbance vary depending on species; herons, gulls, and terns may circle overhead or fly a distance away (Parnell *et al.* 1988). The period of disturbance will also affect response, a short-term disturbance (e.g., aircraft) may result in a rapid return to the nest, and long-term disturbances may result in complete abandonment of the colony (Parnell *et al.* 1988). At double-crested cormorant colonies on Lake Winnipegosis, Manitoba the most significant form of mortality was deliberate killing by humans, as these birds are seen as a threat to local commercial fisheries (Hobson *et al.* 1989).

The position of a colony may also affect the level of disturbance experienced by birds; a colony with a buffer in the form of a visual barrier, or distance (i.e., over water, elevated above perceived threat) may not respond to disturbances (Parnell *et al.* 1988). Mortality due to collisions with wires and increased harvest of some species due to improved access are also potential effects.

Eighteen species of colonial waterbird are potentially found in or immediately adjacent to the Local Study Area (Farrand 1983; Robbins *et al.* 1983; Carey *et al.* 2003), 10 of which were observed during aerial surveys completed in July 2009. Colonial waterbirds are mainly gull, tern, pelican, cormorant, and heron species. These water-dependant species rely on the large number of island, lake, and wetland habitats found throughout and adjacent to the Local Study Area. Ninety-six locations of waterbird colonies, provided by the MBCDC and Ducks Unlimited, were validated in July 2009. Of these, 66 were confirmed to be active. Fifty-two new colonies were also recorded. Colonial waterbird nests identified by species are indicated in Map Series 600 – Colonial waterbird nests observed in 2009 and 2010 by species. All colonial waterbird nests and colonies observed during the colonial waterbird surveys in 2009 and 2010 are indicated in Map Series 700 – Colonial waterbird nests and colonies observed in 2009 and 2010.

A total of 3,454 birds were observed from July 15 to 18, 2010. Of these, 1,533 were colonial waterbirds (Appendix F-4). Seventy-six percent of 49 inactive colonies surveyed were classified as having good to excellent potential for recolonization.

The most commonly observed colonial waterbirds were ring-billed gull, Franklin's gull, and Bonaparte's gull. Of the seven observed colonial waterbird species, four were sporadically observed throughout the Local Study Area. The other species, Bonaparte's gull, black tern and common tern, had a much more limited range in the Local Study Area. Clear distinctions in range were apparent from north to south. Bonaparte's gull was observed only in boreal areas north of Swan River and black tern was only observed in the southern parkland region.

Ring-billed gulls were most frequently observed incidentally during the waterfowl and raptor surveys (Appendix F-4). Other relatively commonly recorded species included great blue heron and American white pelican. Most individuals were observed during the waterfowl survey.

Shorebirds consist of plovers, stilts and avocets, and sandpipers, phalaropes, and allies. The plovers are somewhat unique in their appearance when compared to the other shorebirds due to their plump body shape and short bill and legs (Taylor 2003c). All plovers forage on the ground with their diets typically consisting of small invertebrates (Taylor 2003c). Five species of plover occur in Manitoba, and all but one breed in the province (Taylor 2003c). Plovers that breed in Manitoba all nest on relatively bare ground, often favouring dry sites consisting of gravel, lichen covered ground, sand, and/or dry mud flats (Holland 2003; Holland *et al.* 2003d; Holland and Taylor 2003c; Haig 2003).

In Manitoba there is one breeding member of the stilts and avocets family, the American avocet (Taylor 2003d). They generally arrive in mid to late April, and breed mainly at Oak Hammock Marsh, the Shoal Lakes, Oak Lake, and Whitewater Lake (Koonz 2003b). The American avocet's breeding habitat consists of shallow water bodies with sparse emergent vegetation (Koonz 2003b). Avocets may sometimes form nesting colonies of up to 20 birds in good breeding habitat (Koonz 2003b). The fall migration begins in August, but flocks can remain until October (Koonz 2003b).

The sandpipers, phalaropes, and allies are a diverse group of shorebirds ranging from small to large in size, with short to long bills and legs (Warnock and Warnock 2001). The specialized bills and legs allow for different species to utilize differing water depths and substrates (Taylor 2003e). Essential habitat for shorebirds consists of ephemeral wetlands and the southern wetlands in the province such as Oak Hammock Marsh, Delta Marsh, Whitewater Lake, and the southern shores of Lake Manitoba (Taylor 2003e). There are a few exceptions to these habitat requirements as seen in the upland sandpiper, which utilizes open grasslands, while phalaropes forage in open waters (Taylor 2003e). The shorebirds most often form large groups when foraging, often segregating themselves into groups according to species (Warnock and Warnock 2001).

Many species migrate long distances, breeding in the Arctic and wintering in the southern hemisphere (Taylor 2003e). During migration shorebirds utilize shallow water bodies of any kind that present a source of food, such as wetlands, rice fields, and flooded agricultural fields (Warnock and Warnock 2001). Migration timing varies between species; extreme northern breeders arrive in late spring and begin the southerly migration by mid July (Taylor 2003e), and more southerly breeders begin their migration in the more typical late summer and fall season (Warnock and Warnock 2001).

Colonial waterbirds were documented in relatively large numbers (up to 1000s of individuals) during aerial surveys completed at Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Colonial waterbirds were also identified during point count surveys in various terrestrial habitats along the Nelson River System in relatively low numbers, usually flying over the plot.

The locations of all colonial waterbirds identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Carey *et al.* 2003).

GREAT BLUE HERON

Great blue heron was selected as a VEC because it is an important species in provincial guidelines (MNR 2010), and because sufficient data were collected for this species to represent colonial waterbirds.

The great blue heron is the largest heron found in North America, breeding in slow moving and still bodies of fresh water (Butler 1992). The spring arrival of the great blue heron in Manitoba begins in late March with the majority of herons arriving in early April (Koonz 2003c).

Great blue herons build their nests of sticks (both live and dead) in trees, usually well off the ground (Cottrille and Cottrille 1958); these nests may be built new in the spring or reused and repaired for consecutive years (Cottrille and Cottrille 1958). Great blue herons are seasonally monogamous breeders and like most herons are gregarious and nest in colonies (Davis 2001). Breeding habitat and colony locations are more commonly associated with undisturbed marsh, wetlands, and open water bodies than areas disturbed by human activities such as agriculture and residential development (Gibbs and Kinkel 1997). The location of colonies is typically associated with the amount and quality of foraging habitat in the area (Gibbs and Kinkel 1997).

Upon the completion of the nesting season, great blue herons begin dispersing in late July and migration peaks in September, with most birds leaving Manitoba by the end of September (Koonz 2003c).

Seventy-eight great blue herons were observed during the 2010 colonial waterbird surveys (Appendix F-4). A total of 14 were observed incidentally during the waterfowl and raptor surveys (Appendix F-5). Observations were made the Elm Creek area in south central Manitoba to Thompson (Map 4 – Extent of great blue heron observations in or bordering the Local Study Area). The locations of all great blue herons identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Butler 1992; Carey *et al.* 2003).

Great blue herons were documented in relatively low numbers (up to 19 individuals) during aerial surveys completed at Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Great blue herons were not identified during any of the point count surveys completed.

4.3.3.4 Birds of Prey (Bald Eagle)

Three families of birds of prey can be found in Manitoba, accipiters (hawks, eagles, ospreys and harriers), falcons, and typical owls. A fourth family comprised of a single species, barn owls, are accidental visitors (Goossen 2003). These birds are hunters, and feed on a variety of fish, birds, and mammals.

The accipiters and falcons are **diurnal** and hunt a variety of prey including small mammals, birds, fish, reptiles, and amphibians (Snyder 2001a; Snyder 2001b). Accipiters are often territorial and usually monogamous (Snyder 2001a). Nests are commonly constructed of sticks and other plant material, usually in a tree, although some species may nest on the ground or on cliff faces (Snyder 2001a; Snyder 2001b). The availability of foraging perches nearby may influence the selection of nest sites, as well as cover offered by the surrounding habitat (Smith *et al.* 2003). Young are born blind and featherless; the period until fledging depends on species, ranging from approximately 20 days for small species, to 6 months for larger species (Snyder 2001a; Snyder 2001b).

Raptor breeding and nesting success and territory sizes are most influenced by prey availability (Janes 1984). Hawks known to nest in forested areas (e.g., red-tailed hawk) most often select the tallest tree in an area to construct their nest (Smith *et al.* 2003). Nests in forests are most often located in the vicinity of open areas within the forest (Smith *et al.* 2003). Generalized raptor breeding ranges in Manitoba are depicted in Figures 4-1a and 4-1b.

Raptor populations tend to follow cycles associated with prey density, are found in low densities during the nesting season and tend to be secretive in their habits (Kirk and Hyslop 1998). Raptors migrate north along the Red and Pembina river valleys in spring (Taylor 2003j). Migration concentrates near St. Adolphe and Windygates when spring is late and deep snow remains on agricultural fields (Taylor 2003j). The fall migration is more dispersed (Taylor 2003i). Many raptor species migrate south into the southern United States, Central America and/or northern South America, while a few species may overwinter in boreal and prairie regions within Manitoba (Kirk and Hyslop 1998).

Habitat selection by owls varies with their breeding and foraging ecology. The northern hawk owl shows a preference for recently burned sections of conifer forests and avoids mature or old growth stands (Hannah and Hoyt 2004). Great gray owls utilize large mature trees with existing nests (Duncan 1997). These nests are most often constructed by hawks or other large birds, and the preservation of mature trees is important to this species (Duncan 1997). Other species, such as northern hawk owls, nest in old woodpecker holes or other cavities in decayed stumps (Duncan and Duncan 1998). Some owl species are permanent residents of Manitoba, and others are migratory (Taylor 2003k). Great horned owls are permanent residents in most of Manitoba, but appear to migrate in the Churchill area (Holland *et al.* 2003h). Figure 4-2 depicts generalized owl breeding ranges in Manitoba.

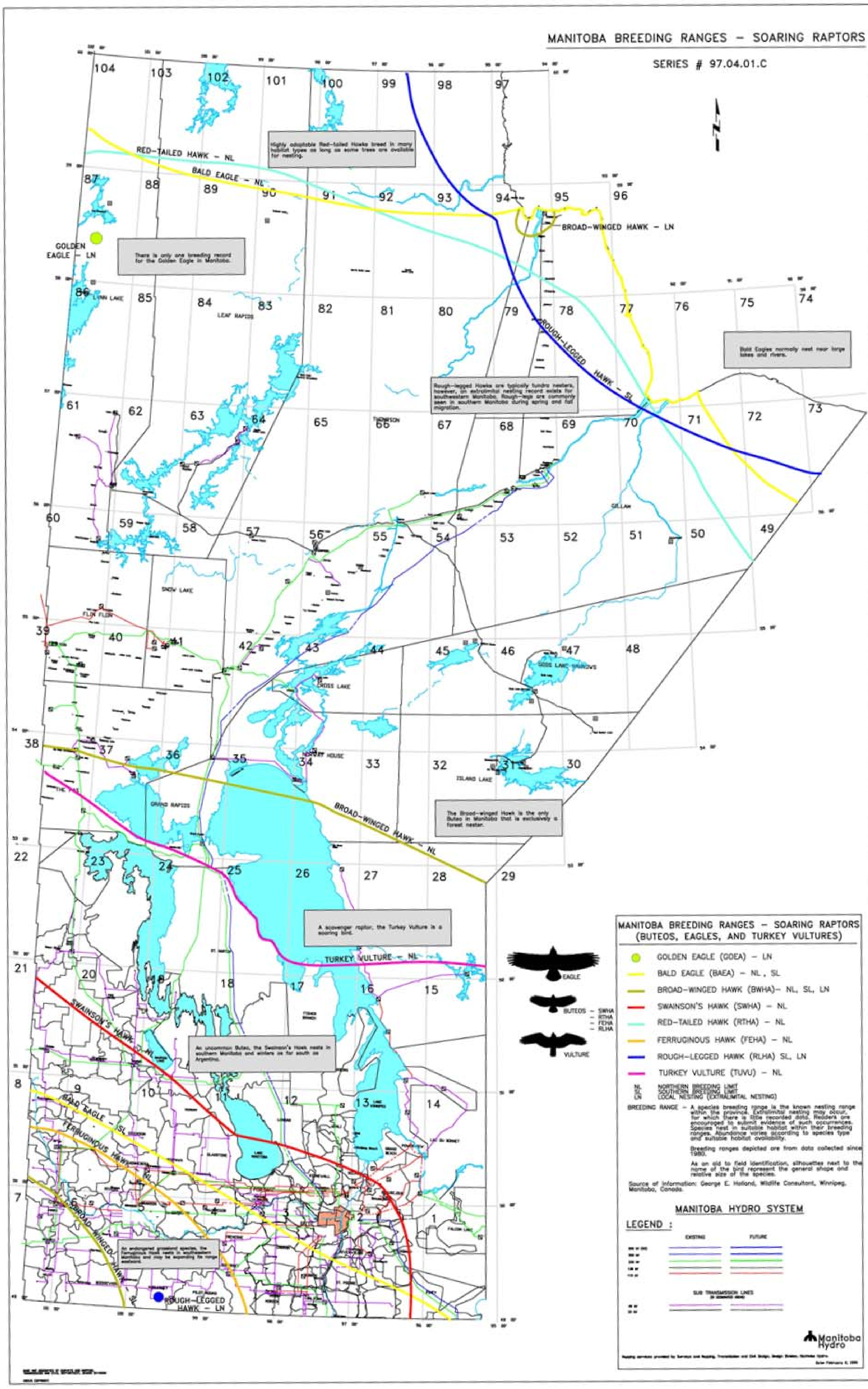

Figure 4-1a. Soaring Raptor Breeding Ranges in Manitoba

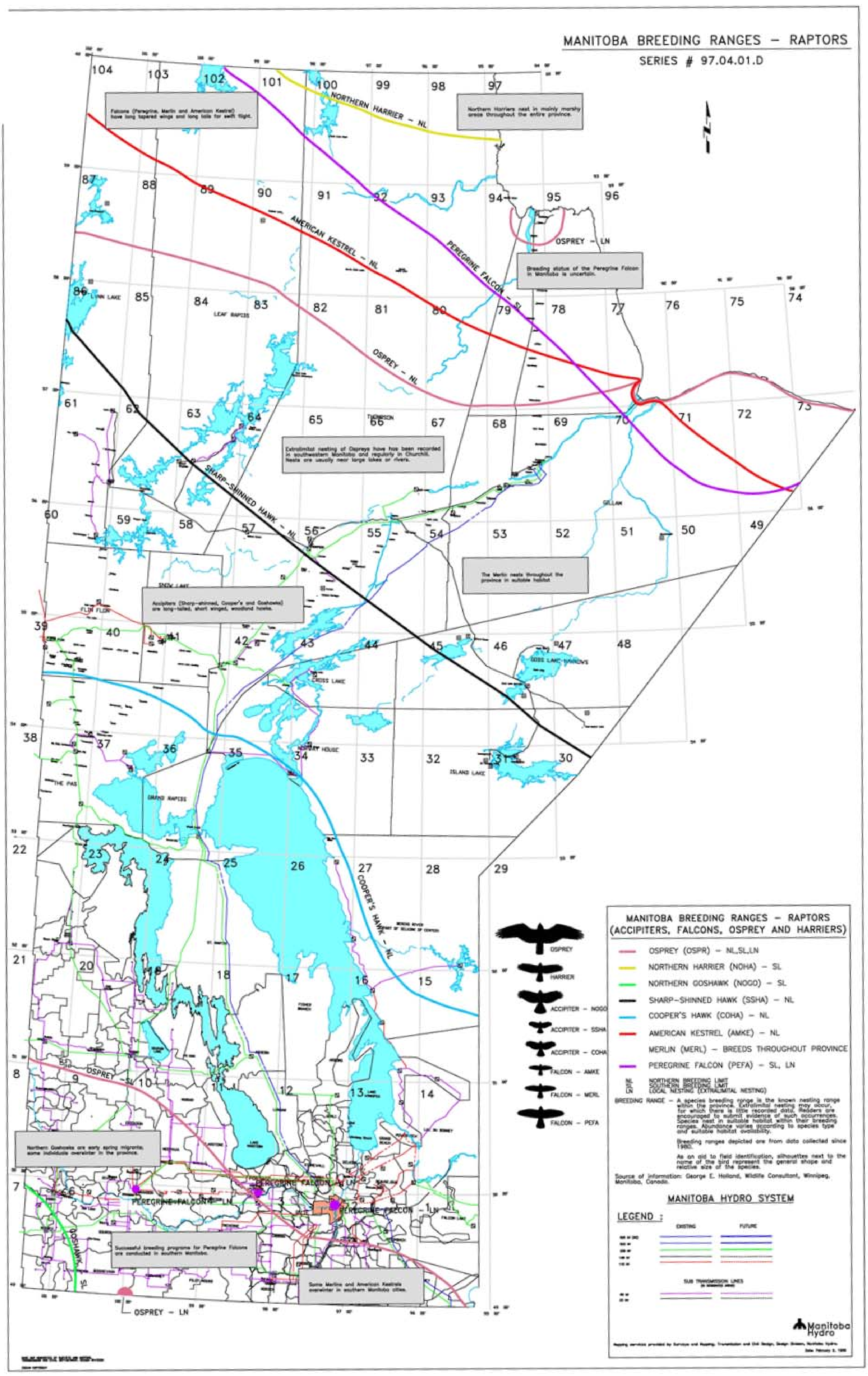

Figure 4-1b. Raptor Breeding Ranges in Manitoba

Raptor nests may be affected by clearing of the RoW (Map Series 800 – Raptor nests observed in 2009 and 2010). However, birds of prey may benefit from increased prey such as small mammals and upland game birds, which may be attracted to the habitat created on the transmission line. Towers could provide nesting and perching opportunities for birds of prey. Mortality of raptors and owls due to electrocution could result when ground and live wires are touched simultaneously.

Birds of prey are found throughout the Local Study Area and consist of 31 species including raptors (falcons, hawks, eagles, and osprey), owls, and vultures (Robbins *et al.* 1983; Carey *et al.* 2003). Eight of these species are year-round residents. During surveys conducted in 2009, three migration corridors with high concentrations of raptors were located. A list of all bird of prey species can be found in Appendix F-1. Birds of prey are found in all major habitat types in the Local Study Area including forests, grasslands, wetlands, and tundra; winter distributions for year-round residents are generally linked to prey availability (Casey *et al.* 2003).

A total of 535 raptors were observed during the 2010 raptor survey (Appendix F-6). Twelve species were identified. Red-tailed hawk was the most frequently encountered, followed by bald eagle. Twenty-eight unidentified individuals were also observed including seven buteos and four accipiters.

During the survey 243 raptor individuals were observed in pairs or flocks or kettles (usually two but as many as four). Fifty-seven of the raptors were identified as residents and 457 were identified as migrants; some were undetermined.

Of the 22 areas surveyed, the greatest number of individuals was observed around the RM of North Norfolk (n = 203). A hundred and four individuals were observed around the RM of South Norfolk. Further southeast, the third greatest number of individuals was found in the RM of Dufferin (n = 57). Twenty-seven raptors were counted around Portage La Prairie and 25 were observed in the vicinity of Grey. The area west of Lake Manitoba around Lakeview was another concentration area with 27 raptors. A maximum of 14 individuals were observed in the other 17 areas, and a single raptor was observed in others. Areas with higher concentrations of raptors are outlined in Map Series 900 – Areas of high raptor concentration from the 2010 raptor migration survey.

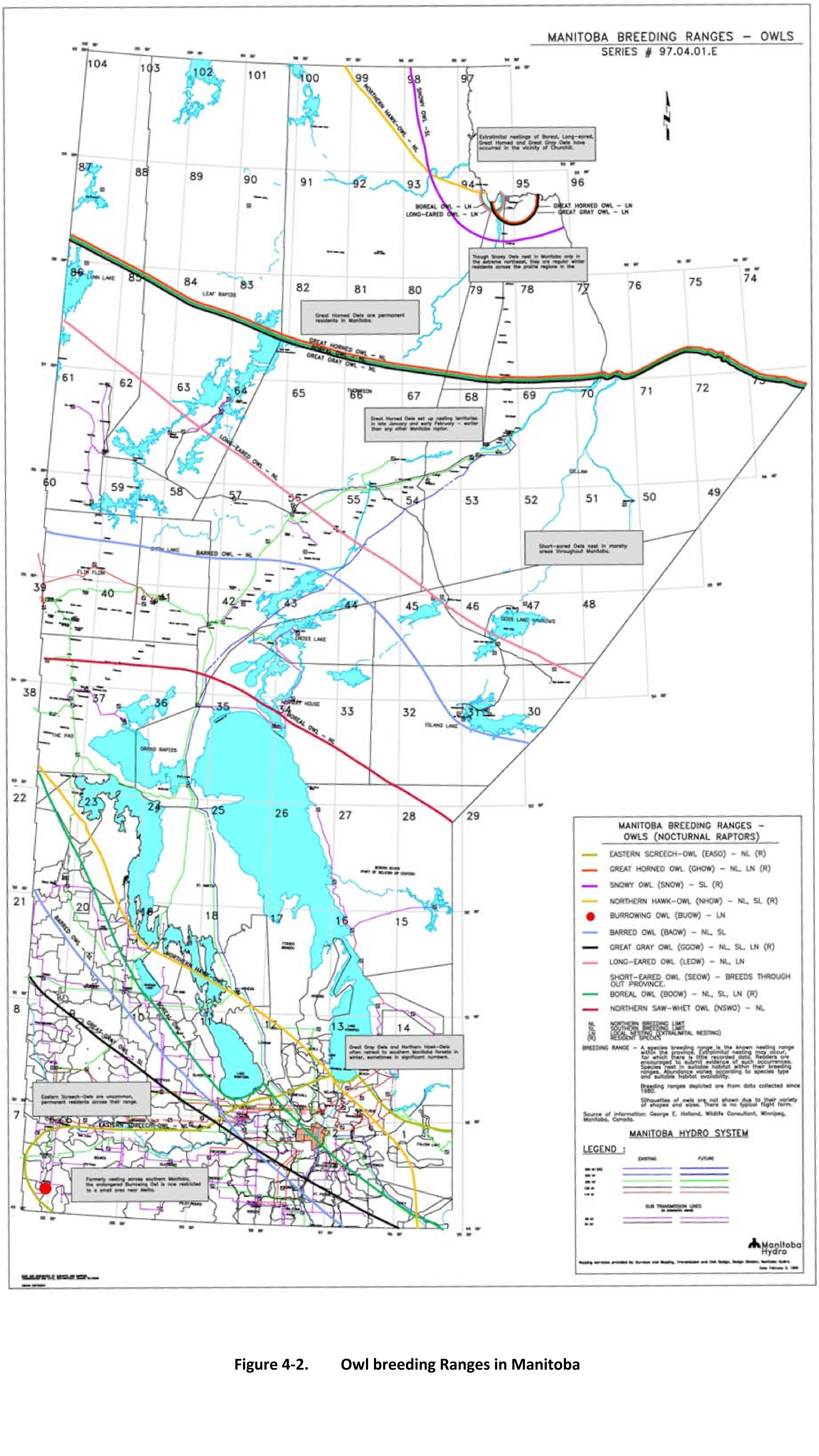

Figure 4-2. Owl breeding Ranges in Manitoba

Nine owl species were encountered during the nocturnal owl surveys (Appendix F-8). The most commonly heard owl was the boreal owl, which comprised 66% of all documented owl calls, followed by great horned owl at 18% and saw-whet owl at 6%. Owl observations are outlined in Map Series 1000 – Owl observations from the 2010 nocturnal owl surveys.

The only owl species listed under SARA and MESA with a range extending into Manitoba is the burrowing owl. No burrowing owls were observed or heard while conducting this survey. Even though the Local Study Area did not include the known range for burrowing owls, limited habitat is available, and some potential for future burrowing owl establishment in the area does exist. One burrowing owl was recorded during 2009 surveys northeast of Carberry, which is not located near the preferred Bipole III route.

Eleven bird of prey species were observed incidentally during waterfowl, colonial waterbird, and nocturnal owl surveys (Appendix F-7). Northern harrier was most frequently observed, followed by red-tailed hawk. Similar numbers of individuals were recorded during both surveys.

Birds of prey were relatively common during the point count and aerial surveys (4 to 98 individuals) completed at Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009), however the Keeyask reports for 2005 do not report on any raptors observed.

The locations of all raptors identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Carey *et al.* 2003).

BALD EAGLE

Bald eagles are common in Manitoba and nest in all forested areas of the province, with some reports of pairs nesting in agricultural areas (Koonz 2003a). There are an estimated 300,000 bald eagles in North America (Rocky Mountain Bird Observatory 2007). Bald eagle nests are commonly found in mature forests, usually within 2 km of a water body, which may be dependent upon the prey availability in the area (Buehler 2000). When nesting in the vicinity of human activity bald eagles select nest sites at a distance from the disturbance, often including a visual buffer in the form of existing tree stands (Andrew and Mosher 1982). Nests are usually constructed in large trees capable of supporting stick nests, while providing the pair with a viewpoint of the surrounding area (Buehler 2000). Nests built in deciduous trees tend to collapse within a few years, but nests in conifers may last two decades (Koonz 2003a).

Bald eagle roosting is similar to nesting in that they perch in trees close to suitable water bodies for foraging, however these roosts are generally located much further from water bodies than nests (Buehler 2000). Migration patterns of bald eagles are complex and associated with the age of the individual bird in question; immature eagles are generally nomadic because they have not established a nesting territory, while adult birds will migrate seasonally, usually due to food shortages as a result of seasonal weather changes (Buehler 2000).

A total of 120 bald eagles were recorded during the waterfowl surveys, with the greatest concentrations found north of Dauphin Lake, Clearwater Lake, Cormorant Lake, and Halfway Lake. Ten additional bald eagles were observed during the nocturnal owl surveys, most of which were located near The Pas. An additional 79 bald eagles were observed during the raptor survey while only five were observed during the breeding bird survey. There was a significant gap in bald eagle observations, with none being made between Swan River and Dauphin. Bald eagles were relatively common in all other areas (Map 5 – Extent of bald eagle observations in or bordering the Local Study Area). The locations of all bald eagles identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Buehler 2000; Carey *et al.* 2003). All nest locations and the presence or absence of eaglets was recorded.

Large numbers of bald eagles have been recorded in northern Manitoba along large rivers including the Nelson River. Bald eagles were relatively common during the aerial surveys (1 - 232 individuals) completed at Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009), however the Keeyask report for 2005 do not report on any bald eagles observed. The majority of all bald eagle observations were made during aerial surveys completed along the Nelson River waterway.

4.3.3.5 Upland Game Birds (Ruffed Grouse and Sharp-tailed Grouse)

Upland game birds include partridges, pheasants, grouse, and turkeys. Six species are indigenous to Manitoba, the ruffed grouse, spruce grouse, willow ptarmigan, rock ptarmigan, sharp-tailed grouse, and the greater prairie-chicken, which no longer exists in the province (Taylor 2003l). Partridges, pheasants, and turkeys have been introduced as game birds (Taylor 2003l). Ruffed grouse and sharp-tailed grouse have been selected as the VECs for this group.

Upland game birds generally utilize small areas for their life history patterns, have high reproductive rates, and are able to utilize newly improved habitat soon after its rehabilitation (Holechek 1981). All nest on the ground (Taylor 2003l) and species such as grouse and wild turkeys are well adapted for a walking habit, sometimes using short flights to escape predators (Delehanty 2001).

Spruce grouse favour closed boreal forest, while ruffed grouse primarily inhabit mixedwoods transitioning to more open habitat (Delahanty 2001). Sharp-tailed grouse habitat typically consists of open meadows with nearby woodlands for shelter, while wild turkey habitat requirements consist of woodland with opportunities for a secure elevated perch and are usually associated with an agricultural food source (Delehanty 2001). In contrast to sharp-tailed grouse, spruce and ruffed grouse do not aggregate during the breeding season on traditional dancing grounds, rather the males display alone in favoured habitat (Delehanty 2001).

The current population of wild turkeys in Manitoba is a result of the northward expansion of turkeys from their traditional range; this expansion has been attributed to the expansion of agricultural activities and the purposeful trapping and release of turkeys (Kane *et al.* 2007). Winter weather significantly affects wild turkey survival; this effect is largely attributed to snow depth (Kane *et al.* 2007). Deeper snow limits the birds' ability to forage for food and encumbers movement, increasing predation rates (Kane *et al.* 2007).

The eight upland game bird species potentially found in the Local Study Area are: gray (Hungarian) partridge, ring-necked pheasant, ruffed grouse, spruce grouse, willow ptarmigan, rock ptarmigan, wild turkey, and sharp-tailed grouse (Appendix F-1). All are permanent residents of the Local Study Area and key in on wooded habitats with edges and openings. Often, upland game bird populations such as ruffed grouse are cyclic (Holland and Taylor 2003d).

A single spruce grouse was observed northeast of Ponton during waterfowl surveys. One wild turkey was recorded during the waterfowl survey. The majority of upland game bird observations were made south of The Pas, more specifically in the RMs of Alonsa and Springfield. This also reflects the distribution of individual species, with ruffed grouse being the dominant species in the southern portion of the Project Study Area, followed by sharp-tailed grouse.

Upland game birds were observed and documented during point count surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Upland game birds were identified during point count surveys in various terrestrial habitats, where this bird group made up a small proportion of the birds identified (1 to 5 individuals) from any particular survey.

The locations of all upland game birds identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Carey *et al.* 2003).

RUFFED GROUSE

Ruffed grouse are common year-round inhabitants of southern Manitoba's deciduous and mixed-woods forests and in northern coniferous forests (Holland and Taylor 2003d). Habitats of continuous forested areas containing young and mature stands provide the most optimal conditions of cover and forage (Rusch *et al.* 2000). They tend to avoid clear-cut forest (Blanchette *et al.* 2007). Cold temperatures during winters force ruffed grouse to divide their time between seeking out refuge in suitable habitat (deep snow cover) and foraging on winter buds (Marshall 1965). In the absence of suitable snow cover, ruffed grouse have been observed roosting in thick spruce-fir stands to minimize heat loss (Marshall 1965).

Male drumming sites are typified by dense woody shrub and conifer vegetation and fewer open areas when compared to brood and roosting sites (Stauffer and Peterson 1985). Males drum from late March until early June, creating the sound by rapidly beating their wings (Holland and Taylor 2003d).

Territory sizes of ruffed grouse vary by sex and season. During the early spring territory sizes are generally large, excluding cold days in which territory sizes were shown to shrink (Archibald 1975). Males' territory sizes decrease during the peak drumming season and expanded thereafter (Archibald 1975). Female territory size dramatically decreases at the onset of incubation (Archibald 1975). Males have larger territory sizes that average approximately 2.3 ha (Archibald 1975).

Ruffed grouse often construct their nests in a small hollow on the ground or at the base of a tree (Holland and Taylor 2003d). A relatively open forest canopy combined with dense undergrowth of herbaceous plants providing adequate ground cover in the spring and summer is the favoured habitat for ruffed grouse raising a brood (Stauffer and Peterson 1985). Females begin to lay eggs in early May and have been known to lay as late as the end of June (Holland and Taylor 2003d).

Population growth is predominately limited by raptor predation upon fledgling young (Eng and Gullion 1962; Larson *et al.* 2001). The predatory pressure exhibited by avian and other predators has been identified as the most likely cause for the observed approximate 10-year cycle in population numbers (Keith 1963). This species is not adept at avoiding large obstructions, and road kills are common (Holland and Taylor 2003d). There are an estimated 8,000,000 ruffed grouse in North America (Rocky Mountain Bird Observatory 2007).

Ruffed grouse observations were limited to areas south of The Pas, and were sporadically clustered in certain areas rather than being widespread (Map 6 – Extent of ruffed grouse observations in or bordering the Local Study Area). A low magnitude effect on ruffed grouse habitat is expected, as less than 5% of habitat will be lost to the Project.

A total of 197 ruffed grouse were observed during 2010 bird surveys. All but two were recorded during the breeding bird surveys. None were found during the colonial waterbird, raptor, or waterfowl surveys. The locations of all ruffed grouse identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Rusch *et al.* 2000; Carey *et al.* 2003).

Ruffed grouse were observed and documented during point count surveys as far north as those studies completed for Keeyask and Conawapa Generation Station environmental studies between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Ruffed grouse were identified during point count surveys in various terrestrial habitats, where this species made up a very small proportion of the birds identified (1 to 2 individuals) from any particular survey.

SHARP-TAILED GROUSE

Sharp-tailed grouse are gregarious birds found year-round in Manitoba, excluding areas in the far north (Taylor 2003a). Sharp-tailed grouse tend to remain near breeding areas, but during winter months they have been known to relocate short distances for cover in wooded areas (Connelly *et al.* 1998). Sharp-tailed grouse are typically found inhabiting the prairies and aspen parkland but can also be found in recently burned areas of the boreal forest (Taylor 2003a). In Manitoba, it is expected that as aspen parkland slowly develops into aspen forest (due to a lack of forest fires), sharp-tailed grouse will abandon certain habitats (Berger 1992).

In early spring, males form large groups on display grounds to attract females (Taylor 2003a). These dancing grounds, called leks, are often utilized for many years (Wiley 1974). Male sharp-tailed grouse exhibit great loyalty to these sites and when disturbed they return, often within 20 minutes (Baydack and Hein 1987). Female sharp-tailed grouse may be more prone to disturbance and were found to avoid leks that had experienced a nearby disturbance (Baydack and Hein 1987). In northern environments, leks appear to be more ephemeral in nature compared to southern regions, as these sites are often more heavily influenced by fire and succession.

Females begin laying eggs on nests made of grasses and forbs in mid May; eggs may be laid as late as early-mid July (Taylor 2003a). Average clutch size is 10 to 12 eggs (Connelly *et al.* 1998). The eggs are incubated for approximately 23 days; young are born with their eyes open and with feathers, and follow the female upon hatching (Connelly *et al.* 1998).

There are an estimated 1,200,000 sharp-tailed grouse in North America (Rocky Mountain Bird Observatory 2007). The degradation of lands and land use changes such as encroaching aspen woodlands, conversion to agriculture, and fire suppression in Manitoba has been identified as the most likely cause of the decline in sharp-tailed grouse in the province (Berger and Baydack 1993). Anecdotal evidence compiled by Manitoba Conservation (2010b) suggests that grouse are widely distributed in Manitoba. Sustainable agriculture practices and preservation of grassland habitat are required for long-term stability of sharp-tailed grouse populations (Manitoba Conservation 2010b).

Thirty-two sharp-tailed grouse were observed during all surveys excluding the raptor survey. Of these, 27 were observed distributed along the entire route during the waterfowl survey. One sharp-tailed grouse was also observed approximately 24 km south of McCreary while conducting nocturnal owl surveys. Observations were very limited and very widely spread, occurring in only three locations, north of Gillam and east and northeast of Riding Mountain (Map 7 – Extent of sharp-tailed grouse observations in or bordering the Local Study Area). The locations of all sharp-tailed grouse identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Connelly *et al.* 1998; Carey *et al.* 2003).

Sharp-tailed grouse were not observed except during point count surveys completed during 2007 Keeyask Generation Station environmental assessment (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). However, sharp-tailed grouse signs were identified throughout the area in most years.

4.3.3.6 Woodpeckers (Pileated Woodpecker)

The woodpeckers are a highly specialized family of birds, with a strong bill used to excavate cavities and forage for food in tree trunks (Taylor 2003b). Of the 10 species occurring in Manitoba, five are permanent residents, three are summer visitors, and two are infrequent visitors (Taylor 2003b). Pileated woodpeckers have been selected as the VEC to represent this group.

Most woodpeckers also make use of the noise created when tapping to communicate territories to potential rivals as well as with their mate (Taylor 2003b). All woodpeckers excavate cavities in tree trunks for nesting and roosting purposes, however northern flickers utilize previously excavated cavities as well as human-made nest boxes (Taylor 2003b).

Woodpeckers utilize habitats in all types of woodland and individual species are often specially adapted to certain forest types (Reed 2001). Red-headed woodpeckers require relatively open deciduous woodland habitat containing mature trees with an open understory and canopy (King *et al.* 2007), while three-toed woodpeckers show a strong association with mature and old-growth black spruce forests for foraging (Imbeau and Desrochers 2002).

Due to the high degree of habitat specialization exhibited by most species, woodpeckers are prone to declines when their required habitats become threatened (Reed 2001). This habitat specialization can also make woodpecker species a useful indicator of ecosystem health (McClelland and McClelland 1999).

Migration varies by species, with species arriving from mid April to mid May (Holland and Taylor 2003e; Taylor 2003i). Northern flickers often migrate along the Red and Assiniboine rivers; other observations of large numbers were made in Headingley and near Rennie (Holland and Taylor 2003e). The fall migration occurs in September, when congregations are observed along roadsides, in parks, and along riverbanks and lakeshores (Holland and Taylor 2003e).

Woodpeckers tend to be sparse in northern Manitoba. Woodpeckers were observed very infrequently during point count surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 and 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). No more than five woodpeckers were ever observed during any given field season.

The locations of all woodpeckers identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Carey *et al.* 2003).

PILEATED WOODPECKER

Pileated woodpeckers are year-round residents of forested areas of central and southern Manitoba (Holland and Curtis 2003). Optimal habitat consists of mature and old growth conifer and/or deciduous forests, early successional forests that contain remnant large old growth trees, or standing dead trees (Bull and Jackson 1995). Old growth trees, including dead and/or dying trees, provide habitat for an assortment of other forest wildlife, and the presence of nesting pileated woodpeckers can be a useful indicator of a functioning forest ecosystem (McClelland and McClelland 1999).

Pileated woodpeckers are cavity nesters; excavation begins in mid March to early April, (Holland and Curtis 2003). Cavities are most often constructed in poplars with a minimum diameter at breast height (dbh) of 30 cm (Holland and Curtis 2003). Cavities excavated by pileated woodpeckers are important habitat for secondary cavity nesters; squirrels, bats, owls, and ducks often utilize these cavities either for food storage, roosting, or nesting purposes (Bonar 2000).

Home range sizes of pileated woodpeckers vary by sex, bird pairs, and pairs with fledged young; the average home range size is approximately 478 ha (ranging from 267 – 1,056 ha); males typically have larger home ranges, as do paired versus non-paired, and paired with **fledged** young versus paired with no young (Mellen *et al.* 1992).

The North American population of pileated woodpeckers is estimated at 930,000 individuals (Rocky Mountain Bird Observatory 2007). The most dominant factor limiting pileated woodpecker populations is logging operations in the mature and old growth forests that are necessary for roosting, foraging, and cover (Bull and Jackson 1995). Bull and Jackson (1995) also identified fragmentation of old growth and mature forest stands as the likely factor in declining pileated woodpecker densities, as it increases predatory pressure when birds move between forest stands. Pileated woodpeckers are frequently considered nuisances, as they use wooden transmission line poles for nesting, resulting in damaged and weakened poles (Holland and Curtis 2003).

A single pileated woodpecker was observed in the vicinity of Red Deer Lake during the waterfowl survey. Pileated woodpeckers were recorded in most of the Local Study Area during various surveys (Map 8 – Extent of pileated woodpecker observations in or bordering the Local Study Area). The frequency of pileated woodpecker encounters was greatest in the Porcupine Mountain, Duck Mountain, and Riding Mountain areas. Observations were also relatively frequent in between The Pas and Thompson.

A total of 80 pileated woodpeckers were observed during bird surveys conducted in 2010. Of these, 77 were recorded during the breeding bird surveys, and the remaining three were observed incidentally.

Pileated woodpeckers were only observed during point count surveys completed during the Conawapa Generation Station environmental studies completed in 2006 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). All individuals were observed along the Limestone and Conawapa access roads.

The locations of all pileated woodpeckers identified and recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys correspond with all known ranges and distributions of this species (Bull *et al.* 1995; Carey *et al.* 2003).

4.3.3.7 Species at Risk (SARA and MESA)

LEAST BITTERN

Least bitterns are listed as threatened by SARA, and are not listed by MESA. They are rare breeders in Manitoba, uncommonly found in the southeast and west to Delta Marsh in small wetlands (Koes 2003). Least bitterns favour breeding habitat of small wetlands containing dense, tall, emergent vegetation, with some small areas of open water and woody vegetation (Gibbs *et al.* 1992).

Nesting habitat is commonly associated with wetland edges and tall, dense emergent woody vegetation (Weller 1961; Gibbs *et al.* 1992). Nesting habitat consisting of live and dead emergent vegetation interspersed with open water results in the highest levels of nesting success for least bitterns (Post 1998).

Least bitterns arrive in Manitoba from their wintering grounds in early May and depart breeding areas in southern Manitoba to begin fall migration by the end of October (Koes 2003). Least bittern wintering grounds are located along the Gulf of Mexico and Baja California (Gibbs *et al.* 1992).

Least bitterns exhibit a small degree of territoriality with males defending nest sites from intruders (Weller 1961), however in prime breeding habitat with an abundance of prey nests have been observed within close proximity to one another (Kushlan 1973). The most significant factor thought to limit least bittern populations is the loss of wetland habitats; however, with the protection of wetlands from pollution and degradation least bitterns have shown a tolerance of human presence and disturbance (Gibbs *et al.* 1992).

Four least bitterns were observed during the breeding bird surveys, three located 12 km south of Winnipegosis and one 7.25 km northeast of Langruth (Map 9 – Extent of least bittern observations in or bordering the Local Study Area). These locations appear to be a northerly extension of their range in Manitoba. Least bittern were recorded during the 2010 breeding bird, colonial waterbird and waterfowl surveys at locations north and west of all known ranges and distributions of this species (Gibbs *et al.* 1992; Carey *et al.* 2003).

YELLOW RAIL

Yellow rails are widely distributed in the United States and Canada, particularly in south-central and southeastern Canada during breeding season (Bookhout 1995). This species is listed as special concern by SARA, and is not listed by MESA. Occurrence in Manitoba is from the end of April to mid September (Holland and Taylor 2003f). Breeding habitat is described as wet sedge meadows where sedge species are selected for and water depth surrounding the nest is at least 10 cm (Bookhout and Stenzel 1987; Bookhout 1995). During the breeding season the average range of males is 7.8 ha and for females pre-incubation is 1.2 ha, but is much lower during incubation (0.3 ha) (Bookhout and Stenzel 1987).

Immediately following the breeding season, a two-week moulting period occurs away from breeding areas and in grain and hay fields as well as wet meadows and wetlands (COSEWIC 2009). Migration to coastal marsh wintering areas ranging from North Carolina to Texas occurs from September to October of each year with migration to breeding areas occurring in mid April (Bookhout 1995).

Behaviourally, yellow rails are similar to other rail species in being relatively secretive marsh birds that typically walk or run but will fly when disturbed or when migrating (Taylor and Holland 2003a). The primary predators of yellow rails are raptors although mammalian predators are also common (COSEWIC 2009). Incidences of brood parasitism on yellow rails are unknown (Bookhout 1995).

Due to the close association of rails with wetland areas, the preservation of wetlands for waterfowl can have a positive effect on the persistence of yellow rails and other rail species (Eddleman *et al.* 1988). Where the creation of power line RoWs and generating stations require the alteration of wetland habitat areas species persistence will likely be negatively affected.

A total of 75 yellow rails were observed during the breeding bird surveys, with the most southern observation occurring 16 km southeast of McCreary. The most northern observation was 8.5 km south of Cormorant (Map 10 – Extent of yellow rail observations in or bordering the Local Study Area). The location of all yellow rails identified and recorded during the 2010 breeding bird surveys correspond with all known ranges and distributions of this species (Bookhout 1995; Carey *et al.* 2003).

WHOOPING CRANE

Whooping cranes have been extirpated from Manitoba and are rarely seen during migration (Koes and Taylor 2003). The absence of breeding whooping cranes is thought to be more a result of a small population base than habitat loss (Lewis 1995).

Favoured breeding habitat of whooping cranes includes poorly drained lowlands with variety of small and shallow wetlands (Lewis 1995). Within 500 m of whooping crane nests 56% of the landscape consisted of open water, shrub-bog marshes, and mixed marshes (Timoney 1999). Whooping crane foraging habitat consists of shallow wetlands, agricultural fields, pastures, and burned upland fields (Lewis 1995).

Whooping cranes show fidelity to areas where previous nesting has taken place, which typically are isolated from human activities and disturbance (Lewis 1995). Nests are constructed in areas where vegetation conceals the nest and incubating adult, often on a small island to provide protection from potential predators (Lewis 1995).

Migrating whooping cranes have been observed west of Winnipeg and north of The Pas in the spring from early April to mid May and in the fall in early October (Koes and Taylor 2003). Whooping cranes are diurnal migrants that utilize shallow lakes, ponds, and riparian areas during the night (Lewis 1995). They forage for food in these same areas and in agricultural fields along their migration routes (Lewis 1995).

In the past, hunting of whooping cranes played a significant role in population declines (Lewis 1995). Currently, mistaken identification of whooping cranes for other large waterbirds by hunters and collision with power lines are considered potential threats to the continued growth of whooping crane populations (Lewis 1995).

As whooping crane are rarely found in the Local Study Area as they generally fly directly through to their breeding grounds Alberta, and as no known nesting habitat is expected to occur in the Project Study Area, this species is not expected to be affected by the Project. No whooping cranes were observed during surveys in the Project Study Area. Based on limited to no potential

interactions with the Project Components, whooping crane will not be considered further in the effects assessment.

PIPING PLOVER

Piping plovers are listed as endangered by SARA and MESA. In Manitoba the breeding population is declining. Pairs are found nesting on the west shores of Lake Winnipeg and on Lake Manitoba and westward, usually with minimal disturbance (Haig 2003).

The piping plover nests on open beaches with minimal vegetative cover throughout its breeding range (Gaines and Ryan 1988). The nest is constructed directly on the ground by scraping down 1 to 2 cm and may by lined with small pebbles or shells (Haig 1992). Nesting success has been associated with minimal vegetation cover with existing vegetation clumped sparsely throughout the beach (Gaines and Ryan 1988).

Male piping plovers establish territories upon their arrival at breeding grounds; these territories include a section of shoreline and drier areas of the beach and are defended against other males by ground display along territory borders (Haig 1992). The size of territories in breeding piping plovers varies with a range of 500 – 8,000 m^2 with an average size of 4,000 m^2 (Cairns 1982). Territories within breeding habitat are commonly aggregated, leaving open areas of available habitat with no utilization by piping plovers (Haig 1992).

Piping plovers' arrival at their breeding grounds in Manitoba occurs in early to late May with the fall migration occurring from mid July to early August (Haig 2003). Habitat utilized by the piping plover during migration periods is similar to its favoured breeding habitat (Haig 1992). They spend the non-breeding season in wintering grounds along the Gulf coast and southern Atlantic coast (Haig 2003).

The degradation of breeding habitat through the disturbance of formerly isolated beaches and increased human activity on lesser-disturbed beaches has been a significant factor in the declines of piping plover populations (Haig 2003). Piping plovers nest along broad, sparsely vegetated beaches along Lake Winnipeg and Lake Manitoba. Known nesting locations include the Clandeboye Bay Special Conservation Area along Lake Manitoba, Walter Cook Special Conservation Area along Lake Winnipeg, and Grand Beach, also on Lake Winnipeg. Piping plovers are occasionally found nesting along West Shoal Lake, Oak Lake, and Whitewater Lake. Critical habitats that may be identified by quarter section have yet to be listed in Manitoba (Environment Canada 2007).

Manitoba Conservation (2010b) reports that habitat loss and human disturbance are leading causes of piping plover declines in Manitoba. Nesting beaches are being lost to persistently high water levels and vegetation encroachment on Lake Winnipeg and Lake Manitoba. Decreased nesting success due to human disturbance at popular beaches and increased predation on nests and chicks are also attributed to the species' decline from 130 individuals in 1990 to four pairs of nesting birds (eight individuals) in 2009 (Manitoba Conservation 2010b).

As the SARA-listed critical habitats for piping plover are generally known, including the basins of Lake Winnipeg, Lake Manitoba, and West Shoal Lake (Environment Canada 2007), and these areas were avoided during the route selection process, piping plovers are not expected to be affected by the Project. No piping plovers were observed during bird surveys in the Project Study Area. Based on limited to no potential interactions with the Project Components, piping plover will not be considered further in the effects assessment.

Red Knot

Red knots are uncommon migrants in Manitoba, passing through on route to their breeding grounds in the central Canadian Arctic and wintering grounds in southern South America (Holland and Taylor 2003g). Preferred breeding habitat in the Arctic consists of open landscapes with sparse vegetation in the vicinity of wetlands, or coastal areas (Niles *et al.* 2008). During migration they utilize habitats in estuaries, mouths of bays, and coastal flats associated with muddy and sandy shores (Niles *et al.* 2008).

In Manitoba they are observed in spring along beaches on the shores of Lake Winnipeg and Manitoba as well as Oak Hammock Marsh (Holland and Taylor 2003g). The highest densities of red knots observed in Manitoba are in the extreme north along the coast of Hudson's Bay (Holland and Taylor 2003e). During the breeding season red knots exhibit territorial behaviours; however during migratory periods this behaviour is rarely observed (Harrington 2001).

Red knots are long distance migrants; some breeding populations migrate from the Canadian Arctic to the tip of South America, among the longest migrations undertaken (Harrington 2001). Red knots' spring migration brings groups through Manitoba from late May to early June and the fall migration is from late July to August (Holland and Taylor 2003g).

The large congregations of red knots during staging periods for migration result in their vulnerability to large population declines in the event of loss of food items, extreme weather events, and human disturbance (Harrington 2001).

As red knots are rarely found in the Local Study Area as they fly directly through to their northern breeding grounds in the arctic, and no known nesting habitat is expected to occur in the Project Study Area, this species is not expected to be affected by the Project. No red knots were observed during surveys in the Project Study Area. Based on limited to no potential interactions with the Project Components, red knot will not be considered further in the effects assessment.

ROSS'S GULL

Ross's gulls are extremely rare sea birds with nesting records limited to areas around Churchill (Koes 2003b). Nesting observations in Canada are limited to the Churchill area and three confirmed locations in Nunavut (COSEWIC 2007).

Nesting in northern Manitoba is associated with shallow water bodies, hummocks, sedges, grasses and short shrubby vegetation (COSEWIC 2007). Ross's gulls construct nests on the ground within a shallow depression, lining the bowl with mosses and/or sedges (COSEWIC 2007). Nesting Ross's gulls are commonly found near colonies of nesting Arctic terns (COSEWIC 2007).

Their arrival in Churchill is typically in early May (Koes 2003b). Departure is in early September, upon completion of the breeding season (Koes 2003b). Fall migration of Ross's gulls involves flights to the north and east, where they use areas of open sea water throughout the winter (COSEWIC 2007).

The potential exploitation of oil and gas reserves in the Arctic could pose a threat to Ross's gull populations (COSEWIC 2007). The continued warming and loss of annual sea ice in the arctic has unknown implications for this species (COSEWIC 2007).

As Ross's gulls are not found in the Local Study Area, and no known nesting areas are expected to occur, no Project-related effects are expected. Ross's gull was not observed during field surveys. As such, this species will not be considered further for the effects assessment.

FERRUGINOUS HAWK

Ferruginous hawks are not listed by SARA, and are listed as threatened by MESA. The ferruginous hawk is an uncommon breeder in Manitoba, and its range is limited to the southwestern corner of the province (De Smet 2003a; Map 11 - Ferruginous hawk breeding range). There are an estimated 20,000 ferruginous hawks in North America (Rocky Mountain Bird Observatory 2007). Manitoba Conservation (2010b) reports that no ferruginous hawks were recorded in Manitoba from the 1920s to 1984. The species made a comeback in the province over the next two decades, but in 2009 only 35 nesting pairs, the lowest number in almost 20 years, were reported (Manitoba Conservation 2010b). Ferruginous hawks are highly specialized to open mixed and short grass prairies with an abundance of prey (Bechard and Schmutz 1995). Reduced nesting populations and nesting success have been attributed to declines in ground squirrel numbers since the mid-1990s (Manitoba Conservation 2010b).

Habitat selected by ferruginous hawks is in areas with minimal agricultural land use, as areas with a high degree of agricultural activity show a substantial decline in ferruginous hawk populations (Schmutz 1989). In breeding habitats on the Prairies nests are commonly located above ground in trees and shrubs; however ferruginous hawks build nests on the ground in the absence of an elevated location (Bechard and Schmutz 1995).

The home range of ferruginous hawk pairs has been found to have a mean size of 8.7 km^2, with the area within the home range used for foraging (Learly *et al.* 1998). Home range size is thought to be influenced by the availability of prey in the area; when habitats contain a low density of prey items home ranges may be larger as the hawks must forage further from the nest (Leary *et al.* 1998). This species' dependence on ground squirrels as a food source results in vulnerability to population declines when ground squirrels become less abundant (Schmutz *et al.* 2008).

Migration occurs in late summer to fall, with most ferruginous hawks departing for wintering grounds in the southern United States and northern Mexico by October (Schmutz and Fyfe 1987). The arrival of ferruginous hawks in the spring typically occurs in late March to early April (Lokemoen and Duebbert 1976).

Limiting factors and threats to ferruginous hawk populations have been identified as degradation of habitat, loss of habitat to agricultural activities, declines in critical prey species, and disturbance of nests by human activities (Hoffman and Smith 2003). Although one ferruginous hawk was observed incidentally in 2009, ferruginous hawks were not observed during any of the bird surveys completed in the Project Study Area in 2010.

Peregrine Falcon

Peregrine falcons are listed as threatened by SARA and endangered by MESA, primarily due to its sharp declines in relation to the former, but widespread use of DDT. There are an estimated 300,000 individuals in North America (Rocky Mountain Bird Observatory 2007). The peregrine falcon is an uncommon raptor in Manitoba whose presence is likely attributed to its successful reintroduction (Sliworsky and Nero 2003). Peregrine falcons are not limited to a specific habitat type, and can be found in a range of **biomes**, usually associated with cliffs (White *et al.* 2002). They can also be found nesting on tall buildings in large cities (White *et al.* 2002). Peregrine falcons will fiercely defend their territories from intruding falcons within 200 m of the nest; outside this range favoured prey species will elicit an attack (White *et al.* 2002).

Peregrine falcons arrive in Manitoba from wintering grounds in Central and South America from mid April to mid May (Sliworsky and Nero 2003). Fall migration begins in August and continues into September (Sliworksy and Nero 2003).

The effect of disturbance on peregrine falcons is largely dependent on their previous exposure to disturbance; more remotely located pairs are more significantly affected (White *et al.* 2002). They are susceptible to collisions with vehicles, electrocution by transmission lines, and wire strikes (White *at al*. 2002).

Peregrine falcons were not observed during bird surveys in the Project Study Area. As there is no suitable breeding habitat in the Local Study Area apart from major cities including Winnipeg, Portage la Prairie, and outside the Study Area in Brandon, peregrine falcon will not be considered for the effects assessment.

BURROWING OWL

Burrowing owls are rarely found in Manitoba and are at risk of extirpation; observations are restricted to the southwest of the province (De Smet 2003b; Map 12 – Burrowing owl breeding range). They are listed as endangered by SARA and MESA. The estimated population in North America is 600,000 individuals (Rocky Mountain Bird Observatory 2007). Manitoba Conservation (2010b) reports that nine nesting pairs of burrowing owls were found in Manitoba in 2009. Of these, only five were successful, and raised fewer young than in the previous year. Despite the reduced nesting success in 2009, the burrowing owl population has begun to recover in the last few years (Manitoba Conservation 2010b). Burrowing owls are commonly associated with open landscapes including grasslands, deserts, pastures, and agricultural lands (Haug *et al.* 1993). In Manitoba, most breeding pairs were found in the extreme southwestern corner of the province and one pair was located near Carberry.

Breeding habitat associated with burrowing owls includes treeless short grass prairies, with an abundance of small mammals (Haug *et al.* 1993). Small mammals almost always dig nest burrows utilized by burrowing owls originally, usually associated with a small hummock and bare ground or short grasses around entrances (Rich 1986).

Burrowing owls have been observed nesting in loose colonies with distances between nest burrows ranging from 165 to 351 m with home range size for breeding pairs averaging 2.41 km^2 (Haug and Oliphant 1990). Only the nest burrow itself is defended against intruders, foraging areas are not defended (Haug *et al.* 1993).

The arrival of burrowing owls from their wintering grounds in the southern United States and Mexico is typically from late April to early May (De Smet 2003b). While their departure in the fall typically begins in September, the last owls depart by the end of October (De Smet 2003b).

The most significant factor affecting burrowing owl populations is the loss and degradation of habitat such as conversion of native prairie to agricultural uses and the control of their prey species (Haug *et al.* 1993). No burrowing owls were observed along the FPR; however a burrow was identified in the Project Study Area.

SHORT-EARED OWL

Despite a largely continuous distribution ranging from northern Canada to northern Mexico (Holt and Leasure 1993), the short-eared owl is listed as special concern under SARA. Short-eared owl populations have declined by approximately 23% over the past decade with habitat loss and the degradation of habitat areas, particularly wintering areas, considered the primary cause (COSEWIC 2008a). There are an estimated 700,000 individuals in North America (Rocky Mountain Bird Observatory 2007). Short-eared owls are found throughout Manitoba, except in contiguous forested areas (Holland and Taylor 2003h). Breeding habitat consists of open landscapes with an abundance of small mammal prey (Holt and Leasure 1993).

Short-eared owls mainly nest on the ground, usually in areas with vegetation tall and dense enough to provide suitable cover for incubating females (Hold and Leasure 1993). They are the only owl species known to construct their own nests, typically by scraping the ground and lining the depression with vegetation (Clark 1975). During the breeding season short-eared owls' territories are associated with nesting and foraging behaviours (Clark 1975). In Manitoba mean territory size was reported to be 97.65 ha (Clark 1975).

The migratory behaviour of the short-eared owl is not well studied, but appears irregular and linked to prey abundance (Clark 1975). In Manitoba short-eared owls typically arrive in late March and early April and migrate after the breeding season, from August to October (Holland and Taylor

2003h). Dependence on small mammals as the primary food source may lead to nomadic behaviour (Holt and Leasure 1993). Their nomadic nature may result in population declines due to habitat loss in the form of agricultural expansion, habitat degradation, and habitat loss due to forest encroachment (Holt and Leasure 1993).

While short-eared owls tend to select open areas rather than non-open forested stands (Taylor 2003; COSEWIC 2008a), habitat fragmentation is expected to have an indirect negative effect, as nest predation increases with increased fragmentation (COSEWIC 2008a). There are also recorded occurrences of short-eared owl collisions with transmission lines (COSEWIC 2008a).

Two short-eared owls were observed during the nocturnal owl surveys. One owl was detected 7 km south of Mafeking along Highway 10. The second owl was observed 5 km south of the Overflowing River along Highway 10 (Map 13 – Extent of short-eared owl observations in or bordering the Local Study Area).

CHIMNEY SWIFT

Chimney swifts are listed as threatened under SARA and endangered under MESA. They are rare but locally common breeding birds in Manitoba, mostly observed in urban areas (Taylor and Holland 2003a). Throughout their range, concentrations have been reported in urban areas with a large number of structures for roosting and nesting habitat (Cink and Collins 2002). Chimney swifts are less commonly observed nesting in tree cavities and caves (Cink and Collins 2002). Their nests are constructed in a variety of human-made structures, such as chimneys, barns, air vents, old wells, and silos (Cink and Collins 2002). Nests are constructed with small twigs held together with saliva excreted by the chimney swift (Cink and Collins 2002).

Chimney swifts do not exhibit territorial behaviour, but structures used for nesting usually contain a single pair (Cink and Collins 2002). They show a strong tendency to utilize the same nest site in subsequent years (Cink and Collins 2002). When roosting, chimney swifts may congregate in greater numbers (Cink and Collins 2002).

Chimney swifts arrive in Manitoba in early May and fall migration is from mid August to mid September (Taylor and Holland 2003a). They are long distance migrants, migrating south to the Amazon Basin in South America (Cink and Collins 2002).

The loss of suitable urban nesting habitat in the form of changes to chimney structure on residential housing has been identified as a significant factor in the declining chimney swift populations (Cink and Collins 2002). In addition to the loss of urban habitat, logging operations in old growth forests have resulted in fewer mature trees with suitable cavities for nesting and roosting (Cink and Collins 2002). Currently, there are an estimated 15,000,000 individuals in North America (Rocky Mountain Bird Observatory 2007).

Chimney swift was not observed during field surveys primarily because urban areas were not included in field sampling. As there is no suitable breeding habitat in the Local Study Area apart from urban environments (which the FPR does not intersect), chimney swift will not be considered further in the effects assessment.

COMMON NIGHTHAWK

Common nighthawks are listed as threatened by SARA, and are not listed by MESA. There are an estimated 10,000,000 common nighthawks in North America (Rocky Mountain Bird Observatory 2007). They breed throughout Manitoba, with the exception of the extreme north (Taylor 2003j). Their habitat requirements are not highly specific; they can be found nesting on sand dunes, beaches, logged or burned areas of forests, forest clearings, prairies, farmlands, and gravel rooftops (Poulin *et al.* 1996).

Common nighthawks do not build nests; the female lays her eggs directly on the ground, usually on loose stones or bare rock (Taylor 2003j). The initiation of eggs has been documented from mid June until late July (Taylor 2003j). During the day, common nighthawks roost in trees averaging 12 m tall, most often on cooler north facing slopes (Fisher *et al.* 2004).

Common nighthawks are highly territorial, **crepuscular** birds (Poulin *et al.* 2003). They defend breeding territories and productive foraging territories through vocalizations combined with dives upon intruders (Roth and Jones 2000). In other situations common nighthawks may form loose groups while hunting insects over wetlands, rivers and lakes (Taylor 2003j).

The common nighthawk has one of the greatest migration distances of the North American migratory birds (Poulin *et al.* 1996). In Manitoba they arrive from their wintering grounds in mid to late May (Taylor 2003j). Common nighthawks begin their southward migration from Manitoba in mid August with some late departures in September (Taylor 2003j). The wintering grounds of the common nighthawk are located in South America (Poulin *et al.* 2003).

The declines in common nighthawk populations have been attributed to habitat loss and degradation as well as the use of insecticides (Behrstock 2001).

Six common nighthawks were observed during the breeding bird surveys. The most southerly common nighthawk was observed 11.75 km northwest of Plumas while the most northerly observation was 34 km north of Gillam (Map 14 – Extent of common nighthawk observations in or bordering the Local Study Area). All common nighthawks identified and recorded during the 2010 breeding bird surveys correspond with all known ranges and distributions of this species (Bookhout 1995; Carey *et al.* 2003).

Common nighthawks tend to become rarer in northern Manitoba. Between 2004 and 2007 only two common nighthawks were observed, one during the Conawapa Generation Station environmental studies in 2004 and a second during the Keeyask Generation Station environmental studies in 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009).

WHIP-POOR-WILL

Whip-poor-wills are listed as threatened by SARA, and are not listed by MESA. They are common breeders throughout the southern boreal region of Manitoba, extending from the southeastern corner of the province up to central Saskatchewan (Taylor and Holland 2003b). There are an estimated 1,600,000 whip-poor-wills in North America (North American Bird Observatory 2007). Favoured habitat consists of deciduous and/or mixedwood forests with a fairly open understory (Cink 2002). Whip-poor-wills' habitat preference is significantly associated with edge habitat of regenerating woodlands (Wilson and Watts 2008). Territory size is not well studied, but an average of 5.1 ha has been reported (Cink 2002).

Whip-poor-wills arrive in Manitoba from their wintering grounds in early May (Taylor and Holland 2003b). They lay their eggs directly on the ground of the forest floor, usually in a clump of leaf litter, with some concealment provided by small herbaceous plants (Cink 2002). Whip-poor-wills depart breeding grounds in its northern breeding range for wintering grounds along the Gulf of Mexico and Central America (Cink 2002).

Their habit of resting on gravel roadways results in a high number of traffic collisions (Cink 2002). Small population declines have been attributed to habitat loss/degradation due to the conversion of woodlands to agriculture and forest succession closing favoured open habitat (Cink 2002).

No whip-poor-wills were observed during the 2010 breeding bird surveys. A few whip-poor-wills were recorded during 2009 surveys in areas west of Lake Manitoba (Map 15 –Extent of whip-poor-will observations in or bordering the Local Study Area).

RED-HEADED WOODPECKER

Red-headed woodpeckers are listed as threatened by SARA and are not listed by MESA. They are uncommon in Manitoba, found south of the boreal forest (Taylor 2003i). Favoured nesting habitat includes relatively open deciduous woodlands with little to no understory (Conner 1976). Red-headed woodpeckers nest in cavities in **snags** (Vierling and Lentile 2006). The nest cavity is excavated in standing dead trees, which are typically perpendicular to the ground, often with the bark around the cavity entrance missing (Smith *et al.* 2000). Nesting in Manitoba begins in late May, with eggs reported until the end of June (Taylor 2003i).

Information on the size of red-headed woodpecker summer breeding territory is sparse. They exhibit territorial behaviour throughout the summer and winter, with very small winter territories (0.04 ha; Doherty *et al.* 1996). Red-headed woodpeckers are migratory; most arrive in Manitoba in mid May, with the fall migration south in August and September (Taylor 2003i).

Declines in red-headed woodpecker populations may be associated with removal of standing dead trees that are required for nesting (Taylor 2003i). The degradation and loss of habitat, fire suppression, and changes in agricultural practices are likely to have played a significant role in the declines of red-head woodpeckers (Smith *et al.* 2000). The estimated population of red-headed woodpeckers in North America is 2,500,000 (Rocky Mountain Bird Observatory 2007).

A single red-headed woodpecker was observed along the Rat River north of Otterburne during the breeding bird surveys (Map 16 – Extent of red-headed woodpecker observations in or bordering the Local Study Area). The location of this red-headed woodpecker corresponds with all known ranges and distributions of this species (Smith *et al.* 2000; Carey *et al.* 2003). A few red-headed woodpeckers were recorded incidentally during other surveys in 2009 and 2010.

OLIVE-SIDED FLYCATCHER

Olive-sided flycatchers are listed as threatened by SARA and are not listed by MESA. The estimated population in North America is 1,200,000 (Rocky Mountain Bird Observatory 2007). This species has a relationship to semi-open forest and natural edge adjacent to wetlands. As such, it was selected as the VEC associated with this habitat type. Also contributing to its selection was the availability of information to construct a simple model of habitat preference and distribution in Boreal Plain, Boreal Shield, Taiga Shield, and Hudson Plain Ecozones, and wetland, shrubland and open coniferous wet forest habitats (Altman and Sallabanks 2000; Carey *et al.* 2003).

Olive-sided flycatchers are sparsely distributed south of the boreal forest tree-line in Manitoba and are usually found nesting and foraging near boreal forest bogs, wet areas, or recently burned stands (Altman and Sallabanks 2000; Koonz and Taylor 2003). In northern conifer forests they are most commonly found in edge habitats such as meadows, bogs, and clear-cuts, which appears to correspond to the availability of standing dead trees and remnant live trees that are important for singing and foraging perches (Altman and Sallabanks 2000).

The attraction to human-caused edge habitats, such as commercial logging, for nesting and foraging purposes is a significant factor in the nesting success of olive-sided flycatchers (Robertson and Hutto 2007). Individuals nesting in recently logged forests have significantly lower rates of nest success when compared to those nesting in naturally burned stands (Robertson and Hutto 2007). Nesting pairs of olive-sided flycatchers have relatively large territories stretching to approximately 1.6 km per pair (Bent 1942). In habitat with dense visual buffers pairs were found nesting approximately 200 m apart (Altman 1998).

Olive-sided flycatchers migrate to Central America and northern South America in the fall, where they favour wintering habitat similar to their breeding habitat in North America (Altman and Sallabanks 2000). Their dependence on flying insects for foraging results in a late spring arrival and early fall departure (Altman and Sallabanks 2000).

Olive-sided flycatchers were present along the entire length of the Bird Study Area of the Project route (Map 17 – Extent of olive-sided flycatcher observations in or bordering the Local Study Area). Observations were much more prevalent in the north than in the area south of The Pas. South of Swan River, observations of olive-sided flycatchers were infrequent and widely separated, corresponding with their patchy distribution south of the boreal forest. This species was only recorded during the breeding bird surveys. In all, 198 individuals were observed. The locations of all olive-sided flycatchers identified and recorded during the 2010 breeding bird surveys correspond with all known ranges and distributions of this species (Altman *et al.* 2000; Carey *et al.* 2003).

Olive-sided flycatchers were observed and documented during bird surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 to 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Olive-sided flycatchers made up a small proportion of the birds identified (2 to 8) individuals for any given year).

LOGGERHEAD SHRIKE

Loggerhead shrikes are listed as threatened by SARA and endangered by MESA. The loggerhead shrike is a rare and declining passerine in Manitoba, usually found in the southwest of the province and around Winnipeg (De Smet 2003c; Map 18 – Loggerhead shrike breeding range). Manitoba Conservation (2010b) reports that nesting pairs of western loggerhead shrikes have dwindled from 327 in 1993 to 46 in 2009. Similar declines have been observed throughout the species' range. The North American population is currently estimated at 3,700,000 individuals (Rocky Mountain Bird Observatory 2007). Increased mortality of birds in their breeding ranges, wintering ranges, and during migration, compounded with increased predation on nests and young, have led to the decline. More recently, long periods of cool, wet weather have resulted in increased nestling mortality. Few eastern loggerhead shrikes remain in Manitoba. Only three were observed in 2009. Return rates, movements, and survival rates of western and eastern loggerhead shrikes in Manitoba are assessed by banding young birds. Mortality after fledging, during migration, and in wintering ranges is the suspected cause of low numbers of young returning to nest (Manitoba Conservation 2010b).

Favoured breeding habitat consists of open landscapes such as pastures with fences/hedgerows, roadsides, agricultural fields, golf courses, and riparian areas (Yosef 1996). This open habitat is often associated with interspersed woody vegetation utilized for perching and foraging (Michaels and Cully 1998). Loggerhead shrikes typically nest in woody vegetation such as shrubs and trees that provides suitable cover and protection from predators (Porter *et al.* 1975). They may utilize nests constructed in previous years due to site fidelity and ease of maintenance compared to building a new nest (Yosef 1996).

The loggerhead shrike displays a strong tendency towards territorial behaviour with territory sizes averaging 9.3 ha with a range from 0.77 to 17.6 ha (Yosef and Grubb 1994). The size of loggerhead shrike territories is associated with the size of the prey base and suitable hunting perches within the local habitat (Yosef and Grubb 1994). The loggerhead shrike exhibits unique foraging and hunting behaviour in that upon capture, the prey (insects or small mammals) is impaled on thorns, sharp branches, or barbed wire fences (Yosef 1996).

Loggerhead shrikes are diurnal migrants, with migration occurring over a relatively long period due to short flights interrupted for feeding (Yosef 1996). Loggerhead shrikes arrive in Manitoba from their wintering grounds in late April and May, with the fall migration occurring at the end of August (De Smet 2003c). An eastern race of the loggerhead shrike (an endangered subspecies) has been documented in East St. Paul, a community found just north of Winnipeg near low density housing areas (Carey *et al.* 2003)

The declines in loggerhead shrike populations show a strong correlation with increased use of **organochlorides** in agricultural activities (Yosef 1996). The application of insecticides on agricultural lands has been associated with localized declines in loggerhead shrike populations (Bellar and Maccarone 2002). The loss of suitable breeding habitat in the form of changing agricultural practices such as the removal of trees and hedgerows is contributing to declining loggerhead shrike populations (Bellar and Maccarone 2002). No loggerhead shrikes were observed during bird surveys in the Project Study Area.

SPRAGUE'S PIPIT

Sprague's pipits are listed as threatened by SARA and are not listed by MESA. Sprague's pipits inhabit southwestern Manitoba, are characteristic of mixed-grass prairie, and are associated with open grasslands (Holland *et al.* 2003a; Map 19 – Sprague's pipit breeding range). As such, they were selected as of the VEC for this habitat type. They are rarely observed east and north to the edge of the boreal forest (Martinez-Welgan *et al.* 2000; Holland *et al.* 2003a). Native pastures and seeded pastures are favoured habitat, and hay fields are used less frequently (Davis *et al.* 1999). Sprague's pipits are more often found in moderately to lightly grazed pastures than heavily grazed ones (Davis *et al.* 1999). The North American population is estimated at 900,000 individuals (Rocky Mountain Bird Observatory 2007). Manitoba Conservation (2010b) reports this species' numbers have been relatively stable with slight declines in recent years. Nesting habitat has also been reduced in southern Manitoba (Manitoba Conservation 2010b).

Sprague's pipits typically construct their nests on the ground in dense grasses with low forb densities; the nests are usually constructed with a dome of grasses (Sutter 1997). The male exhibits territorial behaviour and defends the territory against other intruding males by flying 50 to 100 m above ground and singing intermittently (Robbins 1998). These display flights last a few minutes to approximately half an hour (Robbins 1998). Territories in prime breeding habitat with high densities of males can be tightly packed, with five territories in 5 ha in grasslands with no grazing (Robbins 1998; Robbins and Dale 1999).

Sprague's pipits are short to medium distance migrants, arriving in the southern Canadian Prairies in the spring and departing in the fall for the southern United States and northern Mexico (Robbins and Dale 1999). As Sprague's pipits tend to be recorded on their breeding territories, migration dates are not defined, although individuals have been observed from late April to late September in Manitoba (Holland *et al.* 2003a).

Nest depredation and brood parasitism have been identified as major reasons for nest failure (Davis 2003). The most significant factor in the species' decline is the conversion and fragmentation of native grasslands to agriculture (Davis *et al.* 1999). No observations of Sprague's pipit were made during bird surveys in the Project Study Area.

GOLDEN-WINGED WARBLER

Golden-winged warblers are listed as threatened by SARA, and are not listed by MESA. Golden-winged warblers are uncommon and localized breeders in Manitoba, with an estimated few hundred breeding pairs in the province (Edie *et al.* 2003a). There are an estimated 210,000 individuals in North America (Rocky Mountain Bird Observatory 2007). Golden-winged warbler habitat consists mainly of forest edges, shrubby fields, bogs, and marshes (Confer 1992). Bur-oak woodland, young tamarack and willow stands, and other shrubby habitat are also used (Edie *et al.* 2003a). As such, the golden-winged warbler was selected as a VEC for this habitat. Favoured nesting habitat consists of abandoned farmland in early stages of succession, and recently cut forest areas such as clear cut mature forest and transmission line rights-of-way that are not mowed, recent forest fires and blowdowns (Buehler *et al.* 2007). Golden-winged warblers construct their nests at the base of forbs or stem of herbaceous plants, utilizing the leafy material as a form of cover (Confer 1992).

Golden-winged warbler territories are established and defended by males and typically range in size from 0.4 to 6.0 ha (Confer 1992). Boundaries are formed by habitat features such as dense stands or rows of trees and/or by the proximity of other males (Confer 1992).

Limiting factors of the golden-winged warbler populations have been identified as loss of breeding and wintering habitat, brood parasitism, and **interspecific competition** and **hybridization** with blue-winged warblers (Confer 1992; Edie *et al.* 2003a).

Golden-winged warblers are Neotropical migrants, breeding in the north-eastern and north-central United States and into southern Ontario and southeast Manitoba, and wintering in south Central America and northern South America (Confer 1992). They reach their breeding grounds from mid May to late July, and have been observed outside their breeding areas as late as October (Edie *et al.* 2003a).

Golden-winged warbler observations were very limited, and were all made in two relatively small clusters (Map 20 – Extent of golden-winged warbler observations in or bordering the Local Study Area). One cluster of observations was made along the Duck Mountains and another in an area east of Winnipeg, near the Riel Converter Station site. Other than in these two places, no observations of golden-winged warbler were made. A total of 23 individuals were observed during the breeding bird survey, and their locations correspond with all known ranges and distributions of this species (Confer 1992; Carey *et al.* 2003).

CANADA WARBLER

Canada warblers are listed as threatened by SARA, and are not listed by MESA. They are found in the southern half of the boreal forest in Manitoba, and more commonly in west central Manitoba (Holland *et al.* 2003c). They inhabit moist mixedwood forests with dense and diverse understory growth, often near open water such as lakes or rivers (Conway 1999). As such, they were also selected as a VEC for this habitat type. Nesting habitat is usually associated with wet, mossy, forested areas; the nest itself is located in tree stumps, fallen logs, and dense ferns (Conway 1999). Nests are very well hidden and are usually inferred from adult behaviour, such as territorial singing, alarm calls, and carrying food (Holland *et al.* 2003c). Territory sizes of Canada warblers vary according to regional habitat conditions (Conway 1999); Martin (1960) observed territories of Canada warblers in black spruce dominated stands averaging 0.2 ha.

There are an estimated 1,400,000 Canada warblers in North America (Rocky Mountain Bird Observatory 2007). Limiting factors of the Canada warbler are reduction or loss of breeding habitat due to human disturbance (e.g., logging operations) that reduce the density of understory growth, or massive loss of the forest canopy (Conway 1999). There has also been some indication that Canada warbler populations respond positively to spruce budworm outbreaks then experience population declines in following years (Sleep *et al.* 2009).

Canada warblers are Neotropical migrants, traveling from their breeding range in the boreal regions of North America to wintering ranges in northern South America (Conway 1999). Fall migration is in August and September (Holland *et al.* 2003c). In spring, migrants arrive from mid May to early June (Holland *et al.* 2003c).

Factors limiting Canada warbler populations include habitat loss and degradation in wintering and breeding ranges, paved road development, habitat fragmentation, and decline in insect outbreak cycles (COSEWIC 2008b).

Canada warbler observations were made along a large portion of the Bird Study Area during breeding bird surveys (Map 21 – Extent of Canada warbler observations in or bordering the Local Study Area). They were most commonly found between The Pas and Swan River, in areas adjacent to the Porcupine Hills. The area surrounding The Pas appeared to be of some importance, as numerous Canada warbler observations were made. In all, 78 individuals were recorded. The location of all Canada warblers identified and recorded during the 2010 breeding bird surveys correspond with all known ranges and distributions of this species (Conway 1999; Carey *et al.* 2003).

BAIRD'S SPARROW

Baird's sparrows are not listed by SARA and are listed as endangered by MESA. There are an estimated 1,200,000 individuals in North America (Rocky Mountain Bird Observatory 2007). Baird's sparrow range is restricted to the southwestern corner of Manitoba, but this species is occasionally found in south-central Manitoba (De Smet 2003d). Nesting habitat in southwestern Manitoba typically consists of grazed short grass prairie intermixed with small patches of shrubby plants (Davis and Sealy 1998). Baird's sparrows are generally more abundant in native fields than hayed fields (Dale *et al.* 1997).

Periodic fires and some light to moderate grazing create optimal habitat for breeding (Green *et al.* 2002). Baird's sparrows construct their nests directly on the ground, usually at the base of a tuft of grasses utilizing surrounding dead grass for concealment (De Smet 2003d). A full clutch of eggs and incubation has been observed on nests in Manitoba by May 25 (Davis and Sealy 1998). During the breeding season the male Baird's sparrow is highly territorial (Green *et al.* 2002). Territory sizes average 1.5 ha (Winter 1999) and are defended against intruding males by singing and chase flights, particularly during the early spring nesting season (Green *et al.* 2002).

Baird's sparrows are short to medium distant migrants, breeding in the great plains of Canada and the northern U.S., and wintering in central Mexico and the southern U.S. (Green *et al.* 2002).The degradation and loss of optimal breeding habitat to agricultural expansion, habitat fragmentation, and habitat loss due to fire suppression and over grazing is a significant factor in Baird's sparrow populations (Davis *et al.* 1999).

Manitoba's current population of Baird's sparrow occurs outside of the Project Study Area, in southwestern Manitoba. As expected, no Baird's sparrows were observed during bird surveys in the Project Study Area. Based on limited to no potential interactions with the Project Components, Baird's sparrow will not be considered further in the effects assessment.

RUSTY BLACKBIRD

Rusty blackbirds are currently listed as a species of special concern under SARA. This is thought to be largely due to habitat conversion and blackbird control programs occurring in the birds' United States wintering range (COSEWIC 2006a). There are an estimated 2,000,000 individuals in North America (Rocky Mountain Bird Observatory 2007). Rusty blackbirds are not listed by MESA. While rusty blackbird breeding range extends over much of Canada (Avery 1995), in Manitoba they are typically found north of the 55th parallel (Nero and Taylor 2003). This is in contrast to the Brewer's blackbird, which is more commonly found in the south of the province and a species that the rusty blackbird is often mistaken for.

Rusty blackbirds are uncommon breeders in south central Manitoba, with favoured breeding habitat in wet boreal forest regions (Nero and Taylor 2003). These habitats include the mixed woods regions north to the edge of the tundra, usually found near wet areas such as bogs, fens, and riparian areas (Avery 1995). Rusty blackbirds construct their nests in close proximity to water, above ground on stumps, shrubs, and trees (Avery 1995). The nest itself is constructed close to the trunk of a tree or shrub with dense foliage to provide concealment (Avery 1995). They do not reuse nests, constructing a new nest for each nesting attempt (Avery 1995). In Manitoba they are commonly found nesting in the muskegs of the northern boreal forests (Nero and Taylor 2003). Rusty blackbirds are not colonial nesters in Manitoba, but may group together when disturbances are experienced (Nero and Taylor 2003).

Rusty blackbirds are seasonal migrants, usually arriving in Manitoba by early April (Nero and Taylor 2003). The southward migration begins in late July in the north and September in southern Manitoba (Nero and Taylor 2003). During migration this species will often form or join large flocks of other blackbirds (Nero and Taylor 2003).

The degradation and loss of breeding habitat in wet forested areas is considered a significant threat to the rusty blackbird population (Avery 1995). Habitat losses in boreal wetlands have been attributed to the creation of reservoirs flooding large tracts of boreal forest, the harvest of peat for agricultural purposes, and draining of wetlands (Greenberg and Droege 1999). Few direct effects of transmission line construction on rusty blackbirds are expected.

A total of 184 rusty blackbirds were observed during breeding bird surveys. The most southerly observation was 3 km west of east of Briggs Spur while the northern limit was located 22.5 km northeast of Limestone Generating Station (Map 22 – Extent of rusty blackbird observations in or bordering the Local Study Area). The locations of all rusty blackbirds identified and recorded during the 2010 breeding bird surveys correspond with all known ranges and distributions of this species (Altman and Sallabanks 2000; Carey *et al.* 2003).

Rusty blackbirds were observed and documented during bird surveys completed for Keeyask and Conawapa Generation Station environmental studies completed between 2004 to 2007 (TetrES 2005, 2006a, 2006b, 2007, 2008a, 2008b, 2009). Rusty blackbirds made up a small proportion of the birds identified (1 to 15 individuals) for any given year.

YELLOW-BREASTED CHAT

Yellow-breasted chats are listed as special concern under SARA, and are not listed by MESA. The North American population is estimated at 11,000,000 individuals (Rocky Mountain Bird Observatory 2007). Habitat selection by yellow-breasted chats is variable and typically consists of areas without a closed tree canopy including shrubby habitat along streams, swamps, pond margins, forest edges, burned-over forests, logged areas, fencerows and upland thickets of recently abandoned farmland (Eckerle and Thompson 2001). This makes yellow-breasted chat a relatively versatile species, as populations increased in rural settlements but may now be again declining due to forest succession (Eckerle and Thompson2001).

Yellow-breasted chats are not usually found in Manitoba but do have a breeding range in southern Saskatchewan and Ontario (Taylor 2003). Occurrences of yellow-breasted chat in Manitoba are seldom (Taylor 2003). Yellow-breasted chats were not observed during breeding bird surveys. Based on limited to no potential interactions with the Project Components, yellow-breasted chat will not be considered further in the effects assessment.

4.3.3.8 Species at Risk (COSEWIC)

BOBOLINK

Bobolinks are being considered for threatened status by SARA (COSEWIC 2010b). Bobolinks are found in prairie and agricultural areas in Manitoba up to the fringes of the boreal forest (Holland *et al.* 2003f). Favoured breeding habitat consists of tall grasses surrounding wetlands, lush pastures, and agricultural fields such as alfalfa (Holland *et al.* 2003f). Bobolinks favour interior habitat over edge habitat and may be prone to fragmentation of their breeding habitat (Fletcher 2005). The average territory size of males in breeding habitat was 0.72 ha in a meadow in which haying and cattle grazing occurred throughout the season (Wittenberger 1978).

During the breeding season bobolinks are highly territorial, however leading up to migration and during the remainder of the year they are highly gregarious (Martin and Gavin 1995). Females construct nests on the ground, typically at the base of a small forb or herbaceous plant in tall dense vegetation (Martin and Gavin 1995). Bobolinks show a high degree of nest site fidelity (within 1 km) in habitats with high rates of nest success (Wittenberger 1978).

Bobolinks are long distance migrants, traveling to and from Argentina in South America during the spring and fall migratory periods (Holland *et al.* 2003f). Departure from breeding areas begins as early as late July and continues into mid August; individuals congregate around fresh water bodies to moult before making the final journey south (Martin and Gavin 1995). A total of 18 individuals were recorded during the breeding bird surveys completed in 2010, of which, all locations correspond with all known ranges and distributions of this species (Martin *et al.* 1995; Carey *et al.* 2003).

Although bobolink is not a VEC, potential Project-related effects are assumed to be similar to other bird species living in similar habitats such as Sprague's pipit (i.e., prairie and pastures), loggerhead shrike (i.e., open landscapes such as pastures with fences/hedgerows), mallard (i.e., large expanses of tall grasses surrounding wetlands), and in the habitat of other bird species found in alfalfa fields in southern Manitoba. If this species is encountered in the Local Study Area, mitigation measures for species at risk will apply including timing and buffer restrictions (see Section 5.2). Follow-up and monitoring recommendations will be considered for this species if its status is scheduled or changed. There will be no additional discussion of Project-related effects for this species.

CHESTNUT-COLLARED LONGSPUR

Chestnut-collared longspurs are being considered for threatened status by SARA (COSEWIC 2010b). Chestnut-collared longspurs are found in southwestern Manitoba in the remaining unbroken mixed-grass prairies and close cropped grasslands and pastures (Holland *et al.* 2003g). Territory sizes of chestnut-collared longspur range from 0.23 to 0.42 ha in prime breeding habitat in Manitoba (Harris 1944). The probability of occurrence of chestnut-collared longspur increases in response to the size of the area of optimal habitat (Davis 2004).

Males defend their territory during the breeding season against intruding males as well as **intraspecific competitors** (Hill and Gould 1997). Females construct nests directly on the ground in sparse vegetation with some concealment provided by grassy vegetation around the nest (Harris 1944). The loss and conversion of short-grass and mixed-grass prairie in the form of encroachment of tall and invasive grasses and woodlands in combination with the conversion of native grasslands to agricultural uses has been identified as the leading cause of population declines (Askins *et al.* 2007). Increased vegetation density due to the increased moisture in the 1990s is also thought to have led to habitat loss (Holland *et al.* 2003g).

Chestnut-collared longspurs arrive in Manitoba mid April and the southward migration occurs from mid August to early September (Harris 1944; Holland *et al.* 2003g). Chestnut-collared longspurs migrate south to northern Mexico and the southern Unites States (Hill and Gould 1997). No chestnut-collared longspurs were recorded during the bird surveys in the Project Study Area.

Although chestnut-collared longspur is not a VEC, potential Project-related effects are assumed to be similar to other bird species such as Sprague's pipit found in prairie and pastures in southern Manitoba. If this species is encountered in the Local Study Area, mitigation measures for species at risk will apply including timing and buffer restrictions (see Section 5.2). Follow-up and monitoring recommendations will be considered for this species if its status is scheduled or changed. There will be no additional discussion of Project-related effects for this species.

HORNED GREBE

The western population of horned grebe are being considered for Species of Concern status by SARA (COSEWIC 2010b). Horned grebes occupy small ponds, sloughs and shallow, protected inlets on lakes in both the plains and boreal forests of Manitoba (Godfrey 1986) These water bodies are selected as breeding habitat; floating nests are constructed amongst sedges, rushes and cattails (Stedman, 2000). Horned Grebes usually nest solitarily or in small aggregations where feeding and breeding rituals occur in open water and will travel several kilometres from their breeding site to forage for aquatic insects (Stedman 2000).

During the breeding season horned grebes are intensely territorial and monogamous with impressive breeding rituals (Stedman 2000). Nests, made of bulrushes and cattails, are constructed by both male and female and float in shallow water at the base of emergent vegetation or near the shoreline (Stedman 2000). Like the nest, both male and female participate in the incubation of the eggs (5 to 7 eggs laid per nesting pair) for 24 days (Godfrey 1986).

Horned grebes are short-distance distance migrants, traveling to and from Florida or the west coast of California during the spring and fall migratory periods (Holland et al.2003j). Between September and November, Horned Grebes tend group on lakes and rivers before they travel south and will return to breeding grounds in southern Manitoba at the beginning of May and northern Manitoba by early June (Holland et al 2003j) . A total of 2 individuals were recorded during the breeding bird surveys completed in 2010, of which, all locations correspond with all known ranges and distributions of this species (Holland et al 2003j).

Although horned grebe is not a VEC, potential Project-related effects are assumed to be similar to other bird species living in similar habitats such as mallard (i.e., productive wetlands). If this species is encountered in the Local Study Area, mitigation measures for species at risk will apply including timing and buffer restrictions (see Section 5.2). Follow-up and monitoring recommendations will be considered for this species if its status is scheduled or changed. There will be no additional discussion of Project-related effects for this species.

4.3.4 Songbirds and Other Birds

Passerines, including songbirds and other perching birds, are the most abundant of all bird groups in Manitoba. Some of the bird families in this group such as chickadees, nuthatches and some finches and jays are year-round residents, while other groups including but not limited to flycatchers, swallows, thrushes, kinglets, pipits, vireos, tanagers, blackbirds, sparrows and warblers are mainly short-distance or long-distance migrants. A total of 120 species were observed during bird surveys in the Local Study Area.

Many songbird families and species in this group exhibit strong breeding and foraging habitat preferences, often utilizing narrow niches within selected habitats (Power 1971). This group uses a wide variety of habitats ranging from agricultural lands to forest and wetlands, with densities varying according to habitat type. Due to increased vegetation diversity at edge habitats and forest openings such as transmission line RoWs, corresponding increases in passerine diversity may occur (Yahner 1988; Gates and Giffen 1991). Conversely, population declines observed in some birds may be attributed to their habitat requirements, as species that favour interior habitat will experience declines as the habitat becomes increasingly fragmented into smaller and smaller patches (Bender et al. 1998). Olive-sided flycatcher, Sprague’s pipit, golden-winged warbler, and Canada warbler are examples of passerines, are species at risk, and have been selected as VECs. Common nighthawks and whip-poor-wills, members of the Goatsuckers family, are also species at risk and VECs that are found in the Project Study Area. All of these species are listed and described in Section 4.3.3.6.

4.3.4.1 Migration in Passerines

Passerines are mostly seasonal residents; of the 165 species found in the Local Study Area, only 32 are year-round inhabitants (Carey *et al.* 2003) (see Appendix F-1). Seasonal migrations into and out of the Project Study Area occur in spring and fall, mostly to and from Central and South America.

Canada warblers, golden-winged warblers, and olive-sided flycatchers migrate in the fall to wintering habitats in Central America and northern South America (Confer 1992; Conway 1999; Altman and Sallabanks 2000). Sprague's pipits migrate a relatively short distance to the southern United States and northern Mexico (Robbins and Dale 1999). The conditions and interactions experienced during migration and on wintering grounds can have a significant effect on population trends in the subsequent season (Norris and Marra 2007).

Some passerines remain in Manitoba year-round. Winter habitat quality can have a significant effect on distribution of winter resident birds, for example boreal chickadees, which show a strong association with mature forest stands over stands regenerating after timber harvest (Hadley and Desrochers 2008). Wintering passerines show a significant preference for woodland habitats compared to open and grassland habitats (Lewke 1982).

4.3.5 Habitat Use by Valued Environmental Components

The general agreement between logistic regression and NMS analysis to determine habitat areas selected by birds in each ecoregion is important. These statistical techniques are largely independent where having the results from one analysis validate results from the other shows that the assessment of certain habitat classes on bird species are correct. However, while important habitat types can be delineated, there is still some consideration to be given for only a small amount of variation in bird species presence as explained by habitat classes.

Results of cluster analysis for this ecoregion (Appendix E, Figures E-7 to E-12) indicate some association between bird groups based on habitat classes. These groups did not form singular blocks, however, and are distributed amongst other groups where the selection for other habitat classes is occurring. This would indicate that factors other than the selection of a primary habitat class is taking place and could include the selection for multiple habitat classes by species or spatial variation in the selection of habitat by species. A small number of apparent habitat associations (e.g., yellow rail associated with Sprague's pipit) may have resulted from wet climatic conditions, especially in areas of western Manitoba in 2010. See Table 4-6. A more detailed interpretation of habitat selection by VEC species in this ecoregion can be found in Appendix E.

Table 4-6. Species Associations for Selected VEC Species

VEC Species	Ecoregions Represented	Primary Habitat Considerations	LCCEB Habitat	Associated Species Based on Similar Habitat Requirements
Mallard	Lake Manitoba Plain Interlake Plain Mid-Boreal Lowland	Indicator of wetland bird associations and community health	Wetland-shrub Wetland-herb Pasture	American bittern, American crow, American goldfinch, black tern, blue-winged teal, brown-headed cowbird, clay-colored sparrow, common raven, common yellowthroat, eastern kingbird, gray catbird, greater yellowlegs, killdeer, Le Conte's sparrow, lesser yellowlegs, Lincoln's sparrow, magnolia warbler, marsh wren, Nashville warbler, northern harrier, northern waterthrush, pied-billed grebe, red-eyed vireo, red-winged blackbird, rusty blackbird, sandhill crane, savannah sparrow, sedge wren, song sparrow, sora, swamp sparrow, Tennessee warbler, tree swallow, Virginia rail, white-throated sparrow, Wilson's snipe, winter wren, yellow rail
Sandhill crane	Lake Manitoba Plain Interlake Plain Mid-Boreal Lowland Hayes River Upland Hudson Bay Lowland	Indicator of global sparsely treed black spruce or tamarack peatlands and other wetland bird associations and community health	Wetland-herb Herb Broadleaf-open Coniferous-sparse Coniferous-open	American bittern, American coot, American crow, American goldfinch, barn swallow, black tern, blackpoll warbler, blue jay, blue-winged teal, Bonaparte's gull, Brewer's blackbird, brown-headed cowbird, chestnut-sided warbler, clay-colored sparrow, common raven, common yellowthroat, eastern kingbird, fox sparrow, gray catbird, greater yellowlegs, killdeer, Le Conte's sparrow, lesser yellowlegs, Lincoln's sparrow, mallard, magnolia warbler, marsh wren, Nashville warbler, olive-sided flycatcher, orange-crowned warbler, pied-billed grebe, red-winged blackbird, rusty blackbird, savannah sparrow, sedge wren, song sparrow, sora, swamp sparrow, Tennessee warbler, tree swallow, Virginia rail, western palm warbler, Wilson's snipe, Wilson's warbler, winter wren, yellow-headed blackbird, yellow rail
Great blue heron	Interlake Plain	Indicator of western wetland	Wetland-treed	hermit thrush, magnolia warbler, Nashville warbler, Swainson's thrush, ruby-crowned kinglet, western palm warbler, Wilson's

VEC Species	Ecoregions Represented	Primary Habitat Considerations	LCCEB Habitat	Associated Species Based on Similar Habitat Requirements
		treed bird associations and community health		warbler, yellow-bellied flycatcher
Bald eagle	Mid-Boreal Lowland Hayes River Upland	Indicator of mature northern and western riparian forest community health	Water Coniferous-dense	bay-breasted warbler, blue jay, boreal chickadee, brown creeper, Cape May warbler, golden-crowned kinglet, hairy woodpecker, mourning warbler, olive-sided flycatcher, red-breasted nuthatch, red crossbill, ruby-crowned kinglet, white-throated sparrow, white-winged crossbill, winter wren, yellow-rumped warbler, yellow warbler
Sharp-tailed grouse	Lake Manitoba Interlake Plain Mid-Boreal Lowland Churchill River Upland Hayes River Upland Hudson Bay Lowland	Indicator of grassland, shrubland and forest mosaic bird associations and community health	Theoretical habitat association shrublands, grasslands, pasture, herb, broadleaf open, mixedwood open, coniferous open, coniferous sparse	alder flycatcher, American crow, American godwit, American robin, Baird's sparrow, bay-breasted warbler, black-and-white warbler, black-capped chickadee, blackpoll warbler, black tern, blue-headed vireo, blue jay, Brewer's blackbird, brown creeper, brown-headed cowbird, brown thrasher, cedar waxwing, clay-colored sparrow, common raven, common redpoll, Connecticut warbler, eastern towhee, fox sparrow, Franklin's gull, gray jay, greater yellowlegs, hermit thrush, killdeer, least flycatcher, Le Conte's sparrow, marbled godwit, mourning dove, northern waterthrush, olive-sided flycatcher, orange-crowned warbler, ovenbird, Philadelphia vireo, pied-billed grebe, pileated woodpecker, red-billed nuthatch, ring-billed gull, rose-breasted grosbeak, ruffed grouse, sandhill crane, savannah sparrow, sora, swamp sparrow, Swainson's thrush, Tennessee warbler, veery, vesper sparrow, Virginia rail, warbling vireo, western meadowlark, western palm warbler, white-crowned sparrow, white-throated sparrow, Wilson's phalarope, Wilson's warbler, yellow-bellied flycatcher, yellow-bellied sapsucker, yellow-headed blackbird, yellow rail, yellow-rumped warbler, yellow-shafted flicker
Ruffed	Lake Manitoba	Indicator of	Broadleaf-	alder flycatcher, American bittern, American redstart, black-and -

VEC Species	Ecoregions Represented	Primary Habitat Considerations	LCCEB Habitat	Associated Species Based on Similar Habitat Requirements
grouse	Plain Interlake Plain Mid-Boreal Lowland	deciduous and mixedwood forest bird associations and community health	open Broadleaf-dense Shrub-tall	white warbler, black-capped chickadee, black-throated green warbler, brown-headed cowbird, Canada warbler, cedar waxwing, chestnut-sided warbler, Connecticut warbler , common yellowthroat, eastern wood-pewee, golden-winged warbler, great-crested flycatcher, hairy woodpecker, least flycatcher, Le Conte's sparrow, Lincoln's sparrow, mourning warbler, northern waterthrush, ovenbird, Philadelphia vireo, pileated woodpecker, red-winged blackbird, ring-billed gull, rose-breasted grosbeak, Swainson's thrush, swamp sparrow, Tennessee warbler, veery, white-throated sparrow, Wilson's phalarope, Wilson's snipe, yellow-bellied sapsucker, western palm warbler, yellow-shafted flicker, yellow warbler
Yellow rail	Lake Manitoba Plain Mid-Boreal Lowland	Indicator of sedge-dominated wetlands and other wetland bird associations and community health	Grassland Wetland-herb	American bittern, American crow, American goldfinch, black tern, blue-winged teal, Brewer's blackbird, brown-headed cowbird, brown thrasher, clay-colored sparrow, common yellowthroat, unidentified dark-eyed junco, eastern kingbird, eastern towhee, Franklin's gull, gray catbird, greater yellowlegs, killdeer, Le Conte's sparrow, lesser yellowlegs, Lincoln's sparrow, mallard, magnolia warbler, marbled godwit, marsh wren, mourning dove, Nashville warbler, northern waterthrush, pied-billed grebe, red-winged blackbird, rusty blackbird, sandhill crane, Savannah sparrow, sedge wren, song sparrow, sora, swamp sparrow, Tennessee warbler, tree swallow, vesper sparrow, Virginia rail, Wilson's snipe, winter wren
Olive-sided flycatcher	Interlake Plain Churchill River Upland Hudson Bay Lowland	Indicator of northern and western wetland and early successional (i.e., fire) bird associations and	Coniferous-dense Shrub-tall Wetland-shrub Wetland-herb	Baltimore oriole, bay-breasted warbler, blackpoll warbler, blue jay, Bonaparte's gull, boreal chickadee, brown creeper, Cape May warbler, chipping sparrow, unidentified dark-eyed junco, downy woodpecker, fox sparrow, golden-crowned kinglet, greater yellowlegs, hairy woodpecker, least sandpiper, lesser yellowlegs, Lincoln's sparrow, magnolia warbler, Nashville warbler, northern waterthrush, orange-crowned warbler, pine grosbeak, red-breasted

VEC Species	Ecoregions Represented	Primary Habitat Considerations	LCCEB Habitat	Associated Species Based on Similar Habitat Requirements
		community health		nuthatch, red crossbill, ruby-crowned kinglet, rusty blackbird, Swainson's thrush, Tennessee warbler, western palm warbler, white-throated sparrow, white-winged crossbill, Wilson's snipe, Wilson's warbler, winter wren, yellow-bellied flycatcher, yellow-rumped warbler, yellow-shafted flicker, yellow warbler
Sprague's pipit	Lake Manitoba Plain Interlake Plain	Indicator of southern and western dry native grassland bird associations and community health	Theoretical habitat association Grassland	American crow, Baird's sparrow, bobolink, Brewer's blackbird, brown thrasher, clay-colored sparrow, eastern towhee, Franklin's gull, killdeer, marbled godwit, mourning dove, ring-billed gull, savannah sparrow, vesper sparrow, western meadowlark, yellow rail
Golden-winged warbler	Interlake Plain	Indicator of shrubland and shelterbelt bird associations and community health	Broadleaf open	American bittern, black-and-white warbler, black-capped chickadee, brown-headed cowbird, cedar waxwing, common raven, mourning dove, northern waterthrush, Philadelphia vireo, red-eyed vireo, rose-breasted grosbeak, ruffed grouse, tree swallow, veery, Wilson's snipe, yellow-shafted flicker
Canada warbler	Interlake Plain Mid-Boreal Lowland	Indicator of southern and western mature deciduous forest dominated bird associations and community health	Broadleaf-dense Mixedwood-dense	alder flycatcher, American redstart, Blackburnian warbler, black-and-white warbler, black-throated green warbler, Cape May warbler, chestnut-sided warbler, chipping sparrow, common yellowthroat, hermit thrush, least flycatcher, Lincoln's sparrow, mourning warbler, ovenbird, Philadelphia warbler, red-eyed vireo, Swainson's thrush, swamp sparrow, Tennessee warbler, veery
Rusty blackbird	Mid-Boreal Lowland Churchill River Upland	Indicator of northern wetland and shrubland bird	Wetland-herb Wetland-treed Wetland-shrub	alder flycatcher, blackpoll warbler, Bonaparte's gull, chipping sparrow, clay-colored sparrow, common yellowlegs, Connecticut warbler, unidentified dark-eyed junco, eastern kingbird, greater yellowlegs, hermit thrush, killdeer, least sandpiper, Le Conte's

VEC Species	Ecoregions Represented	Primary Habitat Considerations	LCCEB Habitat	Associated Species Based on Similar Habitat Requirements
	Hayes River Upland Hudson Bay Lowland	associations and community health		sparrow, lesser yellowlegs, Lincoln's sparrow, magnolia warbler, Nashville warbler, northern waterthrush, olive-sided flycatcher, orange-crowned warbler, red-winged blackbird, ruby-crowned kinglet, savannah sparrow, sedge wren, solitary sandpiper, song sparrow, Swainson's thrush, swamp sparrow, Tennessee warbler, tree swallow, western palm warbler, white-throated sparrow, Wilson's snipe, Wilson's warbler, winter wren, yellow-bellied flycatcher, yellow rail, yellow rumped warbler, yellow-shafted flicker, yellow warbler

4.4 ABORIGINAL TRADITIONAL KNOWLEDGE

Bird data derived herein is identified as local knowledge (i.e., tangible Aboriginal Traditional Knowledge) that was collected during the Aboriginal Traditional Knowledge (ATK) process (see *Bipole III Aboriginal Traditional Knowledge Technical Report*). Most of these data are related to hunting and fishing activities, or to other traditional land-use activities. Data were also collected from open houses and during the public consultation process. Changes in resource use, differences in bird species and population trends, and the use of chemicals were raised as concerns. For example, the harvest of wild bird eggs was traditionally practiced, and still is by members several First Nations communities interviewed. Waterfowl and upland game bird hunting was identified as an important activity by some members, but there were reports of decreased bird hunting by others. Reports indicated that some species of birds have declined (i.e., specifically grouse and partridges) and these declines were associated with agricultural practices, construction of the Portage Diversion, and the loss of food (e.g., saskatoon berries). It was noted that migration patterns of geese have changed, as more geese stay in some communities for longer periods of time; in some cases however, geese and ducks were not as abundant in certain regions as in the past. Some birds, such as ducks, are no longer hunted for fear of chemical contamination. Although the source of such contamination was not specified, agricultural chemicals were mentioned as part of the general discussion. For some bird species and groups, population increases were reported. Buzzards (i.e., turkey vulture), eagles and magpies reportedly increased, and several communities noted an increase in the number of snow geese.

Table 4-7 lists the bird species identified in the ATK survey reports along with the data type (e.g., hunting locations). Data such as nests, migration corridors, and staging areas were also identified from the data and have been incorporated into the bird assessment found within or near the Local Study Area. Data such as migration corridors and staging areas, plus eagle nest locations and colonial bird colonies were incorporated into the identification of sensitive sites for birds in the Local Study Area. For a detailed account of ATK, public consultation and open house, refer to *EIS Chapter 5 Environmental Assessment Consultation Program* and *Assessing Potential Effects of the Bipole III Transmission Project: A Major Reliability Improvement Initiative on Aboriginal Traditional Knowledge (ATK).*

Table 4-7. List of Bird Species and Important Locations Identified From the Aboriginal Traditional Knowledge Surveys

First Nation Data Sources	Bird Group and Activity	Nearest Geographic Reference
Baden Barrows Camperville Chemawawin Cormorant Dakota Plains Dakota Tipi Dawson Bay Duck Bay Fox Lake Herb Lake Long Plain Manitoba Metis Federation National Mills Pelican Rapids Pikwitonei Pine Creek Powell Red Deer Lake Split Lake Thicket Portage Waywayseecappo Westgate	Blue Herons (nesting), Barred owls (rare) - used for eco-tourism (42, 126), Duck and geese hunting (115, 119), loons (32, 33)	West of Red Deer Lake
	Snow geese, some Canada geese (61), Bald eagle (105)	South of Red Deer Lake
	Whip-poor-wills (60)	Northeast of Porcupine Mountains
	Meadow for hunting ducks & geese (also along shore of river) (97, 98)	Southeast of Red Deer Lake
	Chickens (149), birds and mammals hunting	Southwest of White Sand Lake
	Spring goose hunt (92), duck hunting (7)	Lake Winnipegosis
	Ducks, geese, prairie chickens, seagull eggs, blue herons, turkey vultures, osprey, big horned owl, small owls, screech owls, burrow owls, great horned owls, snowy owls, cranes	N/A - Traditional use areas
	Trapping and hunting - ducks, geese (79)	Saskatchewan River
	Geese and duck hunting (11), Trapping/hunting area, all kinds of animals harvested (65), Bird and Moose hunting (73)	Cedar Lake
	Hunting (birds and mammals (179),	Southeast of McClarty Lake
	Bald eagle nest (18), spring goose hunting (48), Owls, night hawk (182)	Little Cormorant Lake, marshes and Frog Creek
	Goose, duck hunting (105, 113), Used to be world-renowned hunting (waterfowl 114), canvasbacks (ducks) (133)	Mawdesley Lake and area
	Bird hunting (158)	Up to McKenzie's Point
	Night owls (131), Osprey nest on hydro line (132)	Cormorant Lake and area

First Nation Data Sources	Bird Group and Activity	Nearest Geographic Reference
	Spring Goose Hunting (48), Hunting Ducks, geese (113), Herons/Cranes nesting in trees on island - nests in poplars not there anymore - people camp there now (190)	North Moose Lake and area
	Prairie chicken, ducks hunted; eggs harvested in the past (mallards, bluebills, redheads, canvasbacks)	Marshes south of Lake Manitoba (Delta Beach area)
	Prairie chicken and partridge hunting (past and present)	Around the Assiniboine River south of Long Plain
	Duck and goose hunting (past and present)	Along Highway 240 from Oakland to Delta Beach
	Present duck and goose hunting (16)	West of Portage la Prairie, along waterway
	Bald eagle nesting area (fewer eagles now) (17)	Southwest of Portage la Prairie, near Assiniboine River
	Area of hunting (Birds and Mammals - 20), Bird Hunting (Geese, Ducks) (80)	West of Lake Winnipegosis
	Trapping, hunting (79)	East of Red Deer Lake
	Chicken Hunting (along road) (11), Nesting for gulls, cormorants, pelicans (50), Flock of Ruddy Turnstone Sandpiper (rare bird) spotted (55)	West shore and islands of Lake Winnipegosis
	Osprey Nesting (on Transmission Line)	West of Dawson Bay
	Flight path for ducks and geese (138)	Near Pelican Lake
	Bird migration route (ducks and geese) (79, 80).	Large area of wetlands surrounding Spence Lake
	Vultures in summer (61)	Area around Chartrand Lake
	Duck and nesting areas (move towards Duck Bay for mature) mallards, geese, swan nests, herons, cranes, spruce grouse (62)	Large area west of Balsam Lake
	Rock piles for eggs and high nests for herons (63)	Area west of Wigwam Lake
	Duck hunting- tourism with American hunters	Southern portion of Duck Bay and around Hatchery

First Nation Data Sources	Bird Group and Activity	Nearest Geographic Reference
	(84, 85)	Island
	Waterfowl hunting (106)	Area around Carlson Lake
	Local name (“Nest Island”)- duck and geese eggs (131)	Island east of South Camping Island
	Mallard, ruddy duck hunting (132)	Island southwest of South Camping Island
	Canada goose hunting (133)	Between Balsam Lake and Duck Bay
	Dense amounts of cormorants – killed tree/island on lake through over use (139)	Dunoya Island on Pelican Lake
	Flight path for ducks and geese (138)	Large area south of Pelican Lake
	Goose hunting (snow geese, lesser geese and Canada geese)	Ponds and marshy areas in the vicinity of the Conawapa Road
	Spruce grouse (chickens), ptarmigans, stick chickens	Forests (bush) in the vicinity of the Conawapa Road
	Snipe, pigeon, prairie chicken, partridge, goose and duck hunting	Along lands near the Assiniboine River southwest of Portage la Prairie.
	Pheasant, ruffed grouse, sharp-tailed grouse, partridge, chicken, ptarmigan, ducks, and geese.	South of Winnipeg along the Red River, east of Portage la Prairie, northwest of Brandon, west of Lake Manitoba in the Camperville area, north of Riding Mountain National Park, the Duck Mountain area, northeast of Swan River, the Porcupine Hills area and west of Thompson among others.
	Traditional area – hunting & trapping (9)	Perimeter of Pelican Bay on Lake Winnipegosis
	Hunting Area (26)	Large area east of Mason Bay on Lake Winnipegosis
	Great grey owl spotted in area (80)	East side of Pikwitonei Lake
	Duck hunting area (56, 36)	Area including Red Deer Point and Coleman Bay on Lake Winnipegosis
	Duck hunting area (37)	Wickham Bay on Lake Winnipegosis
	Duck and Canada goose hunting (59, 60)	Mouth of Kirk Creek and to the east of the point on Swan Lake
	Hunting area (4)	West of Glenboro
	Grouse (27)	South of Riding Mountain

First Nation Data Sources	Bird Group and Activity	Nearest Geographic Reference
	Hunting area (61)	Area along the western and southern shore of the south basin of Swan Lake
	Hunting area	Lavenham area, Rossendale and Carberry Hills areas
	Duck and goose hunting (44)	South of Pelican Lake along the Pelican River
	Duck and goose hunting (49, 50, 51)	Area around North Camping Island, South Camping Island to the western shore of Lake Winnipegosis
	Traditional area – hunting & trapping	Numerous areas including Little Limestone Lake, Stephens Lake, Split Lake, Waskaiowaka Lake, Pukatawakan Lake, Orr Lake, Nelson River, Cygnet Lake, Assean Lake and area, Pearson Lake, Limestone Lake, and Hunting Lake.
	Hunting trail along old logging road (goose, etc)	Trail east of Thicket Portage
	Eagle locations (110, 111, 174, 175)	Island cluster and point in the middle of Wintering Lake, western half of Landing Lake
	Eagle nesting area; owls (146), Duck & geese area, very rocky – don't travel much by boat (mallards and ducks) (147)	Area around Lucky Bay on Landing Lake

4.5 ENVIRONMENTALLY SENSITIVE SITES

The construction and operation of transmission lines pose a small potential negative impact to most bird species and their habitats. For example, in areas where habitats are common and widespread, transmission line construction and operation will typically have a low risk of affecting the most common bird species and habitats. These types of sites have lower environmental sensitivities, and tend to be resilient to many anthropogenic effects. However where bird species habitat is considered highly sensitive, due to isolation or scarcity such as for federally listed Threatened and Endangered species, even a small negative effect may present a higher risk to associated bird populations. It is important therefore, not only to evaluate the Project Study Area from both a species and habitat perspective, but to consider where environmentally sensitive sites are located in the Local Study Area, and to provide appropriate mitigation measures used to minimize potential projects effects..

In order to assess environmentally sensitive sites for species at risk it is important to consider critical habitat, which is defined as "habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" (SARA 2009). With the exception of piping plover however, critical habitat has not been defined for most listed bird species, and as such, it was not possible to use spatial data and clearly defined habitat areas as variables in identifying and mapping environmentally sensitive sites.

General habitat preferences for birds is not a practical variable that can be used to map potential sensitive sites. Mapping food and cover requirements, for example, would result in the majority of the Bipole III RoW, being identified as a sensitive area. For example, habitat generalists (e.g., rusty blackbird, olive-sided flycatcher), whose habitat requirements appear to be extensive throughout Manitoba's landscapes ranging from agriculture to wetlands and northern sparsely treed wetlands, are particularly problematic. Consequently, only areas with site-specific features (e.g., large stick nests, rookeries, leks) are included as criteria to be mapped within the sensitive site definition. For bird species that are habitat specialists (e.g., red-headed woodpecker), and where specific features and sites can be reasonably defined spatially and temporally, known habitats features could be used to map and avoid sensitive sites, or to provide appropriate mitigation measures. Clearly definable features for critical bird habitat include the nest sites and surrounding buffers of Endangered and Threatened species. Endangered and Threatened species habitat models are discussed further in the effects assessment, Section 5.0.

Other environmentally sensitive sites for birds, in relation to the proposed Project, can be described as areas where there is an increased risk of bird mortality due to habitat loss, increased predation or hunting effort, and collisions with transmission lines[1]. It should be noted from the onset that

[1] The U.S. Fish and Wildlife Service reports tens of thousands of avian fatalities per year (Manville 2000) due to collisions with power transmission and distribution lines, but there are very few quantitative studies relative to the length of powerlines in the U.S. Based on the limited studies, waterfowl including ducks, geese, swans, and cranes appear to be

most researchers agree that for healthy bird populations, collisions are not a biologically significant source of mortality (Avian Power Line Interaction Committee 1994). Collision mortalities that have been estimated in numerous studies usually run less than 1% of the local population, and is considerably less for regional populations. This risk of bird-wire collisions is very low as many migrants such as waterfowl and raptors fly at altitudes well above the height of power lines and any associated structures (Avian Power Line Interaction Committee 1994). Attempts to reduce mortality from such small numbers of collisions include placing bird flight diverters (i.e., wire markers in the form of, e.g., spirals, swivels, plates, or spheres) on static and some electrified wires to increase their visibility. In a comprehensive summary study, Barrientos *et al.* (2011) found that at unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746).

Transmission related mortality results can be compared to other known causes such as habitat removal, hunting, tower collisions, epidemic disease, predation, or motor vehicle interactions. Stout and Cornwell (1976) compared nonhunting mortality causes for waterfowl through extensive analysis of banding returns. They found that collisions (including automobiles, telephone and power wires, television and radio towers, aircraft, farm machinery, fences and buildings, and other objects) accounted for about 0.1% of non-hunting mortality. Botulism alone was responsible for 65% of the deaths. Telephone and power lines were only 0.07% of the mortalities. Those sites that were considered at low risk of bird mortality were not mapped as sensitive sites (Avian Power Line Interaction Committee 1994).

Several assumptions were used in determining whether an area along the Bipole III RoW would be of higher risk for bird-wire collisions:

- Existing engineering as proposed in the Project description, which includes overhead ground wires.
- Visibility as a function of conductor diameter, where large bundles of wires (e.g., dc lines) are more visible and less likely to affect birds.
- Line height, where higher towers are nearer bird flight heights for some species.
- Bisection of daily movement paths across the projected pathway of the Bipole III route.
- Marker effectiveness.
- Bird populations - one of the main animal-related issues is the number of birds that cross this line on a daily movement basis. Large concentrations of birds, such as along migration routes, near staging areas, or adjacent to nesting colonies, are also more likely to result in higher rates of birds colliding with wires, but only under certain sets of environmental conditions. Important wetlands[1] were considered in this context. These types of areas have been considered in past projects and elsewhere (Manitoba Hydro 1992; Manitoba Hydro

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most susceptible to powerline collisions when powerlines are located near wetlands. In upland habitats away from wetlands, raptors and passerines appear most susceptible to collision.

[1] Faanes (1987) searched 6 miles (9.6 km) of powerlines in North Dakota in the spring and fall of 1977 and 1978. Based on a total of 633 dead birds found, he estimated that 200 avian fatalities per mile per year (125 birds/km/yr) were occurring at those sites. The powerlines included in the study were located near wetlands or lakes and most of the fatalities consisted of waterbirds (46%) and waterfowl (26%), followed by shorebirds (8%) and passerines (5%).

1995; Manitoba Hydro 2003; AltaLink Management Ltd. 2006; SaskPower *et al.* 2009; Manitoba Hydro 2010).

- Bird behaviours by groups – where certain groups appear to be more susceptible to collisions. The main considerations focused on waterfowl.
- Flights along waterways.
- Species size, manoeuvrability, flocking behaviour, age and sex, night flights and local disturbances.
- Where possible, local values such as topography, climatic, habitat values, bisected habitats and food values are considered in the risk assessment.

Finally, sensitive sites that were identified through public consultation processes, including ATK consultations, have been incorporated in the environmentally sensitive area analyses. At least one location that included higher waterfowl and other bird community site sensitivities was addressed on a site-specific basis. Several of the waterways that qualified as sensitive sites were also identified by First Nations as areas with higher wildlife values and traditional use areas.

Following the criteria above, a number of data sources were selected to aid in the identification of environmentally sensitive sites. Ducks Unlimited Canada waterfowl pair density estimates, IBAs, and waterfowl hotspots provided information on the locations of high concentrations of waterfowl, which typically occur in high densities. Field data from colonial water bird and waterfowl surveys were used to further help identify areas with high concentrations of birds, including colonies and staging lakes. Finally, known raptor migration routes and field raptor migration surveys were used to identify areas with relatively high concentration of raptors. Finally, professional judgment was used to consider highly probable migration routes for species at risk. These routes, such as along the Red River, have not been well-studied, and are generally not available in the literature.

All available data were assessed using orthophoto imagery in ArcMap 9.2. The entire RoW was reviewed for major and minor river crossings as well as for sections where the RoW passed through areas with moderate to high pair density, IBAs, colonies or rookeries within 300 meters or areas with high raptor concentrations. Areas with major river crossings, known migration routes and staging areas, and where the RoW was passing over waterbodies in IBAs were automatically considered an environmentally sensitive site. Sections passing over smaller rivers and creeks which were associated with IBAs or areas with moderate to high paired densities were also considered to have a high degree of environmental sensitivity. Finally, sections passing over smaller creeks or wetlands but not associated with other features listed here, were considered do have a moderate level of environmentally sensitivity. Field site verification is needed to either include or exclude areas with a moderate and high degree of sensitivity to confirm environmentally sensitive site status as these sites may be more prone to more or less bird movements that expected.

4.5.1 Locations

A total of 134 environmentally sensitive sites for birds have been identified, including 32 point sites, such as gull colonies, and 102 sites sensitive over an expanded area, including waterfowl staging areas. For area-based sensitivities, the beginning and end of the site feature was marked with start and stop locations (Map Series 1100 – Environmentally sensitive sites for birds). Of the 134 sites identified, 68 were considered to have a higher risk of bird-wire collisions, while 66 had a moderate degree of risk. Table 4-8 outlines the distribution of environmentally sensitive sites for birds by type, potential degree of effect, and ecoregion.

A number of the sensitive sites are associated with known geographic features, particularly river and creek crossings. Table 4-9 outlines the locations of sensitive sites using river and creek names when possible.

The general geographic area of highest concern related to the Bipole III Project, are the bird habitats and populations located in the Red Deer Lake to Cormorant Lake region. This area was described as having two physiographic bottlenecks during the alternative route process. The FPR is located in this geographic area of interest, and it contains a relatively high number of overlapping sensitive site features for birds, including landscape sensitivity indicators (e.g., Important Bird Area, Wildlife Management Area, Provincial Park, Ecological Reserves, Designated Protected Areas), a high use area for Aboriginals and for other Socio-economic purposes such as tourism or outfitters, sensitive wetland and riparian bird habitats, a larger potential number of species at risk, the northern fringe of brown-headed cowbird range, a larger and potentially more concentrated number of waterbird colonies, and compared to other regions in Manitoba, relatively high waterfowl and other waterbird densities/abundances used for staging and nesting.

4.5.2 Descriptions

Sensitive sites for birds include areas where higher densities of birds, particularly waterfowl, colonial waterbirds, and migratory raptors, were expected, increasing the likelihood of birds potentially colliding with wires. Bird concentrations were expected to be higher along rivers and creeks, which many birds use as movement corridors and for foraging. Raptors and waterfowl in particular use these features (Manitoba Hydro 2010).

Large open wetlands were considered to have high densities of birds, as waterfowl fly along them and land in them to feed. Finally, if a colony was near the RoW, a sensitive site was identified where any expected flyways could occur. Table 4-9 outlines the description of each sensitive site.

Sharp-tailed grouse leks and large stick nests were also identified as sensitive sites. Specific locations for these sites have not been identified. These sites will require localized search efforts, which should be conducted during pre-Project monitoring and for Environmental Protection Plan development.

Table 4-8. Distribution of Environmentally Sensitive Sites for Birds

Ecoregion	Degree of Risk		
	High	Moderate	Total
Churchill River Upland	**3**	**6**	**9**
Point	0	3	3
Area	3	3	6
Hayes River Upland	**22**	**17**	**39**
Point	0	3	3
Area	22	14	36
Hudson Bay Lowland	**1**	**0**	**1**
Point	0	0	0
Area	1	0	1
Interlake Plain	**14**	**18**	**32**
Point	3	8	11
Area	11	10	21
Lake Manitoba Plain	**21**	**9**	**30**
Point	5	3	8
Area	16	6	22
Mid-Boreal Lowland	**8**	**15**	**23**
Point	2	5	7
Area	6	10	16
Total	**69**	**65**	**134**

Table 4-9. Environmentally Sensitive Sites for Birds

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_001	Water reservoir	Moderate	Increased density of birds feeding.
Bird_002	Floodway crossing	High	High density of birds staging, feeding and nesting.
Bird_003	Rat River crossing	High	Migratory route for species at risk, raptors and waterfowl.
Bird_004	Marsh River crossing	High	Migratory route for raptors and waterfowl.
Bird_005	Red River crossing	High	Migratory route for species at risk, raptors and waterfowl.
Bird_006	Colonies and waterfowl staging area	High	High density of waterfowl and colonial water birds in the area.
Bird_008	Waterfowl staging area	High	RoW adjacent to water body likely used by waterfowl.
Bird_009	Assiniboine River crossing	High	Migratory route for species at risk, raptors and waterfowl.
Bird_010	Nearby Franklins gull colony	Moderate	Colony to the east of the RoW, gulls likely feed in the vicinity of the RoW.
Bird_011	Rat Creek crossing	High	Creek has good riparian habitat for raptors and wide enough to support waterfowl.
Bird_012	Bagot Creek crossing	High	Creek has good riparian habitat for raptors and wide enough to support waterfowl.
Bird_013	Whitemouth River crossing	High	Migratory route for raptors and waterfowl.
Bird_014	Nearby black tern colony	Moderate	Colony to the east of the RoW, gulls likely feed in the vicinity of the RoW.
Bird_016	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_018	Waterfowl and yellow rail sensitivity area	High	RoW crossing a wetland likely used by waterfowl and yellow rail.
Bird_020	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_022	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_024	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_026	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_028	Nearby great blue heron colony	Moderate	Colony to the west of the RoW, herons likely cross the RoW to forage.
Bird_029	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_031	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_033	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_035	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_037	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_039	Lagoon	High	RoW crossing a lagoon likely used by waterfowl.
Bird_043	Nearby great blue heron colony	Moderate	Colony to the west of the RoW, herons likely cross the RoW to forage.
Bird_044	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_048	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_050	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_052	Cork Cliff Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_053	Mossy River crossing, nearby great blue heron colony	Moderate	Movement route for raptors and waterfowl, colony to the north of the RoW, herons likely move along the river.
Bird_054	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_056	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_058	Wellburns Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_059	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_061	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_063	Garland River crossing	Moderate	Movement route for raptors and waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_066	South Pine River crossing	Moderate	Movement route for raptors and waterfowl.
Bird_067	North Pine River crossing	Moderate	Movement route for raptors and waterfowl.
Bird_069	Nearby great blue heron colony	Moderate	Colony to the west of the RoW, herons likely cross the RoW to forage.
Bird_071	Great blue heron feeding area	Moderate	RoW crosses an area likely used by great blue herons for feeding.
Bird_073	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_079	North Duck River crossing	High	Movement route for raptors and waterfowl.
Bird_080	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_081	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_082	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_083	Swan River crossing	High	Movement route for raptors and waterfowl.
Bird_084	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_085	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_086	Nearby great blue heron colony	High	Colony to the south of the RoW, herons likely cross the RoW to forage.
Bird_087	Woody River crossing, nearby great blue heron colony	High	Movement route for raptors and waterfowl, colony to the south of the RoW, herons likely to move along the river or cross the RoW to feed.
Bird_089	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_090	Bell River Drain crossing	Moderate	RoW crossing a drainage ditch likely used by waterfowl.
Bird_091	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_093	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_095	Mafeking Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_097	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_099	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_100	Waterfowl and colonial bird sensitivity area	High	RoW crossing an area heavily used by waterfowl and colonial birds travelling to and from lake Winnipegosis.
Bird_103	Red Deer River Crossing	High	Movement route for raptors and waterfowl.
Bird_105	Waterfowl and colonial bird sensitivity area	High	RoW crossing an area heavily used by waterfowl and colonial birds travelling to and from lake Winnipegosis.
Bird_107	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_108	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_110	Overflowing River crossing	High	Movement route for raptors and waterfowl.
Bird_111	Large drainage ditch crossing	Moderate	RoW crossing a drainage ditch likely used by waterfowl.
Bird_112	Waterfowl and sensitivity area, nearby Bonaparte's gull colony	High	RoW crossing a wetland likely used by waterfowl, colony to the west of the RoW, gulls likely to cross RoW to feed and to head to larger water bodies.
Bird_113	Waterfowl and sensitivity area, nearby Bonaparte's gull colony	High	RoW crossing a wetland likely used by waterfowl, colony to the west of the RoW, gulls likely to cross RoW to feed and to head to larger water bodies.
Bird_114	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_115	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_117	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_119	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_121	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_123	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_125	Ralls Creek crossing	High	RoW crossing a creek likely used by waterfowl.
Bird_127	Ralls Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_129	Ralls Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_130	Saskatchewan River crossing	High	Movement route for raptors and waterfowl.
Bird_132	Waterfowl and colonial bird sensitivity area	High	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes.
Bird_140	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_142	Waterfowl and colonial bird sensitivity area	Moderate	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes.
Bird_144	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_146	Waterfowl and colonial bird sensitivity area, Frog Creek crossing	High	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes.
Bird_148	Nearby great blue heron colony	Moderate	Colony to the south of the RoW, herons likely cross the RoW to forage.
Bird_149	Nearby Bonaparte's gull colony	Moderate	Colony to the north of the RoW, gulls likely cross the RoW to access Hargrave Lake.
Bird_154	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_155	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_156	Kiski Creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_157	Waterfowl and colonial bird sensitivity area	High	RoW crossing an area heavily used by waterfowl and colonial birds travelling to a from Gromley Lake.
Bird_159	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_161	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_163	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_165	Halfway River crossing	High	Movement route for raptors and waterfowl.
Bird_167	Halfway River crossing	High	Movement route for raptors and waterfowl.
Bird_169	Halfway River crossing	High	Movement route for raptors and waterfowl.
Bird_171	Patrick Creek crossing	High	RoW crossing a creek likely used by waterfowl.
Bird_173	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_175	Unknown creek crossing	High	RoW crossing a wetland likely used by waterfowl.
Bird_177	Nearby Bonaparte's gull colony	Moderate	Colony to the north of the RoW, gulls likely cross the RoW to access nearby ponds.
Bird_179	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_181	Unknown creek crossing	High	RoW crossing a creek likely used by waterfowl.
Bird_183	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_187	Unknown creek crossing	High	RoW crossing a wetland likely used by waterfowl.
Bird_189	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_193	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_195	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_197	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_199	Unknown creek crossing	High	RoW crossing a creek likely used by waterfowl.
Bird_201	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_203	Grass River crossing	High	Movement route for raptors and waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_205	Partridge Crop Lake crossing	High	Movement route for raptors and waterfowl.
Bird_207	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_209	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_211	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_213	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_217	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_219	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_221	Waterfowl sensitivity area	High	RoW crossing a wetland likely used by waterfowl.
Bird_223	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_225	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_231	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_233	Burntwood River crossing	High	Movement route for raptors and waterfowl.
Bird_235	Odei River crossing	High	Movement route for raptors and waterfowl.
Bird_237	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_239	Unknown creek crossing	Moderate	RoW crossing a creek likely used by waterfowl.
Bird_241	Crying River crossing	Moderate	Movement route for raptors and waterfowl.
Bird_243	North Moswakot River crossing	Moderate	Movement route for raptors and waterfowl.
Bird_245	Limestone River crossing	High	Movement route for raptors and waterfowl.
Bird_247	Limestone River crossing	High	Movement route for raptors and waterfowl.
Bird_249	Limestone River crossing	High	Movement route for raptors and waterfowl.

Source Name	Environmentally Sensitive Site	Degree of Risk	Site Description
Bird_258	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_259	Waterfowl sensitivity area	Moderate	RoW crossing a wetland likely used by waterfowl.
Bird_260	Nearby Bonaparte's gull colony	Moderate	Colony to the north of the RoW, gulls likely cross the RoW to forage.
Bird_261	AC collector line Limestone River Crossing	High	Movement route for raptors and waterfowl.

5.0 ENVIRONMENTAL ASSESSMENT

5.1 ENVIRONMENTAL EFFECTS IDENTIFICATION/ASSESSMENT

The clearing, construction, operation, and maintenance of the Bipole III transmission line is expected to affect birds and bird communities in several ways. Effects can be positive or negative, depending upon species, and include:

- mortality;
- habitat alteration and sensory disturbance; and
- disruption of movements.

Section 5.1.1 provides a general literature review the potential effects related to general transmission line construction, operation and maintenance activities, and where information is limited, it provides information from projects and activities that may be similar to the construction of transmission line. Where inferences are made in these cases, caution should be used in its interpretation, as it may not be directly applicable or only applicable in part, to the construction and operation of transmission lines. Sections 5.1.2 and 5.1.4 discuss potential Bipole III Project-related effects based on the Project Description. Recommended mitigation measures are considered for the site preparation and construction and operation and maintenance phases of the Bipole III Project in Section 5.2. Residual effects of the Bipole III Project are summarized in Section 5.3 and Cumulative Effects are presented in Section 5.5.

5.1.1 Description of Potential Effects

5.1.1.1 Mortality

COLLISIONS

Most researchers agree that for healthy bird populations, collisions are not a biologically significant source of mortality (Avian Power Line Interaction Committee 1994). Collision mortalities that have been estimated in numerous studies usually run much less than 1% of the local population. This risk of bird-wire collisions is very low as many migrants such as waterfowl, raptors fly and other bird species fly at altitudes well above the height of power lines and any associated structures (Avian Power Line Interaction Committee 1994).

Bird-wire collisions or strikes are one of the most common causes of non-hunter related mortality of birds (Avery *et al.* 1980; Malcolm 1982; Rusz *et al.* 1986; Faanes 1987; Morkill and Anderson 1991; Brown and Drewien 1995; Training Unlimited Inc. 2000) and occur across a broad selection of bird groups. A review of non-hunting mortality indicated that collisions with human-made structures accounted for 0.1% of all mortality (Stout and Cornwell 1976). However, the majority of avian mortality is never reported by utility companies (Manitoba Hydro 2010). Levels of avian mortality may be under-reported in that wounded birds may travel some distance before dying and are not observed or reported (Bevanger 1994). Mortality also occurs from collisions with vehicles that may be used to construct the line (Harness and Wilson 2001; Taylor 2003a; AltaLink Management Ltd. 2006; Stinson *et al.* 2007).

A number of factors can affect bird mortality in relation to potential collisions with transmission lines:

- The morphology of some bird species can greatly increase their risk of collision. For example, species with short wings and heavy, stout bodies that are unable to perform evasive manoeuvres to avoid transmission lines and structures (Bevanger 1998).
- Weather conditions can contribute to bird collisions, as a higher frequency of collision events with species of lower manoeuvrability has been observed when wind speeds are above 24 kilometres per hour (km/h) (Brown and Drewien 1995).
- Time of day influences the occurrence of bird-wire collisions, as the risk of collision increases during dusk and night flights (Brown and Drewien 1995).
- The incidents of avian mortality appear to be affected by the age of the bird involved in the collision, as recently fledged birds have been found to be at greater risk of collision (Brown and Drewien 1995).
- Annual deaths due to collisions with transmission lines may follow the cyclic population fluctuations shown by some bird species (Bevanger 1995).
- The position of a transmission line in the landscape influences the level of bird-wire collisions, as frequent crossing flights between nesting, roosting, and foraging habitats result in a higher rate of bird-wire collision mortality (Brown and Drewien 1995).
- The surrounding environment can decrease collision rates as the presence of nearby topographical features, such as cliffs and tall trees can influence birds to fly at greater heights and in turn avoid power line collisions (Bevanger 1994). Bevanger (1994) observed collision risk was lower along sections of transmission line with dense stands of forest on at least one side of the cleared RoW; these stands provided the greatest decrease in collision risk when tree height was higher than the power line itself.

ELECTROCUTIONS

In the past, electrocution has contributed to some bird mortality on transmission line projects. Mortality from electrocutions is primarily related to smaller distribution lines and is usually not an issue in regards to bird mortality (Avery *et al.* 1980; Bevanger 1998; Janss 2000. The occurrence and risk of electrocution mortality on birds is directly related to body size and behaviour of species, with large birds exhibiting perching tendencies being at higher risk (Bevanger 1998).

Wide spacing between conductors and electrical wires reduces the risk of bird electrocution as bird wingspans rarely exceed 3 m (Boeker and Nickerson 1975; Harness and Wilson 2001; Bureau of

Land Management 2005). The risk of electrocution to smaller birds is very low as they are generally too small to touch simultaneously an electrical wire and/or a conductor and another structure, completing a circuit and resulting in electrocution (Bevanger 1998). A larger body size and greater wingspan and tail length result in a greater risk of electrocution; however the behaviour of different groups of larger birds with these morphological characteristics results in differing levels of mortality due to electrocution (Janss 2000). A minimum horizontal spacing of conductors and ground wires at 15.2 m can accommodate wingspan of an eagle, which is the standard for raptors in the United States (The Edison Electric Institute's Avian Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service 2005).

Seasonal behavioural changes may increase electrocution risk. During the breeding and migration periods, some birds become very gregarious and perch in large, dense flocks on electrical lines, increasing the risk of electrocution (Avian Power Line Interaction Committee 2006). Some bird species construct their nests on transmission towers, but rarely when transmission lines are constructed in dense forested habitats that provide an abundance of natural nesting structures (Bevanger 1994). Nesting structures on lines may increase the probability of outages, and potentially electrocution events (Harness and Wilson 2001).

INCREASED PREDATION

The introduction of transmission lines on the landscape could contribute to increased predation on some bird species. Artificial perching and roosting structures such as transmission towers are used by some raptors in habitats with few natural perches; these perches provide an elevated viewpoint to aid in locating prey (Boeker and Nickerson 1975; Knight and Kawashima 1993). In a study of the effectiveness of perch deterrents on raptor use of transmission towers for hunting, Lammers and Collopy (2007) observed raptors using transmission towers more than any other perch. Raptors utilized transmission towers even in habitats containing natural perch sites as the great height of transmission towers offer the highest vantage point (Lammers and Collopy 2007). The use of transmission lines as predatory perches by raptors has been identified as a significant factor in predation rates on prey species such as grouse that exhibit lek behaviour (Bureau of Land Management 2005). An increase in predation rates is not always associated with availability and use of elevated perches, as a study on ferruginous hawk hunting strategies showed hunting from an elevated perch to be the least successful (Wakeley 1978).

Bird species that utilize mixed habitats associated with edges along transmission lines show a decrease in fledgling success due to higher rates of predation (Chasko and Gates 1982). Nests located near the forest edge are under greater predatory pressures from small mammals such as chipmunks and red squirrels that may not utilize the central portion of transmission line RoWs (Chasko and Gates 1982). This relationship is not universal as a study by Chalfoun *et al.* (2002) found some predatory species to be more abundant in edge habitat while others did not differ between edge and interior habitats. An increase in avian nest predators in edge habitat compared to interior habitat was observed in Chalfoun *et al.*'s (2002) study on nest predation in human-created edge habitats. Fragmented habitats with sharply defined edges such as those associated with forest – agricultural landscapes show a significant increase in nest predation rates (Schmiegelow and Mönkkönen 2002).

For a detailed assessment of potential changes to predators in the Project Study Area, refer to the *Bipole III Mammals Technical Report* and *Bipole III Terrestrial Invertebrates, Amphibians, and Reptiles Technical Report*.

INCREASED BROOD PARASITISM

Clearing of the RoW may contribute to an increase in **brood (nest) parasitism**. Rates of brood parasitism have been shown to increase significantly in habitat edges associated with fragmented habitats compared to interior habitats containing forested buffers between nests and human disturbed landscapes (Tewksbury *et al.* 2006). There is no brood parasitism by brown-headed cowbirds in large contiguous tracts of forests; however these stands must be in excess of 700 km^2 to effectively exclude cowbirds (Chace *et al.* 2005). Brown-headed cowbirds require separate habitat types for feeding and egg laying, with feeding primarily taking place in open pastures and egg laying occurring in edge habitats with an abundance of host species, effectively limiting cowbird expansion into contiguous forests and landscapes with greater distances between their required foraging and nest host habitats (Curson and Mathews 2003). Greater distances between feeding and breeding grounds result in a lower rate of egg laying and decreased brood parasitism pressures on host species (Curson and Mathews 2003). An increase in brood parasitism is to be expected in association with the creation of new edge habitat; this was observed indirectly by a clear increase in the abundance of brown-headed cowbirds along edge habitats (Chafloun *et al.* 2002). In habitats with a large degree of human disturbance further fragmentation resulted in little to no change in brood parasitism, however in landscapes with little to no previous human disturbance, brood parasitism increased significantly with fragmentation and disturbance (Tewksbury *et al.* 2006).

5.1.1.2 Habitat Alteration and Sensory Disturbance

RESPONSE TO NOISE

Birds found along transmission lines could respond to noise and other visual sensory disturbances in a variety of ways. If construction activities occur during nesting, sensory disturbance may affect several groups of birds (Dechant *et al.* 1999), which may abandon the area entirely. Some bird species rely heavily upon song for communication, territory establishment and defence. Bayne *et al.* (2008) found a marked decrease in bird abundance and density near energy developments in boreal forest, with densities increasing with increasing distance from the source of noise disturbance. This lower density is also reflected in the species richness of lower nesting birds in habitats near noise disturbances (Francis *et al.* 2009). Noise disturbance may result in an increase in predatory pressure on some bird species due to a decreased ability to use auditory cues to avoid predators (Slabbekoorn and Ripmeester 2007). However, Francis *et al.*'s (2009) study on the effect of noise disturbance on nesting success found a decrease in predation levels in habitats with human noise disturbance, which was attributed to predators' avoidance of noisy habitats and decreased ability to locate nests using auditory cues. In a study on ground-based and aerial-based disturbance on Mexican spotted owls, Delaney *et al.* (1999) found chain saw noise disturbance elicited more frequent behavioural responses than helicopter flyovers. This was attributed to the gradual increase in noise levels in helicopter approaches and overall shorter-term disturbance duration, whereas chain saw disturbances were abrupt and associated with human activities (Delaney *et al.* 1999).

REMOVAL OF HABITAT

The definition for the removal of habitat involves complete loss of a given type of habitat from an area, leaving no representation of that habitat in the given area (Schmiegelow and Mönkkönen 2002). The loss of individuals and a decline in a species' population is strongly associated with loss of habitat (Scmiegelow and Mönkkönen 2002). The vulnerability of bird species to habitat loss is dependent on their degree of habitat specialization; birds that have broad-ranging habitat requirements are less likely to be affected by habitat loss (Hockey and Curtis 2008). Conversely, species that are highly specialized for small, rare habitat features are extremely vulnerable to any habitat loss (Hockey and Curtis 2008).

The removal of habitat by clearing power line RoWs could result in changes in species composition. The number of bird species that favour interior habitats and avoid edges will decrease and the number of species that prefer edge and early succession habitats will increase (Schmiegelow and Mönkkönen 2002). Changes in the abundance of different bird species as a result of habitat removal may result in an overall increase in the number of species observed, as species favouring open, shrubby, and edge habitat may benefit from this clearing (Schmiegelow *et al.* 1997). The loss of habitat may reduce home range sizes of some bird species, resulting in increased inter- and intraspecific competition (Scmiegelow and Mönkkönen 2002). Bird species with a high rate of reproduction have smaller habitat requirements compared to bird species with low rates of reproduction that require larger areas of contiguous habitat (Vance *et al.* 2003).

For a detailed assessment of potential changes to vegetation, refer to *Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

5.1.1.3 Disruption of Movements

RESPONSE TO GAPS IN HABITAT

Avian response to gaps in habitat varies significantly among bird groups, species, and with gap size (Rail 1997). Boreal forest bird species generally considered specialists, were less likely to cross forest gaps 25 to 40 m wide, whereas habitat generalists were more likely to cross treeless gaps (Rail 1997). These birds were twice as likely to move through wooded habitats as through 50 m forest openings (Desrochers and Hannon 1996; St. Clair *et al.* 1998). When openings or gaps were at least 200 m, individuals were less likely to respond to calls (St. Clair *et al.* 1998). Even small gaps in forest cover have the potential to temporarily halt the movement of some species through an area, potentially creating a significant cumulative barrier effect on the landscape (Bélisle and St. Clair 2001).

Boreal forest birds were found to cross gaps in habitat and utilize cut blocks for dispersal and movement through habitats as these areas regenerated from clear cutting (Hannon and Schmiegelow 2002). This increase was noted four years following the cut (Hannon and Schmiegelow 2002). The likelihood of some bird species crossing larger gaps in habitat is associated with seasonal timing, with larger gaps crossed in the fall and smaller gaps in late winter (Grubb and Doherty 1999). The frequency and likelihood of some bird species crossing habitat gaps was associated with the size of habitat they were leaving; in larger habitats some species were less likely to cross gaps than in small areas of habitat (Grubb and Doherty 1999).

Haas (1995) found that wooded corridors were frequently used for dispersal and movement between nesting habitat and open gaps in preferred woodland habitat where significant barriers to this movement existed. In the absence of habitat corridors, some species may utilize fencerows to traverse gaps in habitat (Grubb and Doherty 1999). Gaps in habitat were avoided and corridors were utilized more frequently despite the longer distance involved in bird movement and dispersal (Desrochers and Hannon 1997).

The tendency to cross gaps in woodland habitat increased with the presence of high shrub cover in the original habitat and in the gap (Grubb and Doherty 1999). In addition to potential movement barriers, smaller gaps in habitat (less than 40 m) affect territorial establishment and defence, as forest interior specialists are less likely to cross gaps in habitat to defend territory (Rail *et al.* 1997). This did not mean however, that even forest interior specialists were prevented entirely from crossing the openings.

The body size of bird species is associated with the distance of gaps crossed, with larger birds frequently traversing greater distances than smaller birds (Grubb and Doherty 1999). The maximum gap distances crossed by larger bird species (blue jay-sized) ranged from 100 to 1,200 m and those crossed by smaller species (sparrow-sized) ranged from 100 to 300 m (Grubb and Doherty 1999). This disruption of movement through landscapes was demonstrated in Bélisle *et al.* (2001), where banded paired male birds were translocated from their breeding territories homing time and success were measured. Males faced with many gaps to traverse had significantly lower success rates and took much longer to return to their home territories.

EFFECTS ON MIGRATION

It is expected that most transmission line projects have little effect on spring and fall migrations of larger bird species as most fly significantly higher than the height of transmission lines and any related construction activities on the ground (Gauthreaux 1972). Migrating birds fly at lower altitudes at night than during the day and the vast majority of migrating birds fly above 240 m (Gauthreaux and Livingston (2006). Blokpoel and Burton (1975) found migrating birds flying at significantly higher altitudes (up to 2,560 m). Cloud ceiling had little effect on migration altitude as birds were regularly detected flying below and above cloud level (Blokpoel and Burton 1975). The most significant factors influencing migration flight altitude are wind speed and direction, with birds selecting altitudes with favourable tail winds (Blokpoel and Burton 1975). Some small bird species' migratory flights are at lower altitudes and they may be at risk of collision with tall human structures; however, this risk is low, as approximately 85% of all flights are above 75 m (Mabee and Cooper 2004).

5.1.1.4 Habitat Fragmentation

The creation of transmission line rights-of-way and other linear features have been implicated in the decline of some sensitive bird species. Fragmentation of habitat involves the removal of existing habitat that results in smaller isolated patches of remaining habitat where there was previously continuous habitat (Bender *et al.* 1998). Stable species abundance in fragmented landscapes may mask changes in bird communities due to replacement of locally extirpated species by immigration by species that favour fragmented habitats (Schmiegelow *et al.* 1997). The population declines of some bird species may be the result of conditions experienced during migration or on their wintering grounds, or in the case of resident species the harsh conditions experienced over the winter months (Donavan and Flather 2002). Declines in some bird populations may not be apparent in the short term as species crowd into smaller patches of available habitat, but over subsequent breeding seasons population declines become more obvious (Schmiegelow *et al.* 1997).

Population declines observed in some birds may be attributed to their habitat requirements, as species that favour interior habitat will experience declines as the habitat becomes increasingly fragmented into smaller and smaller patches (Bender *et al.* 1998). This high degree of habitat specialization increases bird species' susceptibility to habitat loss and fragmentation (Schmiegelow *et al.* 1997). The decline in bird populations due to fragmentation of the landscape is seen in strip-cut forestry harvest practices (Keller and Anderson 1992).

Habitat fragmentation was shown to increase abundances of five bird species in isolated and connected habitat patches in a study of habitat fragmentation on 37 migrant boreal songbirds (Schmiegelow *et al.* 1997). In landscapes with a large, continuous habitat with little to no habitat loss or fragmentation, most bird species show little to no response to initial loss or fragmentation of habitat (Betts *et al.* 2006). Increasing fragmentation of a landscape may not lead to declines in bird populations when remaining patches of habitat are large enough to provide suitable breeding habitat to allow for stable populations (Donovan and Lamberson 2001). Some bird species may remain abundant when large patches of suitable habitat remain, however other species' abundance may decrease depending on the degree of isolation of remaining suitable habitat (Betts *et al.* 2006).

Bird abundance decreases less in fragmented habitat patches that maintain connections to larger contiguous habitat than in isolated habitat fragments (Schmiegelow *et al.* 1997). Nesting success and fledgling survival of some species were greater in larger contiguous areas of forest habitat than in smaller fragmented patches (Burke and Nol 2000; Donovan and Flather 2002). Reliance on these remaining large patches of habitat may result in increased risk of population declines if further habitat loss or fragmentation is experienced (Donovan and Lamberson 2001).

Decreased nesting success of breeding birds in small habitat fragments has resulted in some species' inability to reproduce at levels that would maintain population levels (Burke and Nol 2000). In highly fragmented landscapes, the decline in nesting success has been observed in bird species that usually favour edge habitat (Robinson *et al.* 1995). Nest failures have primarily been attributed to nest predation (Burke and Nol 2000), and in a large part, due to brown-headed cowbird parasitism (Conway 1999). Many host species are affected by brown-headed cowbird parasitism, ranging from birds found in fragmented grassland habitats (Davis 2003) to woodlots and forest (Burke and Nol 2000). A large list of Neotropical migrants, species in decline, and species at risk are particularly vulnerable to brown-headed cowbird brood parasitism (Holland and Taylor 2003i), but the effects are limited to the range of this species. Brown-headed cowbird parasitism rates can be high in southern Manitoba in areas such as Delta Marsh (Sealy 1992), but less is known about northern environments. Not all bird species are vulnerable to parasitism as they may have host rejection, effective nest defense, or parasite avoidance mechanisms (Briskie *et al.* 1992; Sealy and Bazin 2005). Long-term effects of fragmentation may be more prominent in landscapes that are not permitted to recover or where re-growth is limited to small shrubby species (Schmiegelow *et al.* 1997).

Bird species with large home ranges may be more vulnerable to increasing habitat fragmentation as this may affect the ability of individuals to disperse and find a suitable mate, resulting in a decline in nesting and population (Conner and Rudolph 1991). There is a strong negative association between pairing success and increasing habitat fragmentation and isolation (Lampila *et al.* 2005). For additional information on fragmentation see *Bipole III Habitat Fragmentation Technical Report*.

5.1.1.5 Other Potential Effects Identified by First Nations

First Nations communities and members indicated that Project-related construction and maintenance sensory disturbance, mortality, and disruption of movements (migration was specified) could affect birds near the Bipole III transmission line. Such effects were described above, and are evaluated in Sections 5.1.2 and 5.1.3. Other potential Project-related effects on birds considered by First Nations included effects of noise from the transmission line, effects of electric and magnetic fields (EMF), and effects of chemicals used for right-of-way maintenance.

While the effect of transmission line noise on wildlife has not been extensively studied, there is little data to suggest that birds are affected by transmission line noise. Noises associated with transmission lines and towers are produced by wind moving through wires or structures, and corona effects. Corona effects occur electric fields at the surface of power line conductors are large enough to cause local ionization of the air. If there is enough corona activity, audible noise can be noticeable within a few hundred feet of the transmission line. Corona effects, which are most pronounced directly underneath the line conductors, and which decrease with distance from the transmission line, are discussed in depth in *Manitoba Hydro Bipole III Environmental and Health Assessment of the Electrical Environment Direct Current Electric and Magnetic Fields and Corona Phenomena*. Excessive noise levels from vehicle traffic and sounds produced in urban environments can affect bird communication abilities and local bird population density (Reijnen *et al.* 1995). The Bipole III HVdc line and AC lines are not anticipated however, to generate high noise levels (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Studies have shown that fair-weather audible noise generated from modern transmission lines is generally indistinguishable from background noise at a distance of about 30 m (EPRI 1987). As hundreds of bird species commonly perch, roost, and nest on transmission lines and towers, they are not likely to be affected by line noise (Manitoba Hydro 2010).

Respecting electric and magnetic fields (EMF), there has been over 30 years of scientific research performed to explore the potential effect EMF may have on health. To date, scientific panels have consistently concluded there is no causal link between EMF and human, animal or plant health. The potential effects of electric and magnetic fields and corona phenomena are discussed in detail in *Manitoba Hydro Bipole III Environmental and Health Assessment of the Electrical Environment Direct Current Electric and Magnetic Fields and Corona Phenomena*.

Concerns were raised about the use of chemicals for clearing and vegetation management on the RoW, and which in some instances, were related to effects on birds. Manitoba Hydro does not use herbicides to clear new rights-of-way (Manitoba Hydro 2007); clearing of the transmission line will be mechanical or by hand using chainsaws, and there are no plans to use herbicides (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Herbicides are used to control tall broadleaf species, and with proper use, do not affect shrubs, grasses, or conifers (Manitoba Hydro 2010). Broadleaf trees are relatively uncommon in northern Manitoba, and herbicides are rarely used in the north for vegetation maintenance (Manitoba Hydro 2010). Herbicides used by Manitoba Hydro are federally approved and registered, are regulated by the Province of Manitoba, and applicators are trained and licensed by the Province (Manitoba Hydro 2007). The effects on wildlife are minimized when herbicide rates and the timing of application are used according to directions (McGinty *et al*. 2000). The effects of herbicides on birds are indirect, affecting the plant communities that comprise some species' habitat, sometimes beneficially (e.g., Yeager 1956; Easton and Martin 2002; Marshall and Vandruff 2002). Negative, neutral, or positive bird habitat effects resulting from rights-of-way maintenance activities are discussed in Section 5.1.3.

5.1.2 General Effects for Bipole III Site Preparation and Construction

5.1.2.1 Background

The following background materials are excerpts from the Project Description (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*). Overall clearing and construction of the Bipole III HVdc transmission line will require five years to complete. The shorter 230 kV connections to the northern collector system will require approximately 21 months for clearing and construction. Clearing and construction activity for these lines and for the northern portion of the HVdc line will be confined to winter months. Subject to avoidance of conflict with agricultural use, construction in southern Manitoba can occur at any time during the year.

Prior to construction, the RoW and required easements will first be surveyed and flagged to establish the line alignment. Clearing and disposal of trees on the proposed RoW will be undertaken in advance to facilitate construction activities. RoW clearing will be subject to standard environmental protection measures, which have been established in association with Manitoba

Hydro transmission line construction practices, as well as the Project-specific Environmental Protection Plan.

With the exception of environmentally sensitive areas, the cleared RoW width for the southern portion of the HVdc transmission line (involving use of self-supporting towers) will generally be 45 m (148 ft.) within the total 66 m (216.5 ft.) RoW. Clearing will be modified in environmentally sensitive areas (e.g., river and stream crossings) and will be subject to a variety of pre-determined but adaptable environmental protection measures.

For the northern collector lines, the single Long Spruce 230 kV transmission line will involve approximately 58 m of clearing within the 60 m (about 197 ft) wide RoW. For the four Henday lines sharing a single corridor, the RoW will be approximately 310 m wide.

Clearing requirements for the new transmission line RoWs will also require selective clearing of **danger trees** beyond the RoW. Such trees could potentially affect the function of the transmission line or result in safety concerns, and are normally identified during initial RoW clearing activities and removed.

A variety of methods are available for RoW clearing. Typically, these include conventional clearing done by “V” and KG” blades on tracked bulldozers, mulching by rotary drums, selective tree removal by feller bunchers (e.g., for removal of danger trees with minimal adverse effect on adjacent vegetation and trees) and hand clearing with chain saws in environmentally sensitive sites. Final clearing methods will be determined on the basis of detailed survey of the transmission line routes, and site-specific identification of environmentally sensitive features. Trees within the RoW will be cleared to a maximum height of four inches above the ground. Ground vegetation will not be **grubbed** except at tower sites, where the foundation area will typically be scraped to allow unencumbered access for equipment and safe walking areas for workers.

Disposal of cleared vegetation typically involves a variety of options including piling and burning, mulching, collection and secondary use by local communities (e.g., fire wood), or salvage and marketing of merchantable timber resources if feasible. The final decision for disposal of vegetation will be determined by the method of clearing chosen and environmental license conditions applied to the Project.

Apart from removal of danger trees along the RoW edges, clearing procedures are normally confined to the RoW. Where access outside the RoW is necessary (e.g., by-pass trails), supplementary approvals will be obtained from Manitoba Conservation (e.g., work permits and timber permits relating to activity on provincial Crown lands) or from individual landowners. To facilitate such supplementary arrangements and avoid construction delays, every effort will be made to identify related access requirements as soon as possible during the clearing process. In the past, blanket approvals have been granted by Manitoba Conservation for “smaller” by-pass trails.

5.1.2.2 Mortality

Direct effects of clearing and construction could include bird mortality. Because these activities are to be limited to winter in the northern Footprint under frozen ground conditions, with the exception of gray jays, crossbills and other early nesting species such as ravens and owls, most breeding birds potentially found in the Bipole III Project area will not be present, and it is unlikely that many nests could be damaged or destroyed. As construction could occur at any time of year in the southern Footprint, the risk of damaging or destroying bird nests in a variety of habitats, which is prohibited under the *Migratory Birds Convention Act* and the *Wildlife Act,* increases substantively. Reduced nesting success due to nest destruction could result in small and localized population declines of some species. Of particular concern for potential mortality related to construction are species at risk.

Collisions with construction vehicles and machinery are minor potential sources of mortality for many bird species. To date, Manitoba Hydro construction records do not report any bird-related vehicle mortality on the recently completed Wuskwatim transmission line project in northern Manitoba. Increased access to formerly inaccessible areas via access roads and the RoW could result in increased legal (and illegal) harvest of waterfowl, upland game birds, and migratory game species. Legal (and illegal) harvest mortality is unlikely to occur with colonial waterbirds, birds of prey, woodpecker species, and species at risk. The potential illegal collection and harvest of these bird groups is managed by provincial regulatory authorities. Some mitigation measures are required to reduce the potential for direct clearing and construction-related mortality, and potentially, for harvest mortality (see Section 5.2).

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

Few direct causes of mortality on waterfowl and other waterbirds are expected during this phase. As clearing and construction are expected to occur after the fall migration in northern Manitoba, bird mortality should not occur. There is a small potential for waterfowl and other waterbird nests to be damaged or destroyed by machinery during the construction phase in spring and early summer. This potential impact is most likely limited to dry mineral soil areas in southern Manitoba where work may be feasible, and reduced further to habitats where these types of nests might be found.

Construction workers and the public could harvest mallard and sandhill crane opportunistically during the legal hunting season, as access will be improved during clearing and construction. As clearing and construction is expected to occur after the fall migration in the north mainly under frozen ground conditions, hunting mortality is not expected to be an issue during this phase. However, construction activity is scheduled for all seasons in the south, and hunting mortality could increase for local migratory game birds such as mallards and sandhill cranes wherever new access is developed, particularly in the north where more access points are expected to be created. Access in the south is primarily along pre-existing developments such as transmission lines (Manitoba Hydro 2011). Provincial harvest management strategies and regulations should be considered in ensuring sustainable waterfowl and other regulated waterbird populations in the Bipole III Project area. The potential illegal harvest of waterfowl is managed by provincial and federal regulatory authorities.

Where construction occurs in summer in the southern Footprint, mortality due to potential collisions with construction vehicles may affect mallards and other ducks; however these types of collisions do not appear to be frequent (Ashley and Robinson 1996; Clevenger *et al.* 2003; Erickson *et al.* 2005). Vehicle collisions with sandhill cranes are less commonly reported (Ashley and Robinson 1996). As most waterfowl and other waterbirds are found in or near wetland habitats and construction activities are highly unlikely to occur here, there is only a small potential for spatial and temporal overlap with the Local Study Area. Local increases in traffic associated with construction activities may temporarily increase the risk of waterfowl and other waterbird collisions with vehicles, and potentially increase the occurrences of mortality or injury. Manitoba Hydro construction records do not report any bird-related vehicle mortality on the recently completed Wuskwatim transmission line project in northern Manitoba. Vehicle speeds will be slow and controlled along the RoW for safe work operations, especially in rough terrain. Bird-vehicle collisions are highly unlikely to occur as waterfowl and other waterbirds, including VECs mallard and sandhill crane, should be able to avoid on-coming construction vehicles. Mitigation measures are required to reduce the potential for construction-related mortality effects on waterfowl and other waterbirds (see Section 5.2).

Mortality of a few individuals would result in negligibly reduced populations of waterfowl and other waterbirds. These potential effects are considered reversible and no residual effects are anticipated.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Few direct causes of mortality on colonial waterbirds are expected during clearing and construction. As these activities are expected to occur after the fall migration in the north, bird mortality should not occur. There will be limited spatial and temporal overlap with clearing and construction activities; however, a few nests could be disturbed or destroyed during clearing mainly on the southern portion of the HVdc transmission line RoW (hereafter referred to as the RoW).

Where construction occurs in the southern Footprint, mortality due to collisions with construction vehicles could affect a small number of colonial waterbirds. Vehicle collisions with great blue herons are not commonly reported (McCollister and Van Manen 2009) as this VEC and other colonial waterbirds are most likely found in, or associated with, wetland habitats. Clearing and construction activities are not expected to occur in wetlands. As with other bird species, collisions with vehicles are very infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, colonial waterbird mortality due to construction is highly unlikely. Mitigation measures are required to reduce the potential for construction-related mortality effects on colonial waterbirds (see Section 5.2).

Mortality of a few individuals would result in negligibly reduced populations of colonial waterbirds. These potential effects are considered reversible and no residual effects are anticipated.

BIRDS OF PREY (BALD EAGLE)

Few direct causes of bird of prey mortality are expected during clearing and construction. Some owl species including great grey owl, boreal owl and northern hawk owl are more susceptible to clearing and construction mortality in northern regions of the Local Study Area, as these species tend to nest as early as late winter. Other owl species and their nests could be disturbed during clearing in the southern portion of the Local Study Area as with a limited number of other bird species. Great horned owls for example, have nested as early as February (Berger, *pers. comm.* 2010). As such, raptor nests (especially owl species) require mitigation, and are to be avoided when encountered (see Section 5.2).

Raptors and owls are somewhat susceptible to collisions with vehicles (Harness and Wilson 2001; AltaLink Management Ltd. 2006; Stinson *et al.* 2007). Bald eagles are particularly vulnerable when they scavenge road-killed carcasses (Stinson *et al.* 2007). Bald eagles are found predominantly in northern environments, and tend to arrive near their breeding grounds in Manitoba earlier than most other bird species in late winter and early spring. As such, there is small potential for spatial and temporal overlap with the Footprint. Other birds of prey are more likely to occur in the Local Study Area in winter, especially where suitable forest cover occurs. A few resident owl species and individuals are expected to forage along the RoW. Local increases in traffic associated with clearing and construction activities may temporarily increase the risk of bird of prey collisions with vehicles, and potentially increase the occurrences of mortality or injury. Collisions with vehicles are very infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, bird of prey mortality due to clearing and construction is highly unlikely. Mitigation measures are required to reduce the potential for construction-related mortality effects on birds of prey (see Section 5.2).

Mortality of a few individuals would result in negligibly reduced populations of birds of prey. These potential effects are considered reversible and no residual effects are anticipated.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

As the RoW is cleared and access trails are created, opportunities for harvest of upland game birds may increase, particularly in the north where more access points are expected to be created. Access in the south is primarily along pre-existing developments such as transmission lines (Manitoba Hydro 2011). As the season for these species ends in mid-December (Manitoba Conservation 2010c), legal harvest may not increase if clearing occurs out of season, but opportunities for domestic harvest and illegal harvest may improve, increasing upland game bird mortality. Provincial harvest management strategies and regulations are an important consideration in ensuring sustainable upland game bird populations.

Ruffed grouse collisions with vehicles have been reported (Clevenger *et al.* 2003; Holland and Taylor 2003d), and collisions with construction vehicles may contribute to ruffed grouse mortality during clearing and construction. Similarly, bird-vehicle collisions with a few sharp-tailed grouse are possible. Upland game birds are expected throughout the Footprint as these species are widespread and occur commonly in winter, especially where suitable habitats, including forest cover, shrublands and grasslands occur. A few resident upland game bird species and individuals are expected to forage along the RoW. Local increases in traffic associated with clearing and construction activities may temporarily increase the risk of upland game bird collisions with vehicles, and potentially increase the occurrences of mortality or injury. Collisions with vehicles are very infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, upland game bird mortality due to clearing and construction is highly unlikely. Mitigation measures are required to reduce the potential for construction-related mortality effects on upland game birds (see Section 5.2).

Mortality of a few individuals would result in negligibly reduced populations of upland game birds. These potential effects are considered reversible and no residual effects are anticipated.

WOODPECKERS (PILEATED WOODPECKER)

Few direct Project-related effects on woodpecker mortality are expected for the clearing and construction phase. Some woodpecker species might be more susceptible in northern and southern regions of Bipole III Project area, as these species tend to nest in early spring. In addition, resident woodpeckers also use tree cavities for roosting over-night, which makes them more susceptible to night clearing and construction activities. The probability of this occurring however, is extremely low. In particular, woodpecker nests require mitigation, and are to be avoided when encountered (see Section 5.2).

Collisions with construction vehicles could cause infrequent pileated woodpecker mortality, as these birds are prone to collisions with vehicles when foraging on the ground (Bull and Jackson 1995). Collisions with vehicles are very infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, woodpecker mortality due to clearing and construction is highly unlikely. Mitigation measures are required to reduce the potential for construction-related mortality effects on woodpeckers (see Section 5.2).

Mortality of a few individuals would result in negligibly reduced populations of woodpeckers. These potential effects are considered reversible and no residual effects are anticipated.

SPECIES AT RISK

Least Bittern

Least bittern breeding habitat is found throughout the Footprint. Four least bitterns were observed during breeding bird studies; however none occurred in the Local Study Area. No direct Project-related effects on least bittern mortality are expected in the northern Footprint for the clearing and construction phase, as this species is not typically found in the area (Koes 2003a). Least bittern nests located in southern Manitoba within the Project Study Area could be damaged or destroyed if construction occurred during the nesting period in spring and early summer. As construction is not anticipated in wetland habitats where least bitterns occur during the breeding season, increased mortality is unlikely.

In the southern Footprint, collisions with construction vehicles may increase mortality, to the detriment of individuals (COSEWIC 2009b); however, the risk of collisions is small and short-term. Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, least bittern mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Least bitterns are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Yellow Rail

Yellow rail range and habitat includes the entire Footprint. During the breeding bird and rare bird surveys, at least 86 yellow rails were observed, primarily in the southern portion of the Local Study Area. As such, the likelihood of yellow rail mortality is increased by Project activities wherever yellow rails and suitable habitat is found in the Footprint.

No direct Project-related effects on yellow rail mortality are expected in the northern Footprint for the clearing and construction phase, as this migratory species will not be in the area in winter. In the south, there is a small potential for nests to be damaged or destroyed if construction activities occur during the nesting season, which begins in late May (Bookhout 1995). Disguised nests can be found on or near the ground in sedge meadows (Bookhout 1995), which can inadvertently be run over by machinery (COSEWIC 2009a). As construction is not anticipated in wetland habitats including sedge meadows where yellow rail occurs during the breeding season, increased mortality is unlikely. It is also possible that a few yellow rails could be present in damp agricultural areas (i.e., occasionally tame hayfields) where construction activities may occur.

Yellow rails have also been known to collide with vehicles (Bookhout 1995), which could contribute to individual mortality. Incidentally, one yellow rail was found dead on the roadside during 2009 bird surveys. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, yellow rail mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Yellow rails are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Ferruginous Hawk

Ferruginous hawk range has been reduced in about the last 20 years towards the southwest corner of Manitoba (De Smet 2003a). Historic ferruginous hawk range only includes a small area along the southern portion of the FPR. No ferruginous hawks were observed in habitats sampled during rare species surveys and breeding bird surveys, and only one individual was observed incidentally in 2009 during migration.

Ferruginous hawks are particularly susceptible to disturbance by human activity, often resulting in nest or young abandonment (De Smet 2003a; Hoffman and Smith 2003). Additionally, construction activity in the southwest in spring could result in failed, damaged, or destroyed nests. Construction is anticipated for dry mineral soils and potentially pastureland habitats in southern Manitoba where ferruginous hawks may occur during the breeding season.

As with other raptor species, ferruginous hawks may be susceptible to collisions with vehicles (e.g., Bechard and Schmutz 1995). Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, ferruginous hawk mortality due to construction is highly unlikely. Some mitigation measures are required to eliminate the potential effects of construction-related mortality (see Section 6.2) for species at risk. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Ferruginous hawks are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Burrowing Owl

Burrowing owl range is limited to extreme southwestern Manitoba (De Smet 2003b), and as such, Project-related effects on this species should be geographically limited. No burrowing owls were found in the Local Study Area, but a pair was discovered during surveys of alternate routes, indicating that they could be found in the vicinity of the FPR. Burrowing owl population viability is influenced by mortality of adults and young (COSEWIC 2006b). High survival of young after fledging increases the breeding population and yearling recruitment in the next breeding season (Todd *et al.* 2003). Factors such as adult and juvenile mortality rates, productivity, and immigration/emigration are currently identified as key factors in declining burrowing owl populations (COSEWIC 2006b). Construction in the southwestern Footprint in spring or summer could result in the disturbance or destruction of burrowing owl nests. It is highly unlikely that individual effects could occur given the low probability of range overlap between the current range and the Footprint.

Collisions with vehicles contribute to burrowing owl mortality (Haug *et al.* 1993; COSEWIC 2006b). Their tendency to forage near roads makes them susceptible to collisions with vehicles (COSEWIC 2006b). Increased traffic during construction could increase the risk of collisions with vehicles Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, burrowing owl mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Burrowing owls are listed as endangered under SARA and MESA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Short-eared Owl

Short-eared owl populations are eruptive and frequently change breeding locations (Holland and Taylor 2003h), making prediction of effects very difficult and highly uncertain. In addition, short-eared owls periodically occur in southern Manitoba during winter (Holland and Taylor 2003h). Short-eared owl range includes the entire Footprint. During the breeding bird and rare bird surveys only four short-eared were observed, primarily in the central portion of the Footprint. These occurrences are likely under-estimated due to species detection limitations. As such, and by using the precautionary principal, the expected likelihood of short-eared owl mortality is increased by construction activities.

Short-eared owls are ground nesters (Holt and Leasure 1993) and their nests and eggs can be destroyed by machinery (COSEWIC 2008a). If construction occurs in spring and summer in the southern Footprint, short-eared owl nests could be damaged or destroyed. Although many short-eared owls nest in wetlands, and are unlikely to be affected given limited construction activities in these habitats, some short-eared owls nest occasionally in agricultural lands (e.g., haylands) where construction may occur.

Collisions with vehicles contribute to short-eared owl mortality, but likely have no significant effect on populations (COSEWIC 2008a). Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, short-eared owl mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Short-eared owls are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Common Nighthawk

As common nighthawks breed in most of Manitoba (Taylor 2003j), and at least 26 were observed during the 2009 and 2010 surveys, construction in the southern Footprint in spring or summer could result in damaged or destroyed nests. Although northern areas are of no concern due to clearing activities limited to the winter period, its preference for nesting on the ground in dry mineral soils, bare patches and in gravel increases the risk for construction-related common nighthawk mortality.

Common nighthawks frequently roost on the ground on bare patches, and are susceptible to collisions with vehicles, including all terrain vehicles, which can also destroy nests (COSEWIC 2007b). Increased traffic could result in some local common nighthawk mortality. At least one common nighthawk was found dead on the roadside during 2010 bird surveys (Berger, *pers. comm.* 2010). Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, common nighthawk mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Common nighthawks are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Whip-poor-will

Whip-poor-will range includes the southern portion of the Local Study Area. During the breeding bird and rare bird surveys 16 whip-poor-wills were observed. As such the likelihood of whip-poor-will mortality is slightly increased by the Project. As whip-poor-wills nest on the ground (Cink 2002), construction in the southern and west central portions of the Footprint during spring and summer could result in inadvertent damage to or destruction of nests.

Similar to common nighthawks, whip-poor-wills tend to rest beside roadways, making them susceptible to collisions with vehicles (COSEWIC 2009c). Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, whip-poor-will mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Whip-poor-wills are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Red-headed Woodpecker

As red-headed woodpecker range does not include the northern Footprint, no direct Project-related effects on mortality are expected in this area. The only area where red-headed woodpeckers were observed during bird surveys was where the FPR crosses the Rat River. Other incidental observations were recorded in 2009 and 2010, but not in the Local Study Area. Site-level trees with red-headed woodpecker nest and roost cavities have yet to be identified and should be included in environmental protection plans.

Collisions with vehicles during roadside foraging are a source of red-headed woodpecker mortality (COSEWIC 2007c). Increased traffic on roads and access roads during construction could result in infrequent vehicle-red-headed woodpecker collisions, contributing to mortality of a few individuals. Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, red-headed woodpecker mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Red-headed woodpeckers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Olive-sided Flycatcher

Olive-sided flycatchers can range throughout the Local Study Area. During the breeding bird and rare bird surveys, at least 211 olive-sided flycatchers were observed, primarily in the northern portion of the Local Study Area, while only a few individuals were observed using habitat in the southern portion of the Local Study Area. Due to occurrences in the Footprint, the likelihood of olive-sided flycatcher mortality is increased slightly with the Project.

No direct Project-related effects on olive-sided flycatcher mortality are expected in the northern Footprint, as this migratory species will be absent in winter. If construction occurs in spring and summer in the southern Footprint, nests could inadvertently be damaged or destroyed. As olive-sided flycatchers tend to prefer wet shrubland habitats, construction overlap with the Project is unlikely. Burned forested habitats are also frequented, but primarily in northern environments. Although collisions with vehicles were not reported in the literature reviewed, there is a small and infrequent potential for this type of mortality to occur. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Olive-sided flycatchers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Loggerhead Shrike

Loggerhead shrike range is restricted to the southern portion of the Local Study Area. Loggerhead shrikes were not observed in apparently suitable habitats surveyed during rare and breeding bird surveys. Construction activities in the southern Footprint in spring could result in damaged or destroyed nests. Although the endangered eastern sub-species is unlikely to be encountered as its currently known range is essentially restricted to the area around Winnipeg (COSEWIC 2004), there is some minor potential for the western race to occur in pasturelands and shelterbelts in the southern Footprint.

As loggerhead shrikes often forage near roads, collisions with vehicles can be a major source of mortality (COSEWIC 2004). Increased traffic in the southern Footprint, where this species is most likely to occur (De Smet 2003c), could lead to increased loggerhead shrike mortality. In addition, roads attract predators, and mortality of adults and eggs could increase along newly created access roads (COSEWIC 2004). Collisions with vehicles are infrequent. As vehicle speeds are anticipated to be slow and controlled in the Footprint, and primarily limited to winter, loggerhead shrike mortality due to construction is highly unlikely. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Loggerhead shrikes are listed as threatened under SARA and endangered under MESA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Sprague's Pipit

Sprague's pipit range is limited to southern and particularly southwestern Manitoba. This species is rarely observed in the boreal forest (Holland *et al.* 2003a), and no direct Project-related effects on Sprague's pipit mortality are expected in the northern Footprint. Only four observations were recorded during 2009 surveys of the alternative routes, and although habitat appears to be available in community and private pasturelands and elsewhere, none were recorded in the Local Study Area. As they nest on the ground (Robbins and Dale 1999), their nests could be damaged or destroyed during construction in the southern Footprint in spring and summer. Although collisions with vehicles were not reported in the literature reviewed, there is minor potential for this type of mortality to occur. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Sprague's pipits are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Golden-winged Warbler

No direct Project-related effects on golden-winged warbler mortality are expected in the northern Footprint, as their range is limited to southern and western Manitoba (Edie *et al.* 2003a) Twenty-six golden-winged warblers were observed during the breeding bird and rare bird studies. Many other sites in the Project Study Area are known from provincial surveys (C. Artuso, unpubl. data). As golden-winged warblers are known to nest in the province (Eadie *et al.* 2003a), construction in the southern Footprint in spring and summer could result in damage to or destruction of nests. Although collisions with vehicles were not reported in the literature reviewed, there is a small and infrequent potential for this type of mortality to occur. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Golden-winged warblers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Canada Warbler

The breeding distribution of Canada warblers includes the central portion of the Local Study Area (Reitsma *et al.* 2010). Canada warblers are prevalent in the Project Study Area, and at least 142 Canada warblers were observed during the rare bird and breeding bird surveys. Construction in the west-central Footprint in spring and summer could result in inadvertent damage to or destruction of Canada warbler nests. Although collisions with vehicles were not reported in the literature reviewed, there is a small and infrequent potential for this type of mortality to occur. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Canada warblers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Rusty Blackbird

Rusty blackbird range extends throughout the Local Study Area, but they tend to occur more in northern environments post-migration. Two hundred and ten rusty blackbirds were observed during the rare bird and breeding bird surveys in 2010. Few direct Project-related effects on rusty blackbird mortality are expected during clearing and construction. This migratory species nests mainly in northern treed muskeg habitat (Nero and Taylor 2003), and clearing and construction is anticipated to occur in winter in these areas. Where rusty blackbird breeding range overlaps with spring and summer construction, nests could be damaged or destroyed during this phase. Although collisions with vehicles were not reported in the literature reviewed, there is minor potential for this type of mortality to occur. Some mitigation measures are required to reduce the effects of construction-related mortality on species at risk (see Section 5.2).

Rusty blackbirds are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

5.1.2.3 Habitat Alteration and Sensory Disturbance

As the Footprints are cleared and some access roads are created for the HVdc transmission line and associated Project components, forested areas within the Footprint will experience the greatest change when compared with other habitats. The Project-related physical changes to bird habitats will be least in wetlands, grasslands, shrublands, and agricultural areas, and in many cases will be limited to the tower footprints and other permanent infrastructure. The shrub communities and forest edge created by clearing the RoW in some areas will likely benefit some bird species and communities, or could result in a negative, small loss of some habitat for others.

In addition to the physical habitat alterations and potential losses, sensory disturbances created by vehicles, helicopters, machinery, and people during clearing and construction can disrupt the daily activities of some bird species, causing a loss of **effective habitat** if birds avoid the disturbed area. Depending on the frequency of sensory disturbances from machinery, loud noises can diminish bird communications used in the defence of territories or to attract mates, and could result in reduced reproductive success. As clearing and construction activities will advance along the RoW and be relatively short in duration, effects on individual birds or populations in the Local Study Area will be temporary in nature. Seasonal considerations, proximity to the activities, and geographic location will determine the magnitude of potential short-term effects. Disturbances that could lead to individual mortality are discussed in Section 5.1.2.2. Loss of effective habitat is difficult to measure. Tolerances to and thresholds for sensory disturbance are provided by Environment Canada (2009). Some mitigation measures are required to reduce the potential for loss of effective habitat from sensory disturbance during clearing and construction (see Section 5.2), especially as it relates to species at risk.

The footprints of the HVdc transmission line, northern converter station, northern and southern electrode sites, AC collector lines, construction camps, and power sites were considered during the assessment of habitat loss via habitat modeling. Appendix F-16 details the amount of habitat expected to be altered by clearing of the RoW in each ecoregion in the Local Study Area for VECs while Appendix F-17 outlines the amount of habitat affected by other Project components in each ecoregion in the Local Study Area for VECs. Appendix F-18 summarizes the habitat model results for the entire Footprint. In many cases, where physical habitat losses are actually limited to individual tower footprints, the methods used to report potential habitat effects are over-estimating these losses.

As less than 5% of habitat in the Local Study Area is expected to be affected by the Footprint for each VEC, no measurable effect on VECs are anticipated as a result of potential habitat alterations or losses. Further, where large areas are required to support bird species with large home ranges, sufficient habitats exist in the Local Study Area or in the Project Study Area to sustain these populations, and therefore, negligible effects are anticipated.

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

Clearing of the Footprint will result in minimal habitat alteration for waterfowl, mainly because the preferred transmission line route was selected to avoid wetlands and other water bodies where possible (see the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*). Mallard was selected as a VEC to assess potential habitat alterations associated with waterfowl and other waterbirds and bird communities that occupy shallow open water, marsh, and other wetland habitats (see Appendix D) to maintain their life functions.

Mallard data from the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated mallards were most clearly associated with wetland habitat types and with clustered groups of six to eight other species including sandhill crane, pied-billed grebe, American bittern, least bittern and sora rail. NMS plots (Appendix E, Figures E-1 to E-6) indicated mallards were associated with 'wetland' types and with sandhill crane, yellow rail, swamp sparrow, and American bittern, among other species.

It was determined that 1.49% of mallard habitat in the Local Study Area will be affected by the Footprint (Map Series 1200 – Distribution of modeled mallard habitat in the Local Study Area). The greatest amount of habitat alteration will be in the Mid-Boreal Lowland Ecoregion (711.35 ha) and the greatest proportion of habitat alteration will be in the Interlake Plain Ecoregion (1.19%). A small amount of mallard habitat will be affected on the RoWs, at the construction power camp, northern electrode line, potential northern electrode sites, alternate southern electrode site SES3c, and at the Keewatinoow converter station. The amount of habitat altered, and potentially lost (i.e., at the tower footprints and permanent infrastructure sites) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional mallard population or on breeding and nesting habitat availability. In some cases, mallard nesting habitat may improve slightly where forest is converted to grassland or shrubland. There is sufficient habitat in the Local Study Area and throughout the Project Study Area to sustain mallard populations. As mallard habitat alterations will be small, the bird community associated with these potential effects is unlikely to be affected by the Project. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

Sandhill crane was selected as a VEC to assess potential habitat alterations associated with waterfowl and other waterbirds and bird communities that require occupy shallow open water, marsh, swamp and peat and non-peat forming wetland complexes primarily located in northern environments (Appendix D) to maintain their life functions. Sandhill crane data from the Lake Manitoba Plain, Interlake Plain, Mid-boreal Lowland, Hayes River Upland, and Hudson Bay Lowland ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated that sandhill crane was associated with several habitat types, including wetland, herb, and open and sparse coniferous areas. Species associations included mallard, American bittern, rusty blackbird, savannah sparrow, and pied-billed grebe. NMS plots (Appendix E, Figures E-1 to E-6) indicated that sandhill cranes were associated with wetland and coniferous habitat types and with mallard, yellow rail, sedge wren, rusty blackbird, and pied-billed grebe, among other species.

A total of 1.61% of sandhill crane habitat in the Local Study Area will be affected by the Footprint (Map Series 1300 – Distribution of modeled sandhill crane habitat in the Local Study Area). The greatest amount of habitat will be altered in the Mid-Boreal Lowland Ecoregion (1026.92 ha) and the greatest proportion will be affected in the Lake Manitoba Plain Ecoregion (1.46%). Sandhill crane habitat will also be affected on the RoWs, at the construction power camp, potential northern electrode sites, alternate southern electrode site SES3c, and at the Keewatinoow converter station. The amount of habitat altered, and potentially lost (i.e., at the tower footprints and permanent infrastructure sites) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional sandhill crane population or on breeding and nesting habitat availability. In some cases, sandhill crane nesting and brood-rearing habitat may improve slightly where forest is converted to grassland or shrubland. There is sufficient habitat in the Local Study Area and the Project Study Area to sustain sandhill crane populations. As sandhill crane habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. In some cases, waterfowl such as mallard and other waterbirds including sandhill crane could habituate to these disturbances, while some individuals will find habitats elsewhere. Effects on the most sensitive species could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As most waterfowl and other waterbirds are migratory, no effects are anticipated for winter. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Clearing of the RoW will result in minimal habitat alteration for colonial waterbirds, as the transmission line route was selected to avoid wetlands and other water bodies where possible (see the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*). Great blue heron was selected as a VEC to assess potential habitat alterations associated with colonial waterbirds and bird communities (Section 4.3.3.3) that occupy wetland and treed habitat (see great blue heron model Appendix D) to maintain their life functions.

There was insufficient great blue heron data to conduct cluster or NMS analysis. Logistic regression analysis (Appendix E) was performed on colonial waterbirds survey data, and density estimates were calculated (Appendix E). Results indicated that great blue herons prefer wetland habitat areas, and some were observed in coniferous open habitats. Habitat selection was similar to that of mallard and sandhill crane.

It was determined that 1.53% of great blue heron habitat in the Local Study Area will be affected by the Footprint (Map Series 1400 -– Distribution of modeled great blue heron habitat in the Local Study Area). The greatest amount of habitat will be altered in the Lake Manitoba Plain Ecoregion (533.00 ha) while the greatest proportion of habitat will be altered in the Lake Manitoba Plain and Hayes River Upland ecoregions (1.47%). Habitat will be affected on the RoW and at the potential southern electrode sites. The amount of habitat altered, and potentially lost (i.e., at the tower footprints and permanent infrastructure sites) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional great blue heron population or on breeding and nesting habitat availability, but only if heron rookeries are not affected. In some cases, great blue heron foraging habitat may improve slightly where forest is converted to grassland or shrubland. There is sufficient habitat in the Local Study Area and Project Study Area to sustain great blue heron populations. As great blue heron habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. In some cases, colonial waterbirds could habituate to these disturbances, while some will find habitats elsewhere. Great blue herons are considered particularly sensitive as parents are more likely to abandon nests and colonies within 0.5 km of construction and logging activity (Werschkul *et al.* 1976). Effects on the most sensitive colonial waterbird species could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As most colonial waterbirds are migratory, no effects are anticipated for winter. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

BIRDS OF PREY (BALD EAGLE)

Clearing of the Footprint will result in the disruption, alteration, and improvement of some raptor nesting and foraging habitat. The newly cleared RoW may present improved foraging opportunities for raptors, as small mammals may be attracted to the altered habitat (Johnson *et al.* 1979). Bald eagle was selected as a VEC to assess potential habitat alterations associated with birds of prey and bird communities (Section 4.3.3.4) that require mature riparian forest (see bald eagle model, Appendix D) to maintain their life functions.

There was insufficient bald eagle data to conduct cluster or NMS analysis. Logistic regression analysis (Appendix E) was performed on raptor migration survey data and results indicated that this species prefers mature treed habitat in proximity to water areas. No associations were made with other bird species.

A total of 0.74% of bald eagle habitat in the Local Study Area will be affected by the Footprint (Map Series 1500 – Distribution of modeled bald eagle habitat in the Local Study Area). The greatest amount of habitat will be altered in the Hayes River Ecoregion (16.81 ha) while the greatest proportion of habitat will be altered in the Interlake Plain Ecoregion (1.52%). Habitat will be affected on the RoWs. Small habitat alterations and losses could affect a few individuals but are not expected to have a measureable effect on the local or regional bald eagle population or on breeding and nesting habitat availability, but only if multi-generational stick nests are not removed. Transmission towers frequently provide bald eagles with nesting opportunities, especially in northern Manitoba where many nests have been documented on towers (Berger, *pers. comm.* 2010). In some cases, bald eagle foraging habitat could also increase slightly where forest is converted to grassland or shrubland. There is sufficient habitat in the Local Study Area and Project Study Area to sustain bald eagle populations. The amount of affected by the Footprint is less than 5% of the habitat available in the Local Study Area, and considerably less than 1% of the Project Study Area, the scale at which potential habitat effects on the bald eagle population are best measured. As bald eagle habitat alterations will be small, the bird community associated with these potential habitat effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. In some cases, birds of prey could habituate to these disturbances, while some will find habitats elsewhere. Bald eagles are relatively sensitive to disturbances (Buehler 2000). Effects on the most sensitive bird of prey species could be measureable and result in reduced reproductive success. Effects will be limited to the local population. Where birds of prey are migratory, no effects are anticipated for winter. However, of the owl species that are residents, construction noise and people will disturb individuals in proximity to clearing and construction activities. It is anticipated that some birds of prey will habituate to these disturbances, while some individuals will find habitats elsewhere. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

Upland game bird habitat will be altered and disrupted during Footprint clearing. In some cases, the altered habitat created by the RoWs could improve upland game bird breeding and nesting opportunities. Ruffed grouse was selected as a VEC to assess potential habitat alterations associated with upland game birds and bird communities (Section 4.3.3.5) that occupy open and closed deciduous and mixedwood forest (see ruffed grouse model, Appendix D) to maintain their life functions.

Ruffed grouse data from the Lake Manitoba Plain, Interlake Plain, and Mid-Boreal Lowland ecoregions was sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated rugged grouse were associated with broadleaf open and mixedwood dense habitat types and with clustered groups of four to eight other species including American redstart, hermit thrush, Connecticut warbler, and hairy woodpecker. NMS plots (Appendix E, Figures E-1 to E-6) indicated ruffed grouse were associated with broadleaf habitat types and with bird species such as alder flycatcher, pileated woodpecker, and hairy woodpecker and, in the Mid-Boreal Lowland Ecoregion, Canada warbler.

A total of 1.51% of ruffed grouse habitat in the Local Study Area will be affected by the Footprint (Map Series 1600 – Distribution of modeled ruffed grouse habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (531.32 ha, 1.47%). Habitat will be affected on the RoWs and at the potential southern electrode sites. As ruffed grouse is predominantly a forest bird, the amount of potential habitat loss (i.e., the Footprints) is less than 5% of the habitat available in the Local Study Area. Ruffed grouse often use openings in forested habitats for foraging. Small habitat losses may affect a few individuals but are not expected to have a measureable effect on the local or regional ruffed grouse population, breeding and nesting habitat availability, or on winter food and cover requirements. There is sufficient habitat in the Local Study Area and Project Study Area to sustain ruffed grouse populations. As ruffed grouse habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sharp-tailed grouse was selected as a VEC to assess potential habitat alterations associated with upland game birds and bird communities (Section 4.3.3.5) that occupy mixtures of grasslands, shrublands and forested habitat young burned areas (see sharp-tailed grouse model, Appendix D) to maintain their life functions.

There was insufficient sharp-tailed grouse data to conduct cluster or NMS analysis. Density estimates were calculated with 2010 breeding bird survey data (Appendix E). Results indicated that sharp-tailed grouse were associated with broadleaf habitat types and bird species such as alder flycatcher, pileated woodpecker, hairy woodpecker and, in the Mid-Boreal Lowland Ecoregion, Canada warbler. Other species expected to use grassland and shrubland habitats associated with sharp-tailed grouse in southern ecoregions could include western meadowlark, marbled godwit, upland sandpiper, and vesper sparrow, among others (Berger, *pers. comm.* 2010).

A total of 1.67% of sharp-tailed grouse habitat in the Local Study Area will be affected by the Footprint (Map Series 1700 - Distribution of modeled sharp-tailed grouse habitat in the Local Study Area). The greatest amount of habitat will be altered in the Mid-Boreal Lowland Ecoregion (574.22 ha) and the greatest proportion of habitat alteration will be in the Hayes River Upland Ecoregion (1.59%). Habitat will be affected on the RoWs, at the construction power camp, potential northern electrode sites, alternate southern electrode site SES3c, and at Keewatinoow converter station. The amount of habitat altered, and potentially lost (i.e., at the tower footprints and permanent infrastructure sites) will be less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional sharp-tailed grouse population, or breeding and nesting habitat availability, or winter food and cover requirements. In some cases, sharp-tailed grouse nesting and foraging habitat may improve slightly where extensive forested habitats are converted to grassland or shrubland. Sufficient habitat is located within the Local Study Area and the Project Study Area to sustain sharp-tailed grouse populations. As sharp-tailed grouse habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. In some cases, upland game birds could habituate to these disturbances, while some will find habitats elsewhere. Although ruffed grouse appear to be relatively insensitive to disturbances, sharp-tailed grouse are sensitive to disturbances. Male sharp-tailed grouse are not affected by the presence of structures such as sedentary vehicles, but are displaced from leks by human presence (Baydack and Hein 1987; Connelly *et al.* 1998). Effects on the most sensitive upland game bird species could be measureable and result in reduced reproductive success. Effects will be limited to the local population. With the exception of willow ptarmigans, which migrate to the Project Study Area for the winter, all other upland game birds are resident species. Winter construction noise and people will disturb individuals in proximity to clearing and construction activities. It is anticipated that some upland game birds will habituate to these disturbances, while some individuals will find habitats elsewhere. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

WOODPECKERS (PILEATED WOODPECKER)

Clearing of the Footprint will result in minimal habitat alteration for pileated woodpecker, as the preferred transmission line route was selected to avoid core communities with large tracts of forest where possible (see the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*). Pileated woodpecker was selected as the VEC to assess potential habitat alterations associated with the woodpecker group and those bird communities (Section 4.3.3.6) that occupy mature mixedwood forest (see pileated woodpecker model, Appendix B) to maintain their life functions.

Pileated woodpecker data from the Lake Manitoba Plain, Interlake Plain, Mid-Boreal Lowland, and Hayes River Upland ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated pileated woodpeckers were associated with various forest habitat types, and with clustered groups of six to fourteen species including hairy woodpecker, downy woodpecker, chipping sparrow, northern flicker and, in the Mid-Boreal Lowland Ecoregion, Canada warbler. NMS plots (Appendix E, Figures E-1 to E-6) indicated pileated woodpeckers were associated with broadleaf habitat with bird species such as hairy woodpecker, ovenbird, ruffed grouse and, in the Mid-Boreal Lowland Ecoregion, Canada warbler.

It was determined that 1.61% of pileated woodpecker habitat in the Local Study Area will be affected by the Footprint (Map Series 1800 - Distribution of modeled pileated woodpecker habitat in the Local Study Area). The greatest amount of habitat alteration will be in the Lake Manitoba Plain Ecoregion (326.54 ha) and the greatest proportion of habitat alteration will be in both the Lake Manitoba Plain and Churchill River Upland ecoregions (1.46%); however, it is unlikely that a viable pileated woodpecker population would be found in the Churchill River Upland Ecoregion. Habitat will be affected on the RoWs and at potential southern electrode site SES3c. As the pileated woodpecker is predominantly a mature and older-growth forest bird, the amount of habitat potentially lost (i.e., on the RoW and permanent infrastructure sites) is less than 5% of the habitat available in the Local Study Area, and considerably less than 1% in the Project Study Area, the scale at which potential habitat effects on this population are best measured. Pileated woodpeckers often use edges in forested habitats for nesting and foraging. Small habitat losses may affect a few individuals but are not expected to have a measureable effect on the local or regional pileated woodpecker population, breeding and nesting habitat availability, or winter food and cover requirements. There is sufficient habitat in the Local Study Area and the Project Study Area to sustain pileated woodpecker populations. As pileated woodpecker habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. In some cases, woodpeckers could habituate to these disturbances, while some will find habitats elsewhere. Pileated woodpeckers are relatively insensitive to disturbances (Bull and Jackson 1995). Effects on the most sensitive species could be measureable and result in reduced reproductive success. Effects will be limited to the local population. No effects on migratory species are anticipated for winter. However, for resident species, including the pileated woodpecker, construction noise, and people will disturb individuals near clearing and construction activities. It is anticipated that some woodpeckers will habituate to these disturbances, and others will find habitats elsewhere. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

SPECIES AT RISK

Least Bittern

COSEWIC (2009b) reports that habitat loss and degradation are serious threats to least bittern populations. Human activities such as large-scale draining, filling, and dyking have permanently altered least bittern habitat in areas of Quebec and Ontario. Closely related threats are toxins from agriculture and industry, invasive species, disease, and recreational activities (COSEWIC 2009b).

There was insufficient least bittern data to conduct cluster or NMS analysis, and no habitat or species associations were produced. A total of 1.64% of least bittern habitat in the Local Study Area will be affected by the Footprint (Map Series 1900 - Distribution of modeled least bittern habitat in the Local Study Area). The Lake Manitoba Plain Ecoregion is the only ecoregion where habitat is expected to be altered by clearing of the HVdc transmission line RoW (168.92 ha, 1.27%). Habitat will also be affected at potential southern electrode site SES3c. As less than 5% of least bittern will be habitat affected by the Footprint, a small effect on habitat is expected. The amount of habitat altered, and potentially lost (i.e., at the tower footprints) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional least bittern population or on breeding and nesting habitat availability. In some cases, least bittern nesting habitat may improve slightly where forest is converted to marsh wetlands. It is unclear whether there is sufficient habitat on the landscape to sustain least bittern populations. As least bittern habitat alterations will be small, the bird community that associated with potential habitat effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. Least bitterns are relatively tolerant of human disturbance, and may habituate to human activity (Gibbs *et al.* 1992). If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As least bitterns are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Yellow Rail

Yellow rail data from the Lake Manitoba Plain and Mid-Boreal Lowland Ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated yellow rails were most clearly associated with grassland and wetland habitat types with species including yellow-headed blackbird, mallard, and sora rail. NMS plots (Appendix E, Figures E-1 to E-6) indicated yellow rails were associated with wetland habitat types and with mallard, American bittern, and sedge wren.

Habitat loss and degradation are threats to yellow rails (COSEWIC 2009a). Approximately 1.27% of yellow rail habitat in the Local Study Area is expected to be affected by the Footprint (Map Series

2000 - Distribution of modeled yellow rail habitat in the Local Study Area). The greatest amount of habitat will be altered in the Mid-Boreal Lowland Ecoregion (347.72 ha) and the greatest proportion of habitat alteration will be in the Interlake Plain Ecoregion (1.51%). Habitat will be affected on the RoWs and at potential northern electrode sites NES6 and NES7. Habitat loss will be limited to tower footprints. As less than 5% of yellow rail will be habitat affected by the Footprint, a small effect on habitat is expected. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional yellow rail population or on breeding and nesting habitat availability. In some cases, least bittern nesting habitat may improve slightly where forest is converted to wet sedgelands. It is unclear whether there is sufficient habitat on the landscape to sustain yellow rail populations. As yellow rail habitat alterations will be small, the bird community associated with potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. Human activity such as vehicular traffic in wetland habitat is a source of disturbance (COSEWIC 2009a). If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As yellow rails are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Ferruginous Hawk

COSEWIC (2008c) indicates that a 50% reduction in range historically occupied by ferruginous hawk has occurred in Canada. The origin of threats such as lack of secure nest substrates, lack of suitable prey species, and human disturbance has been identified as habitat loss and alteration in the Unites States (Collins and Reynolds 2005). A shrinking prey base is a limiting factor of ferruginous hawk populations in Canada (COSEWIC 2008c).

As no ferruginous hawks were observed during bird surveys, cluster and NMS analysis could not be done, and no habitat or species associations were produced. It was determined that 1.32% of ferruginous hawk habitat in the Local Study Area will be affected by the Footprint (Map Series 2100 - Distribution of modeled ferruginous hawk habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (261.59 ha, 1.27%). Habitat will be affected on the RoW and at the potential southern electrode sites. As less than 5% of ferruginous hawk habitat will be affected by the Footprint, a small effect on habitat is expected. Small habitat alterations and losses could affect a few individuals but are not expected to have a measureable effect on the local or regional ferruginous hawk population or on breeding and nesting habitat availability, but only if multi-generational stick nests are not disturbed or removed. In some cases, ferruginous hawk foraging habitat could also increase slightly where forest is converted to grassland or shrubland. It is unclear whether there is sufficient habitat on the landscape to sustain ferruginous hawk populations. The amount of habitat altered by the Footprint is considerably less than 1% of the Project Study Area, the scale at which potential habitat effects on the ferruginous hawk population are best measured. As ferruginous hawk habitat alterations will be small, the bird community associated with potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Ferruginous hawks are particularly susceptible to disturbance by human activity, often resulting in nest/young abandonment (De Smet 2003a; Hoffman and Smith 2003). Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As ferruginous hawks are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Burrowing Owl

Habitat alteration and degradation are significant contributors to declining burrowing owl populations (COSEWIC 2006b). As no burrowing owls were observed during bird surveys, cluster and NMS analysis could not be done, and no habitat or species associations were produced.

It was determined that 1.33% of burrowing owl habitat in the Local Study Area will be affected by the Footprint (Map Series 2200 - Distribution of modeled burrowing owl habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (261.59 ha, 1.28%). Although habitat will be affected on the RoW and at the potential southern electrode sites, burrowing owls have not occupied apparently suitable habitats in eastern Manitoba for many years. As less than 5% of burrowing owl habitat will be affected by the Footprint, a small effect on habitat is expected. Small habitat alterations and losses could affect a few individuals but are not expected to have a measureable effect on the local or regional burrowing owl population or on breeding and nesting habitat availability, but only if nesting burrows are not disturbed. In some cases, burrowing owl foraging habitat could also increase slightly where forest is converted to grassland. It is unclear whether there is sufficient habitat in the Project Study Area to sustain burrowing owl populations. The amount of altered by the Bipole III Project is considerably less than 1% of the Project Study Area, the scale at which potential habitat effects on the burrowing owl population are best measured. As burrowing owl habitat alterations will be small, the bird community associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project. Refer to Section 5.2 for mitigation recommendations to reduce potential effects.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Potential effects on a few individuals, however, are expected to be small, infrequent and limited to the local population. As burrowing owls are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Short-eared Owl

Habitat alteration or conversion contributes to short-eared owl population decline in British Columbia, the Prairie Provinces, and southern Ontario (COSEWIC 2008a). As no short-eared owls were recorded during the bird surveys, cluster and NMS analysis could not be done, and no habitat or species associations were produced.

It was determined that 1.36% of short-eared owl habitat in the Local Study Area will be affected by the Footprint (Map Series 2300 - Distribution of modeled short-eared owl habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (883.78 ha, 1.37%). Habitat will be affected on the RoWs and at the Keewatinoow construction power site and the potential northern and southern electrode sites. As less than 5% short-eared owl will be affected by the Footprint, a small effect on habitat is expected. Habitat losses are will be limited to tower footprints and permanent infrastructure sites. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional short-eared owl population or on breeding and nesting habitat availability. In some cases, short-eared owl nesting habitat may improve slightly where forest is converted to grasslands and wet shrublands. Although it appears that there is sufficient habitat in the Local Study Area and Project Study Area to sustain short-eared owl populations in Manitoba, there is a moderate level of uncertainty as populations are eruptive and habitat use tends to be sporadic among years. As short-eared owl habitat alterations will be small, the bird community associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As most short-eared owls are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Common Nighthawk

COSEWIC (2007b) reports that habitat loss or alteration may contribute to the decline of common nighthawk populations in the Prairie Provinces (COSEWIC 2007b). In the Prairie Provinces, fire suppression and intense cultivation have reduced the number of openings in forests. Declining insect populations, likely due to the use of insecticides, has also been identified as a threat to common nighthawk populations (COSEWIC 2007b).

There was insufficient common nighthawk data to conduct cluster or NMS analysis, and no habitat or species associations were produced. A total of 2.39% of common nighthawk habitat in the Local Study Area will be affected by the Footprint (Map Series 2400 - Distribution of modeled common nighthawk habitat in the Local Study Area). The greatest amount of habitat will be altered in the Lake Manitoba Plain Ecoregion (1,189.69 ha) and the greatest proportion of habitat alteration will be in the Churchill River Upland Ecoregion (1.60%). The AC collector lines RoW will result in the alteration of 6.97% of common nighthawk habitat in the Local Study Area in the Hudson Bay Lowland Ecoregion. Habitat will also be affected on the RoWs, at the construction power camp, the potential southern and northern electrode sites, and the Keewatinoow converter station. Overall, 2.39% of common nighthawk habitat will be affected by the Footprint. With the exception of the AC collector lines RoW, small habitat alterations and potential losses (i.e., at tower footprints and permanent infrastructure sites) may affect a few individuals but are not expected to have a measureable effect on other local or regional common nighthawk populations or on breeding and nesting habitat availability. In some cases, common nighthawk nesting habitat may improve slightly where forest is converted to open habitats for nesting and foraging. There is sufficient habitat in the Local Study Area and the Project Study Area in northern Manitoba to sustain common nighthawk populations. As common nighthawk habitat alterations will be small, the bird community associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As common nighthawks are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Whip-poor-will

Habitat alteration or conversion is thought to contribute to whip-poor-will population decline in the Prairie Provinces (Cink 2002), but no direct link has been identified (COSEWIC 2009c). While habitat conversion to cropland has increased in Canada, some habitat is created when farmland is abandoned or logged woodlands regenerate (COSEWIC 2009c).

As no whip-poor-wills were observed during bird surveys, cluster and NMS analysis could not be done, and no habitat or species associations were produced. It was determined that 1.68% of whip-poor-will habitat in the Local Study Area will be affected by the Footprint (Map Series 2500 - Distribution of modeled whip-poor-will habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Interlake Plain Ecoregion (33.63 ha, 1.24%). Whip-poor-will habitat will be affected on the RoW and at southern electrode site SES3c. As less than 5% whip-poor-will habitat will be affected by the Footprint, a small effect is expected. Small habitat alterations may affect a few individuals but are not expected to have a measureable effect on the local or regional whip-poor-will population or on breeding and nesting habitat availability. In some cases, whip-poor-will nesting habitat may improve slightly where forest is converted to tall shrubland. There is sufficient habitat in the southern Local Study Area and Project Study Area to sustain whip-poor-will populations. As whip-poor-will habitat alterations will be small, the bird community that with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As whip-poor-wills are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Red-headed Woodpecker

The decline in red-headed woodpecker populations has been attributed to the past loss of large tracts of mature deciduous forests in the United States (COSEWIC 2007c). The removal of dead trees for nesting and As no red-headed woodpeckers were observed during bird surveys, cluster and NMS analysis could not be done, and no habitat or species associations were produced.

A total of 1.42% of red-headed woodpecker habitat in the Local Study Area will be affected by the Footprint (Map Series 2600 - Distribution of modeled red-headed woodpecker habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (468.96 ha, 1.48%). Habitat will be affected on the RoW and at southern electrode site SES1c, where there are few trees except for the yard sites where trees should not be removed. The removal of dead or dying trees on or near the RoW within red-headed woodpeckers' range could result in the loss of some nesting habitat. As less than 5% of red-headed woodpecker habitat will be affected by the Footprint, a small effect on habitat is expected. Small habitat losses may affect a few individuals but are not expected to have a measureable effect on the local or regional red-headed woodpecker population, breeding and nesting habitat availability, or food and cover. It is unclear whether there is sufficient habitat on the landscape to sustain red-headed woodpecker populations. As red-headed woodpecker habitat alterations will be small, the bird community associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. This species is generally tolerant of human disturbance, except near nests (Smith *et al.* 2000). Effects will be limited to the local population. As red-headed woodpeckers are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Olive-sided Flycatcher

COSEWIC (2007d) indicates that habitat loss and contribute to declining olive-sided flycatcher populations. Changes in non-breeding habitat in their wintering range are thought to be a significant threat. Forest management practices in their breeding range also contribute to olive-sided flycatcher declines in these areas (COSEWIC 2007d). Besides being a species at risk, olive-sided flycatcher was selected as a VEC to assess potential habitat alterations associated with bird communities (Section 4.3.3.7) that occupy the edge of openings in coniferous, broadleaf and mixedwood forests (see olive-sided flycatcher model, Appendix D) to maintain their life functions.

Olive-sided flycatcher data from the Interlake Plain, Mid-Boreal Lowland, Churchill River Upland and Hayes River Upland, and Hudson Bay Lowland ecoregions was sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated olive-sided flycatchers were associated with various habitat types, including wetland, coniferous dense, water, and shrub and with clustered groups of nine to fourteen other species including cedar waxwing, northern flicker, lesser yellowlegs, alder flycatcher, pine siskin and, in the Hayes River Upland, rusty blackbird. NMS plots (Appendix E, Figures E-1 to E-6) indicated olive-sided flycatchers were associated with several habitats and with Tennessee warbler, American redstart, and greater yellowlegs.

A total of 1.55% of olive-sided flycatcher habitat in the Local Study Area will be affected by the Footprint (Map Series 2700 - Distribution of modeled olive-sided flycatcher habitat in the Local Study Area). The greatest amount of habitat alteration will be in the Mid-Boreal Lowland Ecoregion (1150.37 ha) and the greatest proportion of habitat alteration will be the Hayes River Upland Ecoregion (1.45%). Habitat will be affected on RoWs including the Henday-Long Spruce RoW, Keewatinoow-construction power site RoW, AC collector line RoW, northern electrode line RoW, and at the construction power camp. The amount of habitat altered, and potentially lost (i.e., limited to the tower footprints) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional olive-sided flycatcher population or on breeding and nesting habitat availability. In some cases, olive-sided flycatcher nesting habitat may improve slightly where forest is converted to open wetland or shrubland. There is sufficient habitat in the Local Study Area and Project Study Area in northern Manitoba to sustain olive-sided flycatcher populations. As olive-sided flycatcher habitat alterations will be small, the bird community associated with these potential effects are also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As olive-sided flycatchers are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Loggerhead Shrike

Habitat loss or degradation contributes to declining loggerhead shrike populations (COSEWIC 2004). The reduction of native grassland in the Canadian Prairie Provinces and the central Great Plains of the United States has eliminated breeding habitat, and foraging habitat in migration and wintering areas has also been lost (COSEWIC 2004).

About 2.10% of loggerhead shrike habitat in the Local Study Area will be affected by the Footprint (Map Series 2800 - Distribution of modeled loggerhead shrike habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (775.85 ha, 1.42%). Habitat will be affected on the RoW and at southern electrode site SES1c. As less than 5% of loggerhead shrike habitat will be affected by the Footprint, a small effect on is expected. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional loggerhead shrike population or on breeding and nesting habitat availability. In some cases, loggerhead shrike nesting habitat may improve slightly where forest is converted to grassland and shrubland. It is unclear whether there is sufficient habitat in the Project Study Area to sustain loggerhead shrike populations. As no loggerhead shrikes were observed during bird surveys, cluster and NMS analysis could not be done, and no habitat associations were produced. As loggerhead shrike habitat alteration will be small, the bird community associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the RoW. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond one kilometre, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. This species is generally tolerant of human disturbance (Yosef 1996). Effects will be limited to the local population. As loggerhead shrikes are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Sprague's Pipit

Clearing of the RoW will result in minimal habitat alteration for sensitive grassland birds such as Sprague's pipit, as the preferred transmission line route was selected to avoid large core communities of grasslands where possible (see the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*). Habitat loss and degradation are threats to Sprague's pipits throughout their breeding range (Environment Canada 2008). Habitat has been lost in the Prairie Provinces due to human development, and habitat quality has been degraded due to cultivation and fragmentation, reducing Sprague's pipit populations (Environment Canada 2008). Habitat loss on wintering grounds is also thought to contribute to the species' decline (COSEWIC 2010c). Besides being a species at risk, Sprague's pipit was also selected as a VEC to assess potential habitat alterations associated with those bird communities (Section 4.3.3.7) that require occupy dry mineral soil grasslands (see Sprague's pipit model, Appendix D) to maintain their life functions.

A total of 1.37% of Sprague's pipit habitat in the Local Study Area will be affected by the Footprint (Map Series 2900 - Distribution of modeled Sprague's pipit habitat in the Local Study Area). The greatest amount of habitat will be altered in the Lake Manitoba Plain Ecoregion (555.98 ha) and the greatest proportion of habitat alteration will be in the Interlake Plain Ecoregion (1.39%). A small amount of habitat will be affected on the RoW and at southern electrode site SES1c. The amount of habitat altered, and potentially lost (i.e., limited to the tower footprints) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional Sprague's pipit population or on breeding and nesting habitat availability. In some cases, Sprague's pipit nesting habitat may improve slightly where forest is converted to grassland. Although it appears that there is sufficient habitat in the Local Study Area and throughout Manitoba to sustain Sprague's pipit populations, there is a moderate level of uncertainty as to why these habitats are not occupied by local populations. As no Sprague's pipits were sampled in the duration of bird surveys, cluster and NMS analysis could not be done. As Sprague's pipit habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As Sprague's pipits are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Golden-winged Warbler

Golden-winged warblers thrive on **anthropogenic** disturbances such as RoWs (COSWEIC 2006c), and could benefit from the habitat created by clearing the RoW in southern and west central Manitoba, where this species is an uncommon breeder (Edie *et al.* 2003a). However, threats to this species include loss of breeding habitat due to succession and reforestation, and a loss of shrubby habitat in eastern North America (COSEWIC 2006c). Besides being a species at risk, golden-winged warbler was selected as a VEC to assess potential habitat alterations associated with those bird communities (Section 4.3.3.7) that occupy shrublands (see golden-winged warbler model, Appendix D) to maintain their life functions.

Golden-winged warbler data from the Interlake Plains were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated golden-winged warblers were associated with broadleaf open habitat and with clustered groups of five other species including eastern kingbird, house wren, and great crested flycatcher. NMS plots (Appendix E, Figures E-1 to E-6) indicated golden-winged warblers were not associated with any particular habitat type or other bird species.

It was determined that 1.38% of golden-winged warbler habitat in the Local Study Area will be affected by the Footprint (Map Series 3000 - Distribution of modeled golden-winged warbler habitat in the Local Study Area). The greatest amount, and proportion, of habitat will be altered in the Lake Manitoba Plain Ecoregion (1,247.98 ha, 1.42%). Habitat will only be affected on the RoW. The amount of habitat altered, and potentially lost (i.e., limited to the tower footprints) is less than 5% of the habitat available in the Local Study Area, and a small and beneficial, but most likely negligible effect is anticipated. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional golden-winged warbler population or on breeding and nesting habitat availability. In some cases, golden-winged warbler nesting habitat may improve slightly where forest is converted to grassland or shrubland. It is unclear whether there is sufficient habitat in the Project Study Area to sustain golden-winged warbler populations. As golden-winged warbler habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond one kilometre, and only where heavy machinery and construction noise are the greatest. In cases for sensitive species at risk, these effects could be measureable with reduced reproductive success. Effects will be limited to the local population. As golden-winged warblers are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Canada Warbler

COSEWIC (2008b) reports that loss and alteration of breeding and wintering habitat are contributing factors in the decline of Canada warbler populations. Human development and deforestation are intense in Colombia, the primary wintering area of Canada warblers. In eastern North America, human activity has been identified as a leading cause of declining Canada warbler populations. Clearing of the boreal forest in the west also contributes to habitat loss (COSEWIC 2008b). Besides being a species at risk, Canada warbler was selected as a VEC to assess potential habitat alterations associated with those bird communities (Section 4.3.3.7) that occupy moist, young and mid-successional deciduous and mixed forests (see Canada warbler model, Appendix D) to maintain their life functions.

Canada warbler data from the Interlake Plain and Mid-Boreal Lowland Ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated Canada warblers were associated with broadleaf dense habitat and within clustered groups of five or six other species including red-breasted nuthatch, gray jay, winter wren and, in the Mid-Boreal Lowland, pileated woodpecker. NMS plots (Appendix E, Figures E-1 to E-6) indicated Canada warblers were associated with forested areas and with pileated woodpecker, ruffed grouse, and northern waterthrush.

A total of 1.30% of Canada warbler habitat in the Local Study Area will be affected by the Footprint (Map Series 3100 - Distribution of modeled Canada warbler habitat in the Local Study Area). The greatest amount of habitat will be altered in the Interlake Plain Ecoregion (371.49 ha) and the greatest proportion of habitat alteration will be in the Lake Manitoba Plain Ecoregion (3.15%). Habitat will only be affected on the RoW. The amount of habitat altered, and potentially lost (i.e., limited to the tower footprints) is less than 5% of the habitat available in the Local Study Area. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional Canada warbler population or on breeding and nesting habitat availability. In some cases, Canada warbler nesting habitat may improve slightly where forest is converted to tall shrublands. It is unclear whether there is sufficient habitat in the Project Study Area to sustain Canada warbler populations. As Canada warbler habitat alterations will be small, the bird community associated with these potential effects is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur in the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the Footprint. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. Effects on sensitive species at risk could be measureable and result in reduced reproductive success. Effects will be limited to the local population. As Canada warblers are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

Rusty Blackbird

COSEWIC (2006a) indicates that alteration of wintering habitat is identified as the most important threat to rusty blackbird populations, and loss of breeding habitat also contributes to the species' decline. In the southern United States, where rusty blackbirds overwinter, alteration and fragmentation of wetland forests was identified as a major contributing factor. Habitat conversion and human development have resulted in habitat loss in Canada (COSEWIC 2006a).

Rusty blackbird data from the Mid-Boreal Lowland, Churchill River Upland, Hayes River Upland, and Hudson Bay Lowland ecoregions were sufficient for interpreting habitat use and similarities with other bird species. Cluster analysis (Appendix E, Figures E-7 to E-12) indicated rusty blackbirds were associated with wetland habitat and with species such as sandhill crane, northern flicker, solitary sandpiper, lesser yellowlegs, and Wilson's snipe. NMS plots (Appendix E, Figures E-1 to E-6) similarly indicated rusty blackbirds were associated with wetland habitat and with killdeer, alder flycatcher, and lesser yellowlegs.

It was determined that 1.49% of rusty blackbird habitat in the Local Study Area will be affected by the Footprint (Map Series 3200 - Distribution of modeled rusty blackbird habitat in the Local Study Area), including RoWs, the construction power camp, potential northern electrode sites, and Keewatinoow converter station. The greatest amount of habitat will be altered in the Mid-Boreal Lowland Ecoregion (1,053.75 ha) and the greatest proportion of habitat alteration will be in the Hayes River Upland Ecoregion (1.41%). As less than 5% of rusty blackbird habitat will be affected by the Footprint, a small effect is expected. Habitat loss is expected to be limited to tower footprints and permanent infrastructure sites. Small habitat alterations and losses may affect a few individuals but are not expected to have a measureable effect on the local or regional rusty blackbird population or on breeding and nesting habitat availability. In some cases, rusty blackbird nesting habitat may improve slightly where forest is converted to tall shrub wetlands. There is sufficient habitat in the Local Study Area and throughout Manitoba to sustain rusty blackbird populations. As rusty blackbird habitat alterations will be small, the bird community that may be associated with these potential effects (but where the associated community was not predicted) is also unlikely to be affected by the Project.

Sensory disturbance is a potential Project-related effect. If construction activities occur In the southern Footprint in spring and early summer, sensory disturbance could affect breeding and nesting activities beyond the edge of the RoW. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond one kilometre, and only where heavy machinery and construction noise are the greatest. In cases for sensitive species at risk, these effects could be measureable with reduced reproductive success. Effects will be limited to the local population. As rusty blackbirds are migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for Project-related effects on species at risk during construction (see Section 5.2).

5.1.2.4 Disruption of Movements

Human presence and physical structures such as towers and machinery could affect seasonal and daily movements of some species or individuals as they alter their pathways to avoid disturbance. Limited movement can prevent individuals from accessing resources and can hamper their ability to avoid predators (AltaLink Management Ltd. 2006). Daily movements could be altered on a local scale.

Seasonal migration pathways are highly unlikely to be disrupted, where migration corridors overlap the Project Study Area. Some species fly in concentrations and are able to travel long distances (Avery 1995), while other species such as whip-poor-will generally migrate solitarily (Cink 2002). Many bird species fly at altitudes above obstacles and obstructions during spring and fall migration. As bald eagles, for example, migrate long distances with relatively few stopovers (Laing *et al.* 2005), and they generally fly an estimated minimum of 1 km above the ground (Harmata 1984), human presence, machinery, and structures associated with clearing and construction of a transmission line are not expected to affect migration movements. Although migration heights can be highly variable, species such as flocks of migrating common nighthawks can fly relatively close to the ground (e.g., Mueller 1970; Poulin *et al.* 1996). Migratory red-headed woodpeckers, for example, also fly relatively low, generally below 200 m, and tend to follow the same pathway year after year

(Smith *et al.* 2000). Some mitigation measures are required to reduce the potential for disruption of movements during the migration and the nesting season (see Section 5.2).

Habitat fragmentation effects due to the cleared RoWs and access routes could alter local movements of a few individuals, as some bird species are less likely to cross wide linear features. Such effects will be long-term, as habitat on the RoWs will be maintained at a relatively static stage of succession, with long-term periodic changes from small trees, to grassland and shrubland environments (Manitoba Hydro 2011). For a general discussion on fragmentation effects, refer to the *Bipole III Fragmentation Technical Report*.

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

Daily movements of waterfowl and other waterbirds could be affected by construction activity, particularly near wetlands and water bodies such as ponds and lakes. In fall, mallards move between feeding sites on fields and resting sites such as lakes and wetlands (Baydack and Taylor 2003). These movements could be disrupted by construction activity in the southern Footprint. As clearing and construction are to be done in winter in the northern footprint, no effects on movements of waterfowl and other waterbirds are expected. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Daily movements of colonial waterbirds could be affected by construction activity, particularly near water bodies and shorelines. As clearing and construction are to be done in winter in the northern footprint, no effects on colonial waterbird movements are expected. Great blue herons appear relatively tolerant of human disturbance, except during the nesting stage, when they can be flushed from their nests by machinery and approaching humans (Vos *et al.* 1985). Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

BIRDS OF PREY (BALD EAGLE)

There is little potential for disruption of bird of prey movements in the northern Footprint. The fall migration of bald eagles is generally over by mid-November (Koonz 2003a), thus they will be absent during winter construction. In the southern Footprint, bald eagles and other birds of prey may experience temporary disruption of daily movements. Bald eagles are somewhat affected by a variety of human activities, particularly during the breeding season (Grubb and King 1991). Outside of the breeding season, large machinery and human presence do not affect raptors when prey is abundant (Shuek *et al.* 2001). Owls frequently use openings and linear features, and are unlikely to be affected even in winter. Effects will be localized and move along the HVdc transmission line as clearing and construction progress. While a few individuals may experience short-term disruption of daily movements, bald eagles will not experience effects at the population level. A few individuals could occasionally be affected in the Local Study Area.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

As ruffed grouse are highly sedentary (Holland and Taylor 2003d), with mean daily movements less than 400 m/day (Thompson and Fritzell 1989; Fearer 1999), highly localized effects on individual movements due to human presence and construction activities are possible in both summer and winter. In most cases, ruffed grouse are tolerant of and do not appear to be affected to a great extent by human disturbance (Rusch *et al.* 2000).

Male sharp-tailed grouse are not affected by the presence of structures such as sedentary vehicles, but are displaced from leks by human presence (Baydack and Hein 1987; Connelly *et al.* 1998). When displaced, males moved less than 400 m from the lek, and attempted to wait out the disturbance (Baydack and Hein 1987). If construction occurs in spring in the vicinity of sharp-tailed grouse leks, reproductive activities could be affected. As this species tends to be more sensitive to human disturbance, mitigation measures are recommended (Section 5.2).

As most upland game bird species are permanent residents of Manitoba, and do not migrate (with the exception of willow ptarmigan, which moves into the Project Study Area during winter), no effects on seasonal movements are expected as a result of clearing and construction activities.

WOODPECKERS (PILEATED WOODPECKER)

Pileated woodpeckers are somewhat tolerant of human disturbance (Bull and Jackson 1995). Daily movements in the vicinity of clearing and construction activity may affect individuals, but the effects will be localized. As pileated woodpeckers do not migrate, disrupted movements could occur year-round in the southern Footprint and extend into northern areas during winter. Other woodpecker species are migratory, and these species will not be affected by Project activities in winter. As clearing and construction will proceed along the RoW, effects will be short-term at any given location. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

SPECIES AT RISK

Least Bittern

In undisturbed wetlands, least bitterns are tolerant of human presence (Gibbs *et al.* 1992). However, these birds are disturbed by recreational activities, resulting in disruption of foraging and nest abandonment (COSEWIC 2009b). Although construction is not anticipated in wetland habitat, the machinery and noise associated with construction in adjacent habitats could disrupt daily movements of least bitterns in the vicinity. Such effects will be short-term, as construction will proceed along the RoW. Disruption of least bittern movements will be confined to the southern Footprint, as this species' range includes a small area in Manitoba. As least bitterns are migratory, they will only be affected during spring and summer construction. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Yellow Rail

As yellow rails are migratory, no effects on daily or seasonal movements are expected in the northern Footprint, as clearing and construction will occur in winter. In the southern Footprint, construction is not anticipated in wetland habitat, but the machinery and noise associated with activity in adjacent habitats could disrupt daily movements of yellow rails in spring and summer. Effects will be short-term, as construction will proceed along the RoW. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Ferruginous Hawk

There is little potential for disruption of ferruginous hawk movements in the northern Footprint, as they are geographically limited to southwestern Manitoba. In the southern Footprint, ferruginous hawks may experience temporary disruption of daily movements. Effects will be short-term, moving along the RoW as construction progresses. As this species is migratory, no effects are anticipated for winter. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Burrowing Owl

There is no potential for disruption of burrowing owl movements in the northern Footprint, as their range is limited to southwestern Manitoba. In the southern Footprint, burrowing owls may experience temporary disruption of daily movements in spring and summer. Effects will be short-term, moving along the RoW as construction progresses. As this species is migratory, no effects are anticipated in winter. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Short-eared Owl

There is little potential for disruption of short-eared owl movements in the northern Footprint, as they are migratory and will be absent during winter construction. In the southern footprint, short-eared owls may experience temporary disruption of daily movements in spring and summer. Effects will be short-term, moving along the RoW as construction progresses. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Common Nighthawk

There is little potential for disruption of common nighthawk movements in the northern Footprint, as they are migratory and will be absent during winter clearing and construction. Daily movements could be affected in the southern Footprint during construction in spring and summer. Effects will be short-term, moving along the RoW as construction progresses. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Whip-poor-will

As whip-poor-will range does not include the northern Footprint, no disruption of daily or seasonal movements is anticipated in this area. Daily movements could be disrupted in spring and summer due to the physical presence of humans and machinery within this species' range. As with most other species, disruptions of daily movements are anticipated to be short-term. As this species is migratory, no effects are anticipated in winter. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Red-headed Woodpecker

There is no potential for disruption of red-headed woodpecker movements in the northern Footprint, as their range is limited to southern Manitoba. In the southern footprint, daily movements could be affected during construction in spring and summer. Effects will be short-term, moving along the RoW as construction progresses. As this species is migratory, no effects are expected in winter. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Olive-sided Flycatcher

There is little potential for disruption of olive-sided flycatcher movements in the northern Footprint, as they are migratory and will be absent during winter. Daily movements could be affected in the southern Footprint during construction. Effects will be short-term, moving along the RoW as construction progresses. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Loggerhead Shrike

There is no potential for disruption of loggerhead shrike movements in the northern Footprint, as their range is limited to southwestern Manitoba. In the southern Footprint, daily movements could be affected during construction in spring and summer. Effects will be short-term, moving along the RoW as construction progress. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Sprague's Pipit

There is no potential for disruption of Sprague's pipit movements in the northern Footprint, as their range is limited to southwestern Manitoba. In the southern Footprint, daily movements could be affected during construction in spring and summer. Effects will be short-term, moving along the RoW as construction progress. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Canada Warbler

There is no potential for disruption of Canada warbler movements in the extreme northern Footprint, as their breeding range extends to central Manitoba. In the southern Footprint, daily movements could be affected during construction in spring and summer. Although Canada warblers can tolerate low levels of human disturbance (Conway 1999), some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Golden-winged Warbler

There is no potential for disruption of golden-winged warbler movements in the northern Footprint, as their range is limited to southern and west central Manitoba. In the southern Footprint, daily movements could be affected construction in spring and summer. This species is susceptible to human disturbance due to construction, particularly when nesting (Confer 1992). Effects will be short-term, moving along the RoW as construction proceeds. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Rusty Blackbird

As rusty blackbird breeding range does not include southwestern Manitoba, no disruption of daily movements is expected in this portion of the Footprint. No disruption of daily movements is expected in the northern Footprint, as clearing and construction will occur in winter, when this migratory species is absent. In the southern Footprint, daily movements could be affected during construction in spring and summer.

5.1.3 General Effects for Bipole III Operation and Maintenance

5.1.3.1 Background

Operation of a transmission line involves the production of electric and magnetic fields (EMF) and corona discharges. Corona discharges may result in audible noise and low frequency electrical interference. The level of these will vary with time, subject to operating mode and loading conditions of the line, and to final line design, conductor condition, and to such external considerations as meteorological conditions.

Estimated levels of these emissions are generally based on mathematical modeling and on comparison to corresponding levels associated with existing lines in the Manitoba Hydro system. Studies are currently underway to establish estimates for the HVdc transmission line and for the AC connections to the northern collection system.

In the case of the HVdc transmission line, modeling will include dc EMF, audible noise (AN) and radio interference (RI) levels associated with a representative range of RoW configurations, operating scenarios, and loading conditions. In the case of the AC transmission lines, modelling will include AC EMF, AN, and RI levels for the RoW configurations planned for the proposed 230 kV transmission lines between Long Spruce and Conawapa, and between Henday and Conawapa. In addition, background measurements will be made of dc and AC EMF, air ions, and charged aerosols, both in everyday Manitoba environments and in the vicinity of the existing Bipole I and Bipole II HVdc transmission lines.

Manitoba Hydro conducts inspection of all its transmission lines and electric transmission corridors on an annual basis. The inspection encompasses both facilities (structures and wires) and vegetation conditions. Following the inspection, all pertinent information and findings are entered into a transmission line management data base program. From this central data base, annual maintenance activities are identified and tracked. The annual patrol is conducted either by ground or by air, and is completed once per fiscal year on every span in the transmission system. Non-scheduled patrols, by ground or air, may be conducted should unexpected information requirements be identified. Patrols are normally undertaken by snow machine, all terrain vehicles, light trucks, or helicopter, depending on the geographical location and ease of access. In winter, equipment operations may include a soft track groomer to facilitate access where snow conditions otherwise restrict travel on the RoW.

Where maintenance tasks involve heavy equipment (such as brushing) winter roads must be built for access in remote areas. Where mobile work camps are required for line maintenance activities, these will typically include a collection of trailers on tank-like tracks consisting of a few bunk trailers (each sleeping three or four people), a shower trailer, a kitchen trailer, and a generator trailer. Mobile work camps generally consist of approximately 12 workers and must be set up in a spot where there is a water source for the shower and kitchen. The camp is moved about every two weeks when enough progress is made in each direction along the line.

Maintenance activities include instances where crews are required to obtain access to specific areas to repair deficiencies on the transmission system. In northern regions, maintenance repairs are typically done in the winter months, after the ground is frozen, using heavier soft track equipment to gain access. When summer access is required in agricultural areas, related maintenance activities are planned, wherever possible, to avoid conflict with farm activity.

In circumstances where maintenance activity requires the use of access trails off the RoW (e.g., difficult terrain), approval is first obtained from Manitoba Conservation, when on provincial Crown land, through formal easement or Crown land reservations. In areas where access to or across private lands is required, or if working on an easement on private lands, the landowners are contacted in advance. In the case of herbicide application, Manitoba Hydro also contacts landowners adjacent to the RoW.

5.1.3.2 Mortality

As described previously in Section 5.1.2, among other site sensitivities, Environmentally Sensitive Sites can include locations where there is an increased risk of bird mortality due to collisions with transmission lines. The U.S. Fish and Wildlife Service reports tens of thousands of avian fatalities per year (Manville 2000) due to collisions with power transmission and distribution lines, but there are very few quantitative studies relative to the length of powerlines in the U.S. Based on the limited studies, waterfowl including ducks, geese, swans, and cranes appear to be most susceptible to powerline collisions when powerlines are located near wetlands. In upland habitats away from wetlands, raptors and passerines appear most susceptible to collision.

It should be noted from the onset that most researchers agree that for healthy bird populations, collisions are not a biologically significant source of mortality (Avian Power Line Interaction Committee 1994). Collision mortalities that have been estimated in numerous studies usually run less than 1% of the local population. This risk of bird-wire collisions is very low as many migrants such as waterfowl and raptors fly at altitudes well above the height of power lines and any associated structures (Avian Power Line Interaction Committee 1994). Transmission-related mortality results can be compared to other known causes such as habitat removal, hunting, tower collisions, epidemic disease, predation, or motor vehicle interactions. Stout and Cornwell compared non-hunting mortality causes for waterfowl through extensive analysis of banding returns. They found that collisions (including automobiles, telephone and power wires, television and radio towers, aircraft, farm machinery, fences and buildings, and other objects) accounted for about 0.1% of non-hunting mortality. Unrelated to transmission lines, diseases such as botulism were responsible for 65% of the deaths. Telephone and power lines were only 0.07% of the mortalities. Sites considered at low risk of bird mortality were not mapped as sensitive sites (Avian Power Line Interaction Committee 1994).

Several assumptions were used in determining whether an area along the HVdc transmission line will be of higher risk for bird-wire collisions:

- Existing engineering as proposed in the Project description, which includes overhead ground wires.
- Visibility as a function of conductor diameter, where large bundles of wires (e.g., dc lines) are more visible and less likely to affect birds.
- Line height, where higher towers are nearer bird flight heights for some species.
- Bisection of daily movement paths across the projected pathway of the HVdc transmission line.
- Marker effectiveness.
- Bird populations - one of the main animal-related issues is the number of birds that cross this line on a daily movement basis. Large concentrations of birds, such as along migration routes, near staging areas, or adjacent to nesting colonies, are also more likely to result in potentially higher rates of birds colliding with wires, but only under certain sets of environmental conditions. Important wetlands[1] were considered in this context. These types of areas have been considered in past projects and elsewhere (Manitoba Hydro 1992; Manitoba Hydro 1995; Manitoba Hydro 2003; AltaLink Management Ltd. 2006; SaskPower *et al.* 2009; Manitoba Hydro 2010).
- Bird behaviours by groups – where certain groups appear to be more susceptible to collisions. The main considerations focused on waterfowl.
- Flights along waterways.
- Species size, manoeuvrerability, flocking behaviour, age and sex, night flights and local disturbances.
- Where possible, local values such as topography, climatic, habitat values, bisected habitats and food values are considered in the assessment.

[1] Faanes (1987) searched 6 miles (9.6 km) of powerlines in North Dakota in the spring and fall of 1977 and 1978. Based on a total of 633 dead birds found, he estimated that 200 avian fatalities per mile per year (125 birds/km/yr) were occurring at those sites. The powerlines included in the study were located near wetlands or lakes and most of the fatalities consisted of waterbirds (46%) and waterfowl (26%), followed by shorebirds (8%) and passerines (5%).

Manitoba Hydro Line Maintenance has not reported areas of high bird-wire collision mortality anywhere in Manitoba to date; however, records are limited. One study conducted in the Oak Hammock Marsh area[1], considered four monitoring sites with either a single pole 12.48 kV line, a single pole 66 kV line, a 115 kV line on H-frame structures, or two single circuit 230 kV on steel lattice transmission lines. Bird flight observations, mortality searches and scavenger removal studies/observer success trials were conducted in fall 2005 and spring 2006. Under these conditions, a preliminary report produced by Terrestrial & Aquatic Environmental Managers (TAEM) in DS-Lea Consultants Ltd (1997) reported a total of 24 bird mortality recoveries. Of 11 birds sent for necropsy, only two mortalities had fractures consistent with trauma.

Manitoba Hydro has initiated monitoring potentially problematic spots at higher risk of bird-wire collisions such as in Important Bird Areas northeast of The Pas for the Wuskwatim Transmission Line. Portions of the transmission line where skywires were fitted with Swan Diverters™, have reported only three mortalities to date. One section of the Wuskwatim Transmission line near Thompson adjacent to a high daily bird movement area for birds foraging near a landfill reported two common raven mortalities. Caution should be used in the interpretation of the results as these data are considered preliminary, and as monitoring was just initiated in fall 2010 (Berger, *pers. comm.* 2010).

Although some variability is expected from potential bird-wire collisions, overall, bird mortality resulting from potential bird-wire collisions with the Bipole III HVdc lines, AC collector lines, or the distribution lines associated with the Project is considered small, long-term, infrequent, and local. Refer to Section 5.2 for recommended mitigation measures for Environmentally Sensitive Sites.

Electrocution can be a significant source of bird of prey mortality (Lehman *et al.* 2007). As bald eagles and other large birds of prey are susceptible to electrocution (Harness and Wilson 2001; Millsap *et al.* 2004), mortality could increase where they are attracted to the transmission line and structures. With the configuration of the I HVdc transmission line, electrocutions are highly unlikely to occur. As the horizontal lattice steel cross-arm from which the conductors are suspended will be 15.4 m (approximately 50.5 feet) in width (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*), birds of prey will not contact the conductors simultaneously (The Edison Electric Institute's Avian Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service (USFWS) 2005). Although unlikely, if the ground electrodes and converter station connections are monitored and electrocutions become problematic, mitigation measures are available (Section 5.2).

Manitoba Hydro has reported anomalous flashovers that have occurred in the Interlake Region of Manitoba on Bipoles I and II HVdc transmission lines. It should be recognized that one of the two leading hypotheses being considered is that bird **streamers** caused by large birds of prey are compromising the air gap strength between the energized conductor and grounded tower (Exponent 2008). As it is unclear as to what has been causing the outages however, recommendations have been made to investigate the anomaly further.

[1] Oak Hammock Marsh is known for very high numbers of waterfowl. Up to 400,000 ducks and geese can be found daily in the marsh and surrounding agricultural areas in fall (Oak Hammock Marsh Interpretive Centre (2009).

Increased harvesting of game species as access to formerly remote areas improves is a potential source of mortality for some species. Information on the number of migratory birds harvested in Manitoba was available through information provided to the U.S. Fish and Wildlife Service from the Canadian Wildlife Service (Raftovich *et al.* 2010). Harvesting of duck species in Manitoba has been estimated at 129,988 ducks from 19 species in 2008 and 124,371 ducks from 17 species in 2009 (Table 5-1). The number of geese harvested ranges from 133,926 geese from five species in 2008 to 111,477 geese from four species in 2009 (Table 5-2).

Although some variability is expected from harvest mortality related to improved access along the transmission lines that could transect wetlands, overall, bird harvest mortality resulting from increased access to the Footprint is essentially negligible to the overall harvest of ducks and geese during the licensed season in Manitoba. The effect of harvest mortality on waterfowl is considered small, long-term, infrequent, and local. Refer to Section 5.2 for recommended mitigation measures for Sensitive Sites.

Table 5-1. Number of Ducks Harvested in Manitoba in 2008 and 2009

	Number Harvested	
Duck Species	**2008**	**2009**
Mallard	60,690	61,160
Black duck	160	155
Gadwall	5,905	2,649
Wigeon	1,631	2,311
Green-winged teal	5,205	3,573
Blue-winged/Cinnamon teal	13,309	5,965
Northern shoveler	3,578	4,180
Northern pintail	7,911	4,582
Wood duck	1,803	269
Redhead	6,020	12,547
Canvasback	3,667	7,897
Greater scaup	343	540
Lesser scaup	12,087	8,238
Ring-necked duck	3,490	3,772
Goldeneyes	643	1,839
Bufflehead	2,039	3,391
Ruddy head	0	0
Long-tailed duck	0	0
Eiders	863	0
Scoters	64	0
Hooded merganser	579	1,003
Other mergansers	0	0
Other ducks	0	0
Total Ducks	129,988	124,371

Table 5-2. Number of Geese Harvested in Manitoba in 2008 and 2009

Goose Species	Number Harvested	
	2008	**2009**
Canada goose	91,804	99,955
Snow goose	13,781	3,236
Blue goose	18,053	5,887
Ross's goose	10,151	2,399
White-fronted goose	139	0
Brant	0	0
Total Geese	133,926	111,477

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

Waterfowl and other waterbirds account for a large portion of deaths due to collisions with power lines (Faanes 1987; Brown and Drewien 1995; Training Unlimited Inc. 2000). While individual birds may collide with wires, otherwise healthy populations should not be affected by such incidents (Bevanger 1998). Mallards (Malcolm 1982; Rusz *et al.* 1986) and sandhill cranes (Morkill and Anderson 1991) are susceptible to wire collisions, particularly in wetlands or near other water bodies. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

Improved access to the area via the RoW and access roads could lead to a small increase in mallard and sandhill crane harvest, particularly in the north where more access points are expected to be created. Access in the south is primarily along pre-existing developments such as transmission lines (Manitoba Hydro 2011). Improved access in some locations could result in improved subsistence harvest of wildlife, increased access by waterfowl outfitters or by the public (see the *Bipole III Resource Use Technical Report*). Provincial harvest management strategies are expected to be an important tool in ensuring stable waterfowl populations.

A few individuals in local waterfowl and other waterbird populations may experience long-term sporadic impacts coinciding with the operation phase. These potential effects are considered reversible and no residual effects are anticipated.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Colonial waterbirds account for a large portion of deaths due to collisions with power lines (Faanes 1987; Brown and Drewien 1995; Training Unlimited Inc. 2000). While individual birds may perish due to collisions with power lines, otherwise healthy populations should not be affected by such incidents (Bevanger 1998). Great blue herons are susceptible to wire collisions (Rusz *et al.* 1986), particularly in wetlands or near other water bodies. These birds often forage at dawn or dusk, and likely do not detect obstructions when visibility is poor (Rusz *et al.* 1986). Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

A few individuals in local colonial waterbird populations may experience long-term sporadic impacts coinciding with the operation phase. These potential effects are considered reversible and no residual effects are anticipated.

BIRDS OF PREY (BALD EAGLE)

Electrocution can be a significant source of bird of prey mortality (Lehman *et al.* 2007). As bald eagles and other large birds of prey are susceptible to electrocution (Harness and Wilson 2001; Millsap *et al.* 2004), mortality could increase where they are attracted to the transmission line and structures. With the configuration of the Bipole III HVdc transmission line, electrocutions are highly unlikely to occur. As the horizontal lattice steel cross-arm from which the conductors are suspended will be 15.4 m (approximately 50.5 feet) in width (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*), birds of prey will not contact the conductors simultaneously. Although unlikely, if the ground electrodes and converter station connections become problematic for electrocutions, mitigation measures are recommended (see Section 5.2). The effects of electrocution are expected to be small, long-term, and infrequent.

A second, source of bird of prey mortality is collisions with power lines. While raptor collisions with power lines appear to be infrequent, instances have been reported (Bevanger 1994; Bechard and Schmutz 1995). While raptors generally have excellent vision, it is thought that collisions with power lines are caused by a large blind zone (Bevanger 1994). Species that fly at high speeds in pursuit of prey, such as peregrine falcon and northern goshawk, are most prone to collisions (Bevanger 1994). Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

A few individuals in local bird of prey populations may experience long-term sporadic impacts coinciding with the operation phase. These potential effects are considered reversible and no residual effects are anticipated.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

The RoWs could create new opportunities for upland game bird harvest, particularly in the north where more access points are expected to be created. Access in the south is primarily along pre-existing developments such as transmission lines (Manitoba Hydro 2011). As species such as grouse are often observed on linear features such as RoWs, improved access by hunters could result in increased upland game bird mortality. Transmission towers may be detrimental to upland game birds, as raptors may perch on them above sharp-tailed grouse leks, and potentially increase mortality due to predation.

Upland game birds are vulnerable to collisions with transmission lines, partially attributed to their somewhat clumsy flying ability (Janss 2000; Bevanger and Brøseth 2001). Sharp-tailed grouse whose leks are on the RoW will be prone to collisions with wires, as they often make short flights at the approximate height of transmission lines (Bevanger 1994). Transmission lines with ground wires (generally located above or below conductors) to protect against lightning tend to increase the susceptibility of some bird species to collisions (Bevanger and Brøseth 2001). As the number of levels of wires increases, so does the chance of collision (Bevanger and Brøseth 2001). Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

A few individuals in local upland game bird populations may experience long-term sporadic impacts coinciding with the operation phase. These potential effects are considered reversible and no residual effects are anticipated.

WOODPECKERS (PILEATED WOODPECKER)

Few Project-related effects on woodpecker mortality are anticipated. A literature search indicates that collisions with transmission wires are uncommon. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2). A few individuals in local woodpecker populations may experience long-term sporadic impacts coinciding with the operation phase. These potential effects are considered reversible and no residual effects are anticipated.

SPECIES AT RISK

Least Bittern

Collisions with overhead wires can be a locally serious threat to least bitterns (COSEWIC 2009b). See Section 4.5 for a list of sensitive wetland sites, where the risk of collisions is expected to be moderate or high. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

Least bitterns are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Yellow Rail

Collisions with tall structures contribute to yellow rail mortality (Goldade *et al.* 2002). See Section 4.5 for a list of sensitive wetland sites, where the risk of collisions is expected to be moderate or high. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

Yellow rails are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Ferruginous Hawk

Ferruginous hawks occasionally strike overhead wires (Bechard and Schmutz 1995). As ferruginous hawk range is limited to a small portion of southwestern Manitoba, the potential risk of collisions with wires is negligible. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

Ferruginous hawks are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Burrowing Owl

Collisions with transmission wires are seemingly uncommon, and do not appear to be a large source of burrowing owl mortality. As burrowing owl range is limited to a small portion of southwestern Manitoba, the potential risk of collisions with conductors is negligible. Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2).

Burrowing owls are listed as endangered under SARA and MESA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Short-eared Owl

Collisions with overhead wires can contribute to short-eared owl mortality (COSEWIC 2008a). Individual birds may occasionally collide with wires, thus mitigation is recommended (see Section 5.2). Short-eared owls are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Common Nighthawk

Predation by terrestrial predators such as raccoon and striped skunk is a source of common nighthawk mortality (COSEWIC 2007b), and could increase due to improved predator mobility on the cleared RoW. As common nighthawks lay eggs on the ground, they could inadvertently be damaged or destroyed during maintenance activities in spring and summer. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Common nighthawks are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Few direct sources of whip-poor-will mortality are expected during operation and maintenance of the HVdc transmission line. If vegetation management is conducted on the RoW in spring and summer, nests may be damaged or destroyed. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Whip-poor-wills are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Red-headed Woodpecker

Few direct sources of red-headed woodpecker mortality are expected during operation and maintenance of the HVdc transmission line. If dead trees are removed on the southern portion of the transmission line in spring and early summer, nests could inadvertently be destroyed. Most tree removal will be done during the construction phase, thus mitigation is recommended (see Section 5.2).

Red-headed woodpeckers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Olive-sided Flycatcher

As olive-sided flycatchers are relatively small and mobile, no mortality due to collisions with overhead wires is expected. No direct sources of olive-sided flycatcher mortality are expected during operation and maintenance of the HVdc transmission line.

Olive-sided flycatchers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Loggerhead Shrike

Predation on loggerhead shrike adults and eggs can increase near openings that attract predators (COSEWIC 2004), potentially contributing to mortality on the RoW. Effects will be limited to the southwestern portion of the transmission line, the extent of loggerhead shrike range in Manitoba.

Loggerhead shrikes are listed as threatened under SARA and endangered under MESA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Sprague's Pipit

As Sprague's pipits nest on the ground (Sutter 1997), they may be more susceptible to brood parasitism along the RoW (Flashpoehler *et al.* 2001). Nest predation reduces reproductive success, and can increase when predator communities change due to habitat alteration, particularly near edges (COSEWIC 2010c). Generally, individuals will be affected, not populations. However, Sprague's pipit distribution is relatively rare and sporadic in Manitoba, with the exception of the southwest corner (Holland *et al.* 2003a), and decreased nesting success may prove problematic over time. Should maintenance occur during the nesting season on the southwestern portion of the transmission line, nests could inadvertently be destroyed. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Sprague's pipits are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Golden-winged Warbler

Golden-winged warblers may be susceptible to brown-headed cowbird brood parasitism (COSEWIC 2006c). The range of these two species overlaps on the southwestern portion of the transmission line. Up to one third of golden-winged warbler nests can contain brown-headed cowbird eggs, but the effect on golden-winged warbler nest success is unknown (Confer 1992). Such parasitism could contribute to golden-winged warbler mortality on the southwestern portion of the transmission line. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Golden-winged warblers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Canada Warbler

As Canada warblers are relatively small and mobile, no mortality due to collisions with overhead wires is expected. Brood parasitism by brown-headed cowbirds is a potential source of mortality (Conway 1999), which could reduce nesting success. Construction in spring and summer could result in the inadvertent destruction of nests along the length of the transmission line. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Canada warblers are listed as threatened under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

Rusty Blackbird

Few direct sources of rusty blackbird mortality are expected during operation and maintenance of the Bipole III transmission line. Construction in spring and summer could result in the inadvertent destruction of nests along the length of the transmission line. As a few nests may be damaged or destroyed, mitigation is recommended (see Section 5.2).

Rusty blackbirds are listed as a species of special concern under SARA. The loss of individual birds could have an irreversible effect on local populations. With the implementation of the federal recovery strategy, these potential effects are considered reversible.

5.1.3.3 Habitat Alteration and Sensory Disturbance

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

As the transmission line route was selected to avoid wetlands and water bodies where possible, few effects of habitat alteration are anticipated during operation and maintenance. No additional alteration of habitat is expected for this phase.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Refer to Section 5.2 for mitigation recommendations.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

As the transmission line route was selected to avoid wetlands and water bodies where possible, few effects of habitat alteration are anticipated during operation and maintenance. No additional alteration of habitat is expected for this phase.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Refer to Section 5.2 for mitigation recommendations.

BIRDS OF PREY (BALD EAGLE)

While clearing of the RoW will result in a permanent alteration of habitat, the diversity (Johnson *et al.* 1979) and density of small mammals will likely increase, providing more prey for raptors. The transmission line towers will provide perches and possible nesting sites for species such as red-tailed hawk (Knight and Kawashima 1993), American kestrel (Reinert 1984), and osprey. However, such nests could interrupt power transmission (Steenhof *et al.* 1993), if constructed on wires and insulators, necessitating their removal (Manitoba Hydro 2010). Grouse species may benefit from the open habitat created by RoW clearing (Training Unlimited Inc. 2000), which could provide prey for raptors.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Refer to Section 5.2 for mitigation recommendations.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

The RoW may provide habitat for upland game birds such as grouse, which are often observed on RoWs and in open areas (Bramble and Byrnes 1983; Taylor 2003). Ruffed grouse have been observed on RoWs (Bramble and Byrnes 1983). These birds feed on shrub and hardwood tree buds along trails and other linear features (Holland and Taylor 2003d). As such, the RoW may create ruffed grouse habitat. Sharp-tailed grouse congregate on leks in spring (Taylor 2003) and open areas on the RoW may provide reproductive and nesting habitat for this species.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Refer to Section 5.2 for mitigation recommendations.

WOODPECKERS (PILEATED WOODPECKER)

Pileated woodpecker nesting habitat could be lost if danger trees are removed from the RoW edge during vegetation management. Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Refer to Section 5.2 for mitigation recommendations.

SPECIES AT RISK

Least Bittern

As the transmission line route was selected to avoid wetlands and water bodies where possible, few effects of habitat alteration and sensory disturbance are anticipated during operation and maintenance. No additional alteration of habitat is expected for this phase.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to the species' range in southern Manitoba. Refer to Section 5.2 for mitigation recommendations.

Yellow Rail

As the transmission line route was selected to avoid wetlands and water bodies where possible, few effects of habitat alteration and sensory disturbance are anticipated during clearing and construction. No additional alteration of habitat is expected for this phase.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Potential effects could occur over the length of the transmission line wherever suitable yellow rail habitat and individuals occur. Refer to Section 5.2 for mitigation recommendations.

Ferruginous Hawk

No additional alteration of ferruginous hawk habitat is anticipated during the operation and maintenance phase. As this species prefers grasslands and is limited to the southwest corner of Manitoba (De Smet 2003a), it may benefit somewhat from increased prey in cleared areas. Where the transmission line overlaps ferruginous hawk range, little clearing of vegetation is anticipated in grassland habitat, limiting the potential for disturbance. Ferruginous hawks may benefit from perches created by transmission towers and from increased prey along the transmission line, as individuals spend a large portion of foraging time perched on these structures (Plumpton and Andersen 1997; Lammers and Collopy 2007).

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to the species' range in southern Manitoba. Refer to Section 5.2 for mitigation recommendations.

Burrowing Owl

No additional alteration of burrowing owl habitat is anticipated during the operation and maintenance phase. As this species prefers cleared areas such as pastures and prairies, and its range is limited to the southwest corner of Manitoba (De Smet 2003b), it may benefit somewhat from increased prey in cleared areas.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will limited to the species' range in southwestern Manitoba. Refer to Section 5.2 for mitigation recommendations.

Short-eared Owl

No additional alteration of short-eared owl habitat is anticipated during the operation and maintenance phase. This species may benefit from increased prey in cleared areas along the RoW.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Potential effects could occur over the length of the transmission line wherever suitable short-eared owl habitat and individuals occur. Refer to Section 5.2 for mitigation recommendations.

Common Nighthawk

No additional alteration of common nighthawk habitat is anticipated during the operation and maintenance phase. Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be short-term, local, and intermittent. Potential effects could occur over the length of the transmission line wherever suitable common nighthawk habitat and individuals occur. Refer to Section 5.2 for mitigation recommendations.

Whip-poor-will

No additional whip-poor-will habitat alteration is anticipated during the operation and maintenance phase. Whip-poor-wills could benefit from the habitat created on the RoW, as they prefer forest edge and RoWs for foraging (COSEWIC 2009c).

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to the species' range in southern Manitoba. Refer to Section 5.2 for mitigation recommendations.

Red-headed Woodpecker

Red-headed woodpecker nesting habitat could be lost if dead trees are removed from the RoW during maintenance. Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to the species' range in southern Manitoba. Refer to Section 5.2 for mitigation recommendations.

Olive-sided Flycatcher

Olive-sided flycatchers could benefit from habitat created along the RoW. However, human disturbances such as forest clearing can mimic more suitable natural habitat, attracting nesting birds and reducing nest success (Robertson and Hutto 2007). Such habitat selection will be local, and will affect individuals rather than populations (Robertson and Hutto 2006).

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Potential effects could occur over the length of the transmission line wherever suitable olive-sided flycatcher habitat and individuals occur. Refer to Section 5.2 for mitigation recommendations.

Loggerhead Shrike

No additional alteration of loggerhead shrike habitat is anticipated during the operation and maintenance phase, if existing shrubby habitat is maintained. Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to southwestern Manitoba, the extent of loggerhead shrike range. Refer to Section 5.2 for mitigation recommendations.

Sprague's Pipit

No additional alteration of existing Sprague's pipit habitat is anticipated during the operation and maintenance phase. As this species prefers moderately tall grasslands with some shrubs, some habitat may be created on the RoW (COSEWIC 2010c).

Maintenance activities that may involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to southwestern Manitoba, the extent of Sprague's pipit range. Refer to Section 5.2 for mitigation recommendations.

Golden-winged Warbler

Golden-winged warblers are often found in areas of human disturbance such as clearcuts or abandoned farmland (Hunter *et al.* 2001). As shrubland birds rely on disturbance for habitat, golden-winged warblers will likely benefit from maintenance of the RoW (Askins 1994). As golden-winged warbler territories often include a forested edge (Hunter *et al.* 2001), the RoW could provide ideal habitat where the transmission line transects forest.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to southwestern Manitoba, the extent of golden-winged warbler range. Refer to Section 5.2 for mitigation recommendations.

Canada Warbler

Canada warblers are known to nest in early successional habitats (Litvaitis 1993; COSEWIC 2008b). As such, vegetation management on the RoW could create nesting habitat for this species.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be limited to southern and central Manitoba, the extent of Canada warbler range. Refer to Section 5.2 for mitigation recommendations.

Rusty Blackbird

No additional loss of rusty blackbird habitat is anticipated during the operation and maintenance phase. As rusty blackbirds can be found in habitats in early stages of succession created by disturbances such as fire and windthrow (COSEWIC 2006a), habitat could be created along the RoW. As this species is generally associated with coniferous wetlands (COSEWIC 2006a), it is unlikely to be affected by habitat alteration.

Maintenance activities that involve helicopter or ground traffic could result in temporary sensory disturbances to individuals in the vicinity of the RoW. Such effects will be short-term, local, and intermittent. Refer to Section 5.2 for mitigation recommendations. Potential effects could occur over the length of the transmission line wherever suitable rusty blackbird habitat and individuals occur, particularly in northern Manitoba.

5.1.3.4 Disruption of Movements

While seasonal movements such as migration could be affected by a transmission line, it is not likely to affect species in the Local Study Area, which tend to migrate long distances and would be expected to encounter many natural and anthropogenic obstacles. Refer to Section 5.1.2.4 for a detailed discussion of disruption of movements during the construction period.

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

A number of waterfowl and other waterbirds utilize wetland habitat in the vicinity of the RoW. While the transmission line may coincide with migratory routes, these species fly at altitudes considerably greater than the height of the transmission line (Richardson 2000). No disruptions of seasonal movements are anticipated. Fragmentation of pre-existing mallard and sandhill crane breeding habitat by Bipole III development will likely have negligible effects on their abundance and distribution.

Daily movements, particularly between wetlands, may be affected by the presence of the transmission line RoW. The AC collector lines RoW, at 310 m in width (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*), are not anticipated to be barriers for mallard and sandhill crane movements.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Colonial waterbird species utilize wetland habitat and water bodies in the vicinity of the transmission line RoW. While the transmission line may coincide with migratory routes, these species fly at altitudes considerably greater than the height of the transmission line (Richardson 2000). No disruptions of seasonal movements are anticipated.

Daily movements, particularly between nesting and feeding sites, may be affected by the presence of the transmission line RoW. The AC collector lines RoW, at 310 m in width (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description*), could create a barrier for great blue heron movements. However, their susceptibility to collisions with transmission lines (Rusz *et al.* 1986) suggests that they do not avoid RoWs. Minimal effects on daily movements are anticipated.

BIRDS OF PREY (BALD EAGLE)

The transmission line and associated RoWs are not expected to affect daily movements of birds of prey. Raptors are frequently observed perching and nesting on transmission towers (e.g., Reinert 1984; Knight and Kawashima 1993; Lehman 2001), and the transmission line will have little effect on daily movements of birds of prey.

No effects on seasonal movements of birds of prey are expected during the operation and maintenance phase. As bald eagles migrate long distances with relatively few stopovers (Laing *et al.* 2005), and they generally fly an estimated minimum of 1 km above the ground (Harmata 1984), human presence and structures associated with clearing and construction are not expected to affect migration movements.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

No effects on daily movements of upland game birds are anticipated. As ruffed and sharp-tailed grouse are permanent residents of Manitoba, they do not migrate. Habitat fragmentation will not likely affect these populations, as they occupy small areas (Holechek 1981) and tend not to avoid forest openings. While habitat fragmentation is not expected to affect grouse movements, fragmentation has been linked to reduced breeding success due to nest predation by generalist predators (Kurki *et al.* 2000). Minimal effects on daily movements are anticipated.

WOODPECKERS (PILEATED WOODPECKER)

No effects on daily movements of woodpeckers are anticipated. As pileated woodpeckers are permanent residents of Manitoba, they do not migrate. Their movements will not likely be affected by the RoWs, as their tendency to nest near openings, stand edges, and even transmission poles (Bonar 2001) suggests they will not be constrained by the opening created by the RoW. However, these birds are more vulnerable to predation as they fly between fragments (Bull and Jackson 1995). Minimal effects on daily movements are anticipated.

SPECIES AT RISK

Least Bittern

The operation of the Project is not anticipated to result in any changes to least bittern movements at the population level. While vegetation management is not anticipated in wetland habitat, the machinery and noise associated with maintenance along the RoW in adjacent wetland habitat could disrupt daily movements of least bitterns in the vicinity. Disruption of least bittern movements will be confined to the southern Footprint, as this species' range includes a small area in Manitoba. As least bitterns are migratory, they will only be affected during spring and summer maintenance. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Yellow Rail

No Project-related effects on yellow rail movement are anticipated at the population level. As yellow rails are migratory, no effects on daily or seasonal movements are expected in the northern Footprint, as maintenance will occur in winter. Although vegetation management is not anticipated in wetland habitat, machinery and noise associated with maintenance in adjacent habitats could disrupt daily movements of yellow rails in spring and summer in the southern footprint. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Ferruginous Hawk

No Project-related effects on ferruginous hawk movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of ferruginous hawk movements in the northern Footprint, as they are geographically limited to southwestern Manitoba. In the southern Footprint, ferruginous hawks may experience temporary disruption of daily movements during spring and summer maintenance. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Burrowing Owl

No Project-related effects on burrowing owl movement are anticipated at the population level during operation and maintenance. In the northern Footprint, there is no potential for disruption of burrowing owl movements during maintenance, as their range is limited to southwestern Manitoba. In the southern Footprint, burrowing owls may experience temporary disruption of daily movements during spring and summer maintenance. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season if (see Section 5.2).

Short-eared Owl

No Project-related effects on short-eared owl movement are anticipated at the population level during operation and maintenance. There is little potential for disruption of short-eared owl movements in the northern Footprint, as they are migratory and will be absent during winter maintenance. In the southern Footprint, short-eared owls may experience temporary disruption of daily movements during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Common Nighthawk

No Project-related effects on common nighthawk movement are anticipated at the population level during operation and maintenance. There is little potential for disruption of common nighthawk movements in the northern Footprint, as they are migratory and will be absent during winter maintenance. Daily movements could be affected in the southern Footprint during spring and summer maintenance. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Whip-poor-will

No Project-related effects on whip-poor-will movement are anticipated at the population level during operation and maintenance. As whip-poor-will range does not include the northern Footprint, no disruption of daily or seasonal movements is anticipated in this area during operation or maintenance. Daily movements could be affected in the southern Footprint during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Red-headed Woodpecker

No Project-related effects on red-headed woodpecker movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of red-headed woodpecker movements in the northern footprint, as their range is limited to southern Manitoba. In the southern Footprint, daily movements could be disrupted during spring and summer maintenance. As this species is migratory, no effects are expected in winter. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Olive-sided Flycatcher

No Project-related effects on olive-sided flycatcher movement are anticipated at the population level during operation and maintenance. There is little potential for disruption of olive-sided flycatcher movements in the northern Footprint, as they are migratory and will be absent during winter, when maintenance is expected to occur. Daily movements could be affected in the southern Footprint during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Loggerhead Shrike

No Project-related effects on loggerhead shrike movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of loggerhead shrike movements in the northern Footprint, as their range is limited to southwestern Manitoba. In the southern Footprint, daily movements could be affected during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Sprague's Pipit

No Project-related effects on Sprague's pipit movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of Sprague's pipit movements in the northern Footprint, as their range is limited to southwestern Manitoba. In the southern Footprint, daily movements could be affected during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Canada Warbler

No Project-related effects on Canada warbler movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of Canada warbler movement in the extreme northern Footprint during maintenance, as their breeding range is limited to central Manitoba. In the southern Footprint, daily movements could be affected during maintenance in spring and summer. Although Canada warblers can tolerate low levels of human disturbance (Conway 1999), some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Golden-winged Warbler

No Project-related effects on golden-winged warbler movement are anticipated at the population level during operation and maintenance. There is no potential for disruption of golden-winged warbler movements in the northern Footprint, as their range is limited to southern and west central Manitoba. In the southern Footprint, daily movements could be affected during maintenance in spring and summer. Some mitigation measures are required to reduce the potential for disruption of movements during the nesting season (see Section 5.2).

Rusty Blackbird

No Project-related effects on rusty blackbird movement are anticipated at the population level during operation and maintenance. As rusty blackbird breeding range does not include southwestern Manitoba, no disruption of daily movements from maintenance activity is expected.. In the southern Footprint, maintenance is expected to occur in winter, when this migratory species is absent. No effects are anticipated.

5.1.3.5 Habitat Fragmentation

The creation of the HVdc transmission line RoW will contribute to habitat fragmentation in the Project Study Area (see the *Bipole III Fragmentation Technical Report*). There are a number of potential effects associated with increased linear feature density and fragmentation of habitat. The addition of linear features by the Footprint includes the transmission line RoW and associated linear features including temporary trails used to develop and maintain Project infrastructure.

The effects of fragmentation are variable and based on a number of factors including the pre-existing level of habitat fragmentation, the type of landscape being fragmented, and to what extent fragmentation will interact with certain pre-existing linear features (Hagan *et al.* 1996; Donovan and Lamberson 2001). These effects vary from the relatively straight-forward loss of habitat but can be difficult to distinguish (Trzcinski *et al.* 1999; Fahrig 2003).

One effect of landscape fragmentation relates to habitat alteration due to the creation of **edge** habitat. Species that use edge habitat areas are often referred to as generalist species and select edge areas due to the presence of multiple habitat types (Devictor *et al.* 2008). In southern Manitoba, common edge-habitat generalist species include corvids (e.g., American crow) and grouse. To this extent, the type of edge habitat created should be considered as certain edges may attract more species, e.g., forest-agricultural edge areas relative to forest-clearcuts edges (Suarez *et al.* 1997).

While the increase in edge habitat attracts some species, other species can be adversely affected (Devictor *et al.* 2008). Species that require some core habitat and are also dependent on edge habitat are likely to be adversely affected by fragmentation. These species could be referred to as **niche** species and the attraction of other generalist species provides an unwanted source of competition for resources and attracts predator species (Henle *et al.* 2004).

Fragmentation of habitat is often due to construction of linear features including roads, transmission lines, seismic lines, and railways (Machtans *et al.* 1996; Trzcinski *et al.* 1999; Villard *et al.* 1999). The extent to which fragmentation affects niche species is largely based on the size of and distance between habitats where forage items, nesting habitats/materials, etc. are located (Henle *et al.* 2004). In addition, there are increased chances of predation associated with birds flying in open areas that further limits the ability of forest birds to travel between patches (Bull and Jackson 1995). Nesting success can be reduced by nest predators and brood parasites, which are often associated with fragmented areas (Fitzgerald *et al.* 1998).

The exploration of linear features on the landscape can serve as a method of identifying the potential degree of fragmentation previous to and following Bipole III development. These amounts can then be associated with the varying effects of landscape fragmentation on bird species of interest. While measures of linear feature density have been important in identifying thresholds for other species, these limits have not been clearly indicated for bird species, although thresholds theoretically exist for some species (Machtans *et al.* 1996).

The *Bipole III Fragmentation Technical Report* compares existing linear features located in the Local Study Area to the post project environment. In descending order of occurrence, forested habitats would potentially be most affected in Aspen Parkland, Churchill River Upland and Hayes River Upland Ecoregions. Hayes River Upland, Mid-Boreal Lowlands and Lake Manitoba Plains were found to be the ecoregions with the longest length of RoW intercepting forest. Of the ecoregions potentially affected, the Lake Manitoba Plain Ecoregion had the lowest percentage of segments intercepting forest. Selwyn Lake Upland Ecoregion did not have any segments intercepting forests.

The potential effects of habitat fragmentation by the Footprint are expected to be negligible in southern ecoregions (Lake Manitoba Plain, Interlake Plain, and Mid-Boreal Lowland). There is currently a high proportion of linear features in these areas. Aside from pre-existing linear features there is also the alteration of habitat by agriculture and forestry. Due to differences in the level of habitat alteration in each ecoregion, the overall increase in fragmentation by linear features alone is difficult to interpret where greater changes in avian species diversity have already been observed in the south, particularly due to agricultural and urban expansion, compared to the relatively undeveloped north.

In more northern ecoregions (Churchill River Upland, Hayes River Upland, and Hudson Bay Lowland), the effects of increased linear feature density on bird species is expected to be negligible. For these northern ecoregions, the amount of pre-existing linear features is not as high in the northern Footprint as in southern ecoregions. In these northern ecoregions the addition of linear features could be expected to potentially cause a greater net increase in landscape fragmentation relative to southern ecoregions. To this extent there are higher quantities of core habitat areas, with little anthropogenic development, where the effects of fragmentation may not be as readily apparent.

Thresholds indicating the effects of habitat fragmentation on bird species have not been clearly established. This is mostly due to the difficulties in separating the effects of actual habitat loss and alteration that often occurs alongside fragmentation as well establishing what parameters to use to link habitat fragmentation with changes in bird species habitat use. To this extent the following discussion will relate the potential effects of habitat fragmentation on VECs and based on literature reviews of outlined threats.

WATERFOWL AND OTHER WATERBIRDS (MALLARD AND SANDHILL CRANE)

The fragmentation of habitat through increased linear feature density has not been established as a major factor affecting the persistence of waterfowl populations; particularly in comparison to actual loss of habitat. Mallards tend to select brood-rearing habitats with sufficient forage (Sjöberg *et al.* 2000; Gunnarsson *et al.* 2004). As mallards are the among the first migrant waterfowl species to arrive in Manitoba each spring (Baydack and Taylor 2003), they are not likely limited by the availability of brood-rearing habitats relative to other waterfowl species. Gunnarsson *et al.* (2006) indicate that where mallards are forced to brood in ponds with inadequate forage ducklings will travel along the shore edge; indicating the amount of water-land edge area may be important but where some possibility of movement between ponds exists (Sjöberg *et al.* 2000). Nest success of mallards and other ducks declines in fragmented agricultural areas, mainly due to increased predation by mammalian predators (Greenwood *et al.* 1995). In the evaluation of sandhill crane nesting behaviour, Baker *et al.* (1995) indicate nesting occurs a minimum of 200 m from varied wetland and flooded agricultural or grassland habitats. Downs *et al.* (2008) indicate the sizing and distribution of sandhill crane habitat patches is difficult to establish. Fragmentation of pre-existing mallard and sandhill crane breeding habitat by Bipole III development will likely have negligible effects on their abundance and distribution.

COLONIAL WATERBIRDS (GREAT BLUE HERON)

Colonial waterbirds generally avoid human disturbance. This is also true of the establishment of great blue heron colonies (Naylor and Watt 2004). Consequently, the development and use of linear features is often restricted in areas adjacent to colonies (Naylor and Watt 2004; Manitoba Conservation 2010a). These issues relate to sensory disturbance (Section 5.1.3.3), and effects can be reduced with mitigation.

Great blue herons are often associated with wetland complexes (Gibbs 1991; Gibbs and Kinkel 1997) and are commonly found in the southern ecoregions of Manitoba (Koonz 2003c). While there is some fidelity to nesting areas during each breeding season (Manitoba Conservation 2010a), other factors, particularly the proximity to foraging areas (Gibbs 1991), play a key role in the selection of nesting sites. Great blue herons, and most colonial waterbirds, also travel considerable distances from nesting areas to foraging areas when required (Hamilton *et al.* 1967; Gibbs 1991). The quantity of foraging areas is a greater limiting factor to great blue heron distribution than habitat fragmentation. Fragmentation of pre-existing great blue heron habitat by Bipole III development will likely have negligible effects on its abundance and distribution.

BIRDS OF PREY (BALD EAGLE)

While some species of raptors and owls are somewhat sensitive to urbanization, (e.g., Bosakowski and Smith 1997; Berry *et al.* 1998), habitat fragmentation does not appear to have a large effect on these birds. Bald eagle productivity is negatively affected by the presence of active logging roads during breeding season. Alternatively, paved roads have a positive correlation with bald eagle productivity (Naylor and Watt 2004). As southern Manitoba is already highly fragmented, the transmission line is not expected to have an additional effect on birds of prey. In the northern Footprint, where there is considerably less human development, the addition of a transmission line and associated components is not expected to affect bird of prey populations and their habitats. Fragmentation of pre-existing bald eagle breeding habitat by Bipole III development will likely have negligible effects on its abundance and distribution.

UPLAND GAME BIRDS (RUFFED GROUSE AND SHARP-TAILED GROUSE)

Upland game bird species in the Local Study Area have a variety of habitat requirements, and different effects of increased density of linear features are expected for each. For ruffed grouse, which often use linear features and edge habitat areas, there will likely be an increase in nest predation by species such as crows and blue jays (Yahner and Scott 1988), particularly near agricultural areas (Kurki *et al.* 1997). Reduction of usable sharp-tailed grouse habitat and increased hunting areas are the primary causes of population decline (Drummer *et al.* 2011). The effects of habitat fragmentation have been less well established for sharp-tailed grouse. Fragmentation of pre-existing ruffed grouse and sharp-tailed grouse breeding habitat by Bipole III development will likely have negligible effects on their abundance and distribution.

WOODPECKERS (PILEATED WOODPECKER)

Measurements of pileated woodpecker habitat selection at two spatial scales in Canada indicated loss of coniferous and deciduous stands could lead to declines in habitat areas for these species, where no variation based on distance to edge areas was considered (Savignac *et al.* 2000). Consequently, forest fragmentation could make pileated woodpeckers more vulnerable to predation when flying between fragments (Bull and Jackson 1995). Fragmentation of pre-existing pileated woodpecker breeding habitat by Bipole III development will likely have negligible effects on their abundance and distribution.

SPECIES AT RISK

As this group constitutes a variety of birds with unique habitat use patterns and responses to varying development practices, the potential increase of linear features through Bipole III development cannot be clearly distinguished. Some effects of increased fragmentation of habitat areas are recognizable in terms of potentially affecting species at risk populations, such as brood parasitism by brown-headed cowbirds (see Section 5.1.3.2).

When forest fragments are created, birds may be crowded into smaller habitat fragments. This has a greater effect on Neotropical migrants than short-distance migrants and year–round residents due to fidelity to particular nesting areas and the need for Neotropical migrants to breed and brood quickly and efficiently once arriving at their breeding range (Schmiegelow *et al.* 1997). This crowding effect has been associated with short-term increases in species richness in the year following fragmentation and a decrease in species numbers in subsequent years (Schmiegelow *et al.* 1997).

Least Bittern

As least bitterns generally prefer small wetlands (Gibbs *et al.* 1992) with highly variable home range sizes (COSEWIC 2009b) it is expected that habitat fragmentation due to the addition of Bipole III on the southern Manitoba landscape will play a negligible role in the growth of least bittern populations, particularly as southern Manitoba is considered the northern extent of the breeding range for this species (Koes 2003).

Yellow Rail

Fragmentation of pre-existing yellow rail breeding habitat by Bipole III development will likely have negligible effects on yellow rail abundance and distribution. This species is often found in wetland habitats (COSEWIC 2009a) where the loss of habitat is considered the limiting factor rather than the fragmentation of habitat (Bookhout 1995).

Ferruginous Hawk

The effects of habitat fragmentation through the development of Bipole III will likely be negligible for ferruginous hawk as the Footprint only overlaps the northern extent of its range. If the ranges were to overlap more, vegetation maintained on the RoWs could serve as habitat for prey species such as ground squirrels.

Burrowing Owl

The effects of fragmentation are expected to be negligible due to similarities in native grassland and prairie areas relative to maintained RoWs. Consequently, changes in landscape composition on the RoW will not alter those habitat areas still used by this species (De Smet 2003b).

Short-eared Owl

Short-eared owls, while rare, are considered mobile and opportunistic hunters (Holt and Leasure 1993). It is expected that increases in fragmentation will have negligible effects and not limit the distribution of this species; particularly as its breeding range does not extend to contiguous forest areas (Holland and Taylor 2003h). This negligible effect is further validated through relative abundances of this species identified in proximity to urban centres including Winnipeg, Portage la Prairie, and Carberry, which have considerable levels of habitat fragmentation (Holland and Taylor 2003h).

Common Nighthawk

As common nighthawks are seen in a variety of habitat types where the clearing of land has occurred (Poulin *et al.*1996) it is not expected that fragmentation will precipitate population declines or limit the distribution of this species.

Whip-poor-will

As a ground-nesting species that uses edge-habitat areas, including roadsides, it is expected that there will be negligible effects on whip-poor-wills fragmentation of habitat at the landscape level (Cink 2002). This will be particularly evident as this species has limited distribution limited to southern Manitoba where the increase in linear feature density along the HVdc transmission line RoW, is expected to be less than 30%.

Red-headed Woodpecker

Fragmentation effects are expected to be negligible on red-headed woodpeckers based on their preference for open deciduous forest areas (COSEWIC 2007c). In addition, the range of red-headed woodpeckers is primarily limited to southern Manitoba (Taylor 2003i); an area where the linear feature density will increase less than 30%, and where substantial anthropogenic development has occurred alongside agricultural and urban expansion.

Olive-sided Flycatcher

As olive-sided flycatchers are associated with burns, forest edges, and wetlands (Altman and Sallabanks 2000; COSEWIC 2007d), effects associated with habitat fragmentation are expected to be negligible. The extension of linear features in northern ecoregions, such as Churchill River Uplands, may allow for the increased distribution of this species; although the resulting edge areas have been identified as potential 'ecological traps' where predation by squirrels and corvids is higher (Altman and Sallabanks 2000).

Loggerhead Shrike

Habitat use by loggerhead shrikes is poorly understood; however this species is often positively associated with prairie habitats with some use of sparsely forested areas for nesting (COSEWIC 2004). In addition, loggerhead shrike presence is limited to the southwestern portion of the province (De Smet 2003c) where little interaction between the Project and this species is expected. As a result, potential effects of landscape fragmentation are expected to be negligible.

Sprague's Pipit

Sprague's pipits are associated with large tracts of native prairie and grassland habitats (Davis *et al.* 1999). In Manitoba, the range of Sprague's pipit has been increasingly limited to the southwestern portion of the province (Holland *et al.* 2003a; COSEWIC 2010c). There is little overlap expected between Bipole III and remaining native prairie areas; consequently fragmentation effects on this species are expected to be negligible. As a short-range migrant (COSEWIC 2010c) the effects of fragmentation should not limit the distribution of this species relative to Neotropical migrants utilizing the same habitat areas (Schmiegelow *et al.* 1997).

Golden-winged Warbler

Golden-winged warblers are largely restricted to southwestern Manitoba during the breeding season (Taylor 2003k). The extension of possible brown-headed cowbird range through the creation of edge habitat areas could have negative consequences on golden-winged warbler population persistence (Edie *et al.* 2003a) (see Section 5.1.3.2). Their limited breeding in Manitoba indicates an already long-standing interaction between anthropogenic development and habitat viability for this species. Consequently, the Project is expected to have only a negligible effect.

Canada Warbler

As a Neotropical migrant that accesses forest habitats, particularly wet-forest and riparian forest areas (COSEWIC 2008b), it was hypothesized that the fragmentation of forested areas could lead to a crowding effect, but that was not the case (Schmiegelow *et al.* 1997). This species is relatively resilient to some levels of anthropogenic disturbance (Cooper *et al.* 1997) but potentially vulnerable to the expansion of brown-headed cowbirds with the expansion of forest-agricultural edge areas (Cooper *et al.* 1997) (see Section 5.1.3.2). To this extent habitat will have only negligible effects on Canada warblers.

Rusty Blackbird

A negligible effect of fragmentation on rusty blackbirds and their northern wetland habitats is anticipated. This is largely due to occurrence of the northern breeding range in areas with low levels of pre-existing linear features in the Local Study Area, as well as existing in habitat areas largely unsuitable to other species (Nero and Taylor 2003).

5.1.4 Decommissioning

There is currently no definitive timeline or plan for final disposition or decommissioning of the Bipole III transmission line and associated Project components. Should transmission lines be decommissioned at some future date, Manitoba Hydro has tentatively identified acceptable means for environmentally restoring sites and RoWs. Established procedures are available for decommissioning temporary infrastructure or facilities (e.g., borrow pits, access trails, marshalling areas, mobile construction camps, etc.). The restoration of the project footprint upon decommissioning will result in a reversal of a number of the effects associated with the project. Most habitats are expected to return to pre-project conditions that would allow bird species to return to previously disturbed areas. However, this may take a long period of time to occur, especially in areas where soils are less productive for the development of vegetation cover. At the time of decommissioning, no effect on vegetation VECs presented are anticipated to occur; however, upon decommissioning of any project components, it is recommended that a revegetation plan be developed that would include only native species (see *Terrestrial Ecosystems and Vegetation Assessment of the Bipole III Transmission Project* and the *Technical Report on Terrain and Soils – Bipole III Transmission Project).* Additionally, access for hunting will become more restricted as vegetation regrows and the RoW is no longer accessible using ATV's or snowmobiles.

Current methods of decommissioning of transmission lines will entail dismantling of the structures and salvage or disposal of all steel structure components, as well as removal and salvage of insulators, conductors, and ground wires.

Decommissioning of RoWs currently involves clean-up and/or remediation to a standard commensurate with local environmental conditions including existing land use and policy with respect to future development.

Decommissioning of marshalling yards currently involves the removal of all new and used equipment and materials, dismantling of any ancillary equipment or structures, and the remediation of the yard property.

Based on the longevity of the existing Bipoles I and II, the Bipole III HVdc transmission line is expected to be in service for at least fifty years. Other identified transmission facilities (i.e., northern collector lines) are also expected to have a service life of at least fifty years. In the event that transmission lines are taken out of service, specific methods and procedures for decommissioning and salvage will be adjusted to meet the regulatory and legislative requirements in place at the time.

5.2 MITIGATION MEASURES

5.2.1 Site Preparation and Construction

Clearing and construction will be limited to winter in the northern Footprint, and clearing will only occur in winter in the southern Footprint (see *Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description)*. However, construction could occur year-round in the southern Footprint. As such, mitigation will be required to reduce potential effects on VECs, and particularly species at risk. See Appendix F-19 for specific dates of reproductive activity and recommended setback distances for species at risk.

5.2.1.1 Waterfowl and Other Waterbirds (Mallard and Sandhill Crane)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on waterfowl and other waterbirds during the clearing and construction phase:

- Hunting and harvesting of wildlife by Project staff will be limited while working on Project sites and restrict firearms at construction sites, minimizing the potential effect of harvesting on mortality;
- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance; and
- Vegetated buffers will be maintained in riparian areas to minimize the effect of habitat alteration on mallards.

5.2.1.2 Colonial Waterbirds (Great Blue Heron)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on colonial waterbirds during the clearing and construction phase:

- Project activities will be restricted during bird breeding and brood rearing months from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Vegetated buffers will be maintained in riparian areas to minimize the effect of habitat alteration on colonial waterbirds;
- Buffers within a 200 m radius of heron colonies will be maintained from April 1 to July 31 to protect from sensory disturbance during the breeding season; and
- Buffers within a 100 m radius of heron colonies will be maintained from August 1 to March 31 to protect nest trees and maintain the integrity of nesting sites.

5.2.1.3 Birds of Prey (Bald Eagle)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on birds of prey during the clearing and construction phase:

- Trees containing large stick nests will be left undisturbed until unoccupied to minimize mortality due to nest destruction during the nesting season;
- Artificial structures will be provided for nesting if unoccupied nests must be removed to reduce the loss of nesting habitat (i.e., but only if the raptor nest is not located adjacent to a sensitive site e.g., sharp-tailed grouse lek or species at risk habitat);
- Buffers within a 200 m radius of eagle and osprey nests will be maintained from April 1 to July 31 to protect from sensory disturbance during the breeding season;
- maintain buffers within a 100 m radius of eagle and osprey nests from August 1 to March 31 to protect nest trees and maintain the integrity of nesting sites; and
- Project activities during bird breeding and brood rearing will be restricted months from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance.

5.2.1.4 Upland Game Birds (Ruffed Grouse and Sharp-tailed Grouse)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on upland game birds during the clearing and construction phase:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Hunting and harvesting of wildlife by Project staff will be limited while working on Project sites and restrict firearms at construction sites to minimize the effect of harvesting on upland game bird mortality; and
- Setback distances will be applied around sharp-tailed grouse leks if the timing of construction activity overlaps with sensitive time periods.

5.2.1.5 Woodpeckers (Pileated Woodpecker)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on woodpeckers during the clearing and construction phase:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Dead standing trees will be retained where possible, to reduce the loss of woodpecker nesting habitat;
- Danger trees near the RoWs will be topped, rather than removed to reduce the loss of adjacent woodpecker nesting habitat; and
- Clearing of trees with roost cavities will be limited to daylight hours, and preferably in fall, to minimize disruption of resident woodpeckers and retain shelter and nesting sites.

5.2.1.6 Species at Risk

LEAST BITTERN

The following mitigation measures are proposed to minimize and mitigate Project-related effects on least bitterns during the clearing and construction phase. The recommended setback distance for least bittern is 400 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods; and

- Vegetated buffers will be maintained in riparian areas to minimize the effect of habitat alteration on least bitterns.

YELLOW RAIL

The following mitigation measures are proposed to minimize and mitigate Project-related effects on yellow rails during the clearing and construction phase. The recommended setback distance for yellow rail is 350 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods; and
- Vegetated buffers will be maintained in riparian areas to minimize the effect of habitat alteration on yellow rails.

FERRUGINOUS HAWK

The following mitigation measures are proposed to minimize and mitigate Project-related effects on ferruginous hawks during the clearing and construction phase. The recommended setback distance ferruginous hawk is 1,000 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods;
- Construction activity will be prohibited within 1,000 m of ferruginous hawk nests for 45 days following hatching of young to minimize disturbance (Environment Canada 2009);
- Trees containing large stick nests will be left undisturbed until unoccupied when clearing the south-western portion of the RoW to avoid disturbing ferruginous hawk nests;
- Artificial structures will be provided for nesting if unoccupied nests must be removed to reduce the loss of nesting habitat (i.e., but only if the raptor nest is not located adjacent to a sensitive site e.g., sharp-tailed grouse lek or species at risk habitat);
- Buffers will be maintained within a 200 m radius of large stick nests from April 1 to July 31 to protect from sensory disturbance during the breeding season; and
- Buffers will be maintained within a 100 m radius of large stick nests from August 1 to March 31 to protect nest trees and maintain the integrity of nesting sites.

BURROWING OWL

The following mitigation measures are proposed to minimize and mitigate Project-related effects on burrowing owls during the clearing and construction phase. The recommended setback distance for burrowing owl is 500 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods; and
- Night-time activities will be avoided during the nesting season to minimize disturbance to burrowing owl.

SHORT-EARED OWL

The following mitigation measures are proposed to minimize and mitigate effects of Project-related effects on short-eared owls during the clearing and construction phase. The recommended setback distance for short-eared owl is 500 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

COMMON NIGHTHAWK

The following mitigation measures are proposed to minimize and mitigate effects Project-related effects on common nighthawk during the clearing and construction phase. The recommended setback distance for common nighthawk is 200 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods; and

- Night-time activities will be avoided during the nesting season to minimize disturbance to common nighthawk.

WHIP-POOR-WILL

The following mitigation measures are proposed to minimize and mitigate effects of Project-related effects on whip-poor-will during the clearing and construction phase. The recommended setback distance for whip-poor-will is 200 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods;
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods; and
- Night-time activities will be avoided during the nesting season to minimize disturbance to whip-poor-will.

RED-HEADED WOODPECKER

The following mitigation measures are proposed to minimize and mitigate effects of Project-related effects on red-headed woodpecker during the clearing and construction phase. The recommended setback distance for red-headed woodpecker is 200 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

OLIVE-SIDED FLYCATCHER

The following mitigation measures are proposed to minimize and Project-related effects on olive-sided flycatchers during the clearing and construction phase. The recommended setback distance for olive-sided flycatcher is 300 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance.

LOGGERHEAD SHRIKE

The following mitigation measures are proposed to minimize and mitigate Project-related effects on loggerhead shrikes during the clearing and construction phase. The recommended setback distance for loggerhead shrike is 400 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

SPRAGUE'S PIPIT

The following mitigation measures are proposed to minimize and mitigate Project-related effects on Sprague's pipits during the clearing and construction phase. The recommended setback distance for Sprague's pipit is 250 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

GOLDEN-WINGED WARBLER

The following mitigation measures are proposed to minimize and mitigate Project-related effects on golden-winged warbler during the clearing and construction phase. The recommended setback distance for golden-winged warbler is 300 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

CANADA WARBLER

The following mitigation measures are proposed to minimize and mitigate Project-related effects on Canada warblers during the clearing and construction phase. The recommended setback distance for Canada warbler is 300 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer construction if the timing of construction activity overlaps with sensitive time periods; and
- Setback distances will be applied if the timing of construction activity overlaps with sensitive time periods.

RUSTY BLACKBIRD

The following mitigation measures are proposed to minimize and mitigate effects Project-related effects on rusty blackbirds during the clearing and construction phase. The recommended setback distance for rusty blackbird is 100 m and is to be applied to construction zones in southern Manitoba if they intersect with species at risk habitats and active breeding areas:

- Project activities during bird breeding and brood rearing months will be restricted from April 1 to July 31, to reduce the risk of nest destruction and sensory disturbance.

5.2.2 Operation and Maintenance

When vegetation maintenance occurs in spring and summer, mitigation will be required to reduce potential effects on VECs, and particularly species at risk. See Appendix F-19 for specific dates of reproductive activity and recommended setback distances for species at risk.

5.2.2.1 Waterfowl and Other Waterbirds (Mallard and Sandhill Crane)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on waterfowl and other waterbirds during the operation phase:

- Access trails associated with the RoWs will be decommissioned to reduce access to the area by hunters and decrease the local harvest of waterfowl and other waterbirds;
- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to reduce access to the area and to reduce sensory disturbances arising from recreational use;
- Bird diverters will be placed at environmental sensitive sites such as wetlands to reduce the potential for collisions with wires; and
- Vegetation management activities will be avoided near wetlands from April 1 to July 31 on the length of the RoW, to prevent nest disturbance or abandonment.

Several types of diverters are available, and are generally divided into two categories, swinging plates and coiled PVC wire markers. Advantages of swinging plates are increased visibility by birds, either during the day or at night or both, depending on coloration and markings (Avatar Environmental *et al*. 2004). Coiled PVC diverters are also effective at reducing bird-wire collisions (Brown and Drewien 1995). Since they are attached directly to the wire and do not flap, visibility may not be as great as swinging plates. Swinging plates cause a greater occurrence of corona discharge from lines greater than 115 kV than coiled PVC diverters, and create greater stress on the line (Hurst 2004). Thus, brightly coloured coiled PVC diverters, such as Bird Flight Diverters or Swan Flight Diverters, which cover a greater area, are recommended. The manufacturer can provide Manitoba Hydro engineers guidance in choosing the most appropriate size and placement of these devices.

5.2.2.2 Colonial Waterbirds (Great Blue Heron)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on colonial waterbirds during the operation phase:

- Bird diverters will be placed at environmental sensitive sites such as wetlands to reduce the potential for collisions with wires;
- Vegetation management activities will be avoided near wetlands from April 1 to July 31on the length of the RoW, to prevent nest disturbance or abandonment;
- Colonies or other groups of birds will be avoided during helicopter use for line maintenance (AltaLink Management Ltd. 2006); and
- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via snowmobile and ATV, and some foot traffic, to reduce access to the area and reduce sensory disturbances arising from recreational use.

5.2.2.3 Birds of Prey (Bald Eagle)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on birds of prey during the operation phase:

- Vegetation management activities will be avoided near large stick nests from April 1 to July 31, to prevent nest disturbance or abandonment;
- Buffers will be maintained within a 50 m radius of active large stick nests when discovered;
- Bird diverters will be placed at environmental sensitive sites such as the Red River crossing to reduce the potential for collisions with wires;
- Perch deterrents such as porcupine wire or triangles will be installed where raptor perching and nesting are problematic to discourage such activity, reducing the small chance of electrocution and possibly the need for removing nests;
- Artificial nest structures will be installed in adjacent habitats where nests on transmission towers are removed, to reduce loss of nesting habitat (i.e., but only if the raptor nest is not located adjacent to a sensitive site e.g., sharp-tailed grouse lek or species at risk habitat); and

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via snowmobile and ATV, and some foot traffic, to reduce sensory disturbances arising from recreational use.

A number of deterrents exist to prevent birds from perching in unwanted areas such s on transmission towers, including netting, porcupine wire (wire or plastic), Avi-away, fine wires, and bird balls (Transport Canada 2010). Porcupine wire is the primary recommended bird deterrent for hydro to keep birds from perching or roosting on flat surfaces as it has been proven to be effective, is easy to install on towers, and permanently prevents birds from perching (Transport Canada 2010).

5.2.2.4 Upland Game Birds (Ruffed Grouse and Sharp-tailed Grouse)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on upland game birds during the operation phase:

- Access trails associated with the RoWs will be decommissioned to reduce access to the area by hunters and to decrease the local harvest of upland game birds;
- Shrubby vegetation on the RoWs will be maintained where possible to impede transportation via snowmobile and ATV, and some foot traffic to reduce access to the area by hunters and decrease the local harvest of and sensory disturbance sharp-tailed grouse;
- Bird diverters will be placed at environmental sensitive sites such as sharp-tailed grouse leks, to reduce the potential for collisions with wires; and
- Perch deterrents (see Section 5.2.2.3) such as porcupine wire or triangles on transmission towers will be installed near sharp-tailed grouse leks to reduce predation on sharp-tailed grouse by raptors.

5.2.2.5 Woodpeckers (Pileated Woodpecker)

The following mitigation measures are proposed to minimize and mitigate Project-related effects on upland game birds during the operation phase:

- Where feasible, danger trees near the RoWs topped, rather than removed, to reduce the potential loss of adjacent woodpecker nesting habitat;
- Removal of danger trees with roost cavities will be limited to daylight hours, to minimize disruption of resident woodpeckers and retain shelter and nesting sites;
- Removal of danger trees near the RoW will be prohibited during the spring nesting period to minimize nest destruction and sensory disturbance during the nesting season; and
- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via snowmobile and ATV, and some foot traffic, to reduce sensory disturbances arising from recreational use.

5.2.2.6 Species at Risk

LEAST BITTERN

The following mitigation measures are proposed minimize and mitigate Project-related effects on least bitterns during the operation phase:

- Bird diverters will be placed at environmental sensitive sites such as wetlands to reduce the potential for least bittern collisions with wires;
- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where least bittern could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

YELLOW RAIL

The following mitigation measures are proposed minimize and mitigate Project-related effects on yellow rails during the operation phase:

- Bird diverters will be placed at environmental sensitive sites such as wetlands to reduce the potential for yellow rail collisions with wires;
- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where yellow rail could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season (see Bipole III Birds: Technical Report for potential habitat and locations);
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

FERRUGINOUS HAWK

The following mitigation measures are proposed minimize and mitigate Project-related effects on ferruginous hawks during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where ferruginous hawk could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations;
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods; and
- Maintenance activity will be prohibited within 1,000 m of ferruginous hawk nests for 45 days following hatching of young to minimize disturbance (Environment Canada 2009).

BURROWING OWL

The following mitigation measures are proposed minimize and mitigate Project-related effects on burrowing owls during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where burrowing owl could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations;
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods; and
- Night-time maintenance activities will be avoided in species at risk habitats during the nesting season to minimize disturbance burrowing owl.

SHORT-EARED OWL

The following mitigation measures are proposed minimize and mitigate Project-related effects on short-eared owls during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;

- Vegetation management will be limited in areas where short-eared owl could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season (see Bipole III Birds: Technical Report for potential habitat and locations);
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

COMMON NIGHTHAWK

The following mitigation measures are proposed minimize and mitigate Project-related effects on common nighthawk during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where common nighthawk could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations;
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods; and
- Night-time maintenance activities will be avoided in species at risk habitats during the nesting season to minimize disturbance to common nighthawk.

WHIP-POOR-WILL

The following mitigation measures are proposed minimize and mitigate effects Project-related effects on whip-poor-wills during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where whip-poor-will could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season; and
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

RED-HEADED WOODPECKER

The following mitigation measures are proposed minimize and mitigate Project-related effects on red-headed woodpeckers during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where red-headed woodpecker could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations;
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods; and
- Where feasible, danger trees near the RoWs will be topped, rather than removed to reduce the potential loss of adjacent red-headed woodpecker nesting habitat.

OLIVE-SIDED FLYCATCHER

The following mitigation measures are proposed minimize and mitigate Project-related effects on olive-sided flycatchers during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Shrubby vegetation will be maintained on the RoW where possible as potential olive-sided flycatcher habitat; and
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

LOGGERHEAD SHRIKE

Vegetation management may occur year round in the known range of loggerheaded shrikes and consequently may affect their breeding, nesting, and daily movements. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

The following mitigation measures are proposed minimize and mitigate Project-related effects on loggerhead shrikes during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where loggerhead shrike could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season; and
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

SPRAGUE'S PIPIT

The following mitigation measures are proposed minimize and mitigate Project-related effects on Sprague's pipits during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where Sprague's pipit could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

GOLDEN-WINGED WARBLER

The following mitigation measures are proposed minimize and mitigate Project-related effects on golden-winged warblers during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Vegetation management will be limited in areas where golden-winged warbler could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations;

- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods; and,
- Where feasible, maintain golden-winged warbler habitat by selective basal spraying (Askins 1994) for vegetation management on the southern portion of the RoW.

CANADA WARBLER

The following mitigation measures are proposed minimize and mitigate Project-related effects on Canada warblers during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Shrubby vegetation will be maintained on the RoW where possible as potential Canada warbler habitat;
- Vegetation management will be limited in areas where Canada warbler could occur from April 1 to July 31 to minimize the risk of nest destruction and sensory disturbance during the nesting season; and
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

RUSTY BLACKBIRD

The following mitigation measures are proposed minimize and mitigate Project-related effects on rusty blackbirds during the operation phase:

- Shrubby vegetation will be maintained on the RoWs where possible to impede transportation via ATV, and some foot traffic, to minimize access to the area and to reduce sensory disturbance;
- Searches for nests will be undertaken prior to spring or summer vegetation management if the timing of maintenance activity overlaps with sensitive time periods and locations; and
- Setback distances (see Section 5.2.1) will be applied if the timing of vegetation management overlaps with sensitive time periods.

5.2.3 Environmentally Sensitive Sites

Initial protection measures for sensitive sites were established during the alternative routing process (see the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*), where the route crossing the fewest sensitive sites was selected. For sensitive sites that could not be avoided, four means of mitigation are proposed:

- seasonally limited clearing, construction, and maintenance times;

- the placement of bird diverters;
- avoidance or replacement of large stick nests; and
- placing bird deterrents (e.g., porcupine wire) on towers.

The most important mitigation measure for all bird species, including species at risk, bird colonies and other VECs is that vegetation clearing should not be allowed during the nesting season. The restriction of vegetation clearing during the breeding bird season eliminates the possibility that sensitive sites, including bird nests, will not be destroyed by the operation of heavy equipment and other construction activities.

Bird diverters are recommended at sensitive sites where a higher risk of wire strikes is expected. The sites identified in Table 5-5 are areas with potentially higher risk of collision rates and require further surveys to assess the risk for bird-wire collisions. Twenty eight sensitive sites were identified within The Pas & Surrounding Area IBA, eleven of which were also found in the Tom Lamb WMA. These areas are of particular importance for a number of bird communities, including waterfowl and colonial waterbirds.

With the exception of bird colonies and bald eagle nests located elsewhere in the Project Study Area (i.e., not near the preferred route), the locations of other large stick nests that may be located along the preferred route are currently unknown. Pre-project monitoring will be conducted to locate as many of these nest types as possible, and these features will be included in the development of the Environmental Protection Plan. If a large nest is found within 300 m of the RoW it should be avoided where possible. If a nest must be removed, considerations must be made to replace large multi-generational stick nests with an alternative nesting structure such as an artificial nest.

The location of most sharp-tailed grouse leks has not yet been determined, and therefore, associated sensitive site locations have yet to be mapped. Sharp-tailed grouse population concentrations (i.e., at leks) are prone to indirect mortality because the transmission towers create perch habitat for birds of prey (e.g., red-tailed hawks). Pre-project monitoring will be conducted to locate sharp-tailed grouse leks in southern and western parts of the province. These features will be included in the development of the Environmental Protection Plan. Leks identified within 500 metres of the preferred route are anticipated to be exposed to increased predation by raptors perching on transmission towers. Perch deterrents such as porcupine wire is recommended for towers that are located within 500 metres of a lek. Raptor perch prevention is anticipated to reduce predation in these circumstances.

Where environmental sensitive sites or areas were identified, site-specific mitigation measures are outlined in Table 5-3.

Table 5-3. Potential Effects and Mitigation Measures at Environmentally Sensitive Sites (ESS) for Birds

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_001	Water reservoir	Increased density of birds feeding	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the RoW while construction disturbance can effect colonies up to 400 m away	Monitoring for bird interactions, Placement of bird diverters
Bird_002	Floodway crossing	High density of birds feeding and nesting	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Placement of bird diverters, Limit construction to winter
Bird_003	Rat River crossing	Migratory route for species at risk, raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_004	Marsh River crossing	Migratory route for species at risk, raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_005	Red River crossing	Migratory route for species at risk, raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_006	Colonies and waterfowl staging area	High density of waterfowl and colonial water birds in the area	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_008	Waterfowl staging area	RoW adjacent to waterbody likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_009	Assiniboine River crossing	Migratory route for species at risk, raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_010	Nearby Franklins gull colony	Colony to the east of the RoW, gulls likely feed in the vicinity of the RoW.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_011	Rat Creek crossing	Creek has good riparian habitat for raptors and wide enough to support waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_012	Bagot Creek crossing	Creek has good riparian habitat for raptors and wide enough to support waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_013	Whitemouth River crossing	Migratory route for species at risk, raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_014	Nearby black tern colony	Colony to the east of the RoW, gulls likely feed in the vicinity of the RoW	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_016	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_018	Waterfowl and yellow rail sensitivity area	RoW crossing a wetland likely used by waterfowl and yellow rail	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 350 meters away	Placement of bird diverters, Limit construction to winter
Bird_020	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_022	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_024	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_026	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_028	Nearby great blue heron colony	Colony to the west of the RoW, herons likely cross the RoW to forage.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_029	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_031	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_033	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_035	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_037	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_039	Lagoon	RoW crossing a lagoon likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_043	Nearby great blue heron colony	Colony to the west of the RoW, herons likely cross the RoW to forage.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_044	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_048	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_050	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_052	Cork Cliff Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_053	Mossy River crossing, nearby great blue heron colony	Movement route for raptors and waterfowl, colony to the north of the RoW, herons likely move along the river	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_054	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_056	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_058	Wellburns Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_059	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_061	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_063	Garland River crossing	Movement route for raptors and waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_066	South Pine River crossing	Movement route for raptors and waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_067	North Pine River crossing	Movement route for raptors and waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_069	Nearby great blue heron colony	Colony to the west of the RoW, herons likely cross the RoW to forage.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_071	Great blue heron feeding area	RoW crosses an area likely used by great blue herons for feeding	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_073	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_079	North Duck River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_080	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_081	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_082	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_083	Swan River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_084	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_085	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_086	Nearby great blue heron colony	Colony to the south of the RoW, herons likely cross the RoW to forage.	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_087	Woody River crossing, nearby great blue heron colony	Movement route for raptors and waterfowl, colony to the south of the RoW, herons likely to move along the river or cross the RoW to feed	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_089	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_090	Bell River Drain crossing	RoW crossing a drainage ditch likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_091	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_093	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_095	Mafeking Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_097	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_099	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_100	Waterfowl and colonial bird sensitivity area	RoW crossing an area heavily used by waterfowl and colonial birds travelling to and from lake Winnipegosis	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_103	Red Deer River Crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_105	Waterfowl and colonial bird sensitivity area	RoW crossing an area heavily used by waterfowl and colonial birds travelling to and from lake Winnipegosis	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_107	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_108	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_110	Overflowing River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_111	Large drainage ditch crossing	RoW crossing a drainage ditch likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_112	Waterfowl and sensitivity area, nearby Bonaparte's gull colony	RoW crossing a wetland likely used by waterfowl, colony to the west of the RoW, gulls likely to cross RoW to feed and to head to larger water bodies	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Placement of bird diverters, Limit construction to winter
Bird_113	Waterfowl and sensitivity area, nearby Bonaparte's gull colony	RoW crossing a wetland likely used by waterfowl, colony to the west of the RoW, gulls likely to cross RoW to feed and to head to larger water bodies	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Placement of bird diverters, Limit construction to winter
Bird_114	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_115	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_117	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_119	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_121	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_123	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_125	Ralls Creek crossing	RoW crossing a creek likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_127	Ralls Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_129	Ralls Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_130	Saskatchewan River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_132	Waterfowl and colonial bird sensitivity area	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_140	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_142	Waterfowl and colonial bird sensitivity area	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_144	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_146	Waterfowl and colonial bird sensitivity area, Little Frog Creek crossing, Frog Creek crossing	RoW crossing an area heavily used by waterfowl and colonial birds travelling between large lakes	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Placement of bird diverters, Limit construction to winter
Bird_148	Nearby great blue heron colony	Colony to the south of the RoW, herons likely cross the RoW to forage.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 1000 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_149	Nearby Bonaparte's gull colony	Colony to the north of the RoW, gulls likely cross the RoW to access Hargrave Lake.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_154	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_155	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_156	Kiski Creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_157	Waterfowl and colonial bird sensitivity area	RoW crossing an area heavily used by waterfowl and colonial birds travelling to a from Gromley Lake	High	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Placement of bird diverters, Limit construction to winter
Bird_159	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_161	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_163	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_165	Halfway River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_167	Halfway River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_169	Halfway River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_171	Patrick Creek crossing	RoW crossing a creek likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_173	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_175	Unknown creek crossing	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_177	Nearby Bonaparte's gull colony	Colony to the north of the RoW, gulls likely cross the RoW to access nearby ponds	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_179	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_181	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_183	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_187	Unknown creek crossing	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_189	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_193	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_195	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_197	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_199	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_201	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_203	Grass River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_205	Partridge Crop Lake crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Move transmission line 750 m west, Placement of bird diverters
Bird_207	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_209	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_211	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_213	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_217	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_219	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_221	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_223	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_225	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_231	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_233	Burntwood River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_235	Odei River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_237	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_239	Unknown creek crossing	RoW crossing a creek likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_241	Crying River crossing	Movement route for raptors and waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_243	North Moswakot River crossing	Movement route for raptors and waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters

Source Name	ESS	ESS Description	Degree of Risk	Environmental Effects	Mitigation Measures
Bird_245	Limestone River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_247	Limestone River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_249	Limestone River crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters
Bird_258	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_259	Waterfowl sensitivity area	RoW crossing a wetland likely used by waterfowl	Moderate	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Monitoring for bird interactions, Placement of bird diverters
Bird_260	Nearby Bonaparte's gull colony	Colony to the north of the RoW, gulls likely cross the RoW to forage.	Moderate	Higher risk of wire collision, Disturbance during breeding and nesting, Risk of wire collision is localized to the right-of-way while construction disturbance can effect colonies up to 400 meters away	Monitoring for bird interactions, Placement of bird diverters
Bird_261	AC Collector Line Limestone River Crossing	Movement route for raptors and waterfowl	High	Higher risk of wire collision, Risk of wire collision is localized to the right-of-way	Placement of bird diverters

5.2.4 Other Best Practises

Standard practices and general environmental protection measures for Manitoba Hydro projects will address most outstanding issues likely to arise during the Project. General measures to minimize the effects of such activities as temporary access trails, borrow areas, clearing of the RoW, and working in wetlands, equipment maintenance, and work site cleanup and demobilization have been discussed in other recent Manitoba Hydro *Environmental Protection Plan*s (e.g., Wuskwatim, Rosser-Silver, Glenboro). Activities such as handling and storage of fuel and other hazardous materials are regulated by law. Where Project-specific effects on birds are anticipated, detailed mitigation measures are outlined in Section 5.2.1 and 5.2.2. Best practises for protecting bird populations and their habitats include the following measures:

- Access routes:
  - Existing roads and trails should be utilized wherever possible.
  - If machinery and vehicle traffic must use route other than the RoW or existing roads or trails, the temporary access route should be kept to a minimum and located away from sensitive sites. The Natural Resource Officer must approve a temporary route before it is cleared.
  - Temporary access routes should be minimized during construction of access roads. Snow should be compacted and levelled rather than pushing it and organic material aside.
  - Buffer zones must be maintained between construction areas and natural water bodies.
  - If sensitive sites or areas of concern are found during clearing of a temporary access route, the Field Supervisor must be notified. New sensitive sites might include large stick nests.
  - Helicopter landing pads should be located within the RoW as much as possible and away from sensitive sites.
  - When access routes are no longer needed, they should be rehabilitated. When a construction season is finished and an access route is required for use in the future, it should be left in stable condition. Steps should be taken to limit public access to these routes.
  - Debris and felled trees should not be pushed into standing timber.
- Borrow pits:
  - Obtain borrow pit approval and work permit from Manitoba Conservation and make sure all permit conditions are met.
  - The borrow pit should be located as close to the existing access as possible.
  - A vegetated barrier should be left between the access route and the borrow pit to help prevent soil erosion and also to help enhance wildlife habitat.
  - The borrow pit must be located more than 100 m away from the high-water mark of water bodies.

  - The vegetation and top soil stripped from the borrow pit is to be stockpiled for later use in reclaiming the area.
  - Once a borrow pit is no longer required, the pit must be re-contoured to create stable slopes. Stockpiled slash and soil should be spread over the area to promote the re-establishment of vegetation. The area should be restored to as close to the original state as possible.
  - Waste/garbage is not to be buried in the pit during reclamation activities.

- Mechanical clearing of the RoW:
  - Centre and boundary lines must be flagged prior to commencement of initial clearing work. Areas identified for selective clearing (e.g., buffer zones, sensitive sites) must be accurately flagged and appropriate mitigation measures must be identified and applied.
  - Clearing equipment must use "V" or "K-G" blades for clearing. Straight "bulldozer" blades must not be used.
  - Clearing by mulching and mechanized forestry equipment may also be considered.
  - If new sensitive sites or areas of concern are found during clearing, the Field Supervisor must be notified. New sensitive sites might include trees containing large stick nests.
  - The slash from the RoW must be cut, piled, burned or disposed of as specified in the Work Permit. Debris and brush must not be pushed into standing timber.
  - Access to the clearing area should utilize existing roads and trails as much as possible.

- Marshalling yards:
  - Both permanent and any temporary marshalling yards should be located 300 m away from known sensitive features such as raptor nests.
  - The amount of clearing should be minimized by using natural forest openings.
  - If the organic cover and topsoil is removed during clearing, it must be stockpiled so that it can be used later to reclaim the area.
  - If new sensitive sites are discovered during site preparation, the Field Supervisor must be notified immediately.
  - All potential contaminants should be stored in a manner that will maximize containment in the event of spills.

- Working in and around wetlands:
  - Project activities should avoid wetland areas as they are considered sensitive sites for wildlife. If avoidance is not an option, minimize disturbance and follow applicable guidelines listed below.
  - Natural buffers must be maintained around wetlands and riparian zones.
  - Where possible, the timing of work around wetlands should be planned to avoid critical nesting periods (spring/early summer).
  - Keep clearing and construction debris/waste out of wetland and riparian zones.
  - Structure placement should be planned to avoid wetland sites. If avoidance is not an option, use of CCA treated poles or steel/concrete structures must be used.

- Any dewatering of excavations or alterations to drainage should be done so that it avoids entering the natural water system.
- Although beaver dams can be a nuisance, they create valuable wildlife and aquatic habitat for many species. When possible, work with local area trappers and consult the current Department of Fisheries and Oceans operational statement for Beaver Dam Removal.

- Equipment maintenance:
  - All equipment must arrive on site in clean condition free from fluid leaks and weed seeds. All equipment should be inspected and maintained on a regular schedule to help prevent any harmful incidents on the Project.
  - A specific site should be chosen to conduct equipment maintenance and repairs. This site must be located a minimum of 100 m from any lake, river or stream.
  - Storage of petroleum products as well as refuelling sites should be a minimum of 100 m away from any lake, river, or stream.
  - Ensure there is an appropriate spill kit(s) available at the Project site – including at equipment service and fuel storage sites.
  - While equipment is being serviced, catchment trays and/or other methods (tarps) should be used so that used oils can be contained and disposed of at an approved site. Welding mats should be utilized to prevent potential forest fires during the fire season of April 1 to November 15 of each year.
  - Wash/clean equipment on roads or other appropriate sites when possible and at least 100 m from lakes, rivers or streams.
- Handling and use of petroleum products:
  - All petroleum products must be transported/handled in accordance with the Manitoba Provincial Dangerous Goods Handling and Transportation Act. All slip tanks and barrels must be securely fastened to the vehicle during transport and refuelling operation.
  - All petroleum products must have correct placards and labelling and stored and handled in accordance with Manitoba Regulation 188/2001 respecting Storage and Handling of Petroleum Products and Allied Products.
  - Storage of petroleum products must be located a minimum of 100 m from any lake, river or stream.
  - Ensure there is an appropriate spill kit(s) available at the Project site – including at equipment service and fuel storage sites.
  - The transportation of dangerous goods must be in accordance with the Hazardous Materials Management Handbook.
- Work site cleanup and demobilization:
  - The work site must be kept tidy at all times. Work and personal waste must be collected for proper disposal. Garbage must be removed regularly to an approved site so that wildlife is not attracted to work sites.

  - Tool, surplus and waste materials, rubbish, and debris must be removed from the work site once work has been completed.
  - Burning and slash disposal must be carried out as stipulated in the Work Permits.
  - All stream crossings and drainages should be free of obstructions so as not to impede spring runoff.
  - Temporary facilities must be removed from the Project.
  - A final inspection should be conducted with a Natural Resource Officer.
- Pesticide use:
  - Manitoba Hydro's Forestry Section must obtain a Pesticide Use Permit (PUP) that includes the Project.
  - Conditions on the Work Permit and PUP permits must be followed closely.
  - The person(s) using pesticides must possess a valid applicators license in order to use herbicides and insecticides (not wood preservatives).
  - The applicator must understand emergency response, and a spill response kit must be readily available on site.
  - Store pesticides 100 m from water bodies and a safe location as reasonably practicable from other sensitive areas.
  - Thirty metre buffer zones must be flagged around water bodies.
- Handling treated wood:
  - Avoid using treated poles and other wood products where they may come into contact with potable water supplies.
  - Where practical, avoid the use of treated poles and other treated wood products in or near aquatic environments. If avoidance is not possible, use chromated copper arsenate (CCA) treated wood.
  - Deliver treated wood to structure locations or construction sites as required in order to reduce storage time in the field.
  - Wherever possible maintain treated wood in service, or encourage re-use.
  - Surplus or unwanted treated wood products may be disposed of as domestic waste products in small quantities at an approved landfill site.
  - Salvage and disposal of treated wood products must be in accordance with Corporate Policies and Procedures on salvaging material.
  - Burning of treated wood is prohibited – regardless of age of the product.
- Waste management:
  - All applicable laws, regulations, and standards for the safe use, handling storage and disposal will be followed.
  - Indiscriminate burning, dumping, littering, or abandonment of garbage is not to occur. Any burning is to follow conditions specified in the Work Permit.

- o All garbage/waste (construction, domestic, and sewage) is to be collected on a regular basis and disposed of at approved refuse sites. This will help to eliminate nuisance wildlife incidents.
- o Waste oils and other petroleum products are not to be used for burning brush piles.
- o All work sites are to be kept tidy at all stages of the Project including operation and maintenance.

- Handling and use of explosives:
  - o Compliance with the federal Explosives Act and The Workplace Safety and Health and Dangerous Goods Handling and Transportation Acts of Manitoba is mandatory.
  - o Blasting is encouraged to take place in winter months in an effort to prevent permafrost degradation as well as to avoid sensitive breeding and brooding periods (April 1 to July 31) for wildlife species.
  - o Waste and debris resulting from the use of explosives must be cleaned up in timely fashion and disposed of at appropriate sites.
  - o Site remediation must occur as soon as possible after the blast. Materials and debris that enter nearby waters shall be removed immediately. Surplus excavated soils will be disposed of at approved sites.

5.3 RESIDUAL EFFECTS ON VALUED ENVIRONMENTAL COMPONENTS

During the route selection process three route alternatives with a number of interconnections were assessed in order to determine which alternative would have the fewest effects on bird populations and their habitats. This included the selection of a route that avoided wildlife management areas, ecological reserves, provincial parks, provincial forests, Ducks Unlimited Canada hotspots, Important Bird Areas, and areas with high paired density values, where possible. Where it was not possible to avoid these features (e.g., Important Bird Area located near The Pas) routes were selected to minimize potential effects on bird populations, by following pre-existing linear features or developments wherever possible. The final preferred route that was assessed for residual effects had the lowest potential effects on bird populations and their habitats.

Although the effects assessment is summarized below using a VEC-based approach, the effects assessment took a precautionary approach considering all potential effects. Where insufficient corroborative data were not available to reduce the level of uncertainty to a low level (e.g., in the case of some species at risk, or other sparse species being considered for listing such as bobolink, chestnut-collared longspur and horned grebe) which were not VECs, an effects assessment was still conducted.

After mitigation, the Bipole III Project is not expected to have significant adverse residual effects on bird populations or their habitats. Potential long-term residual effects include the following:

- small decrease in productivity to some local bird populations due to brood parasitism by brown-headed cowbird and possibly by opportunistic invasive species such as blue jay and American crow, which are known to occasionally consume eggs or young;
- small alteration of habitat and its use by birds along the HVdc, AC and distribution line RoWs, borrow areas, and the electrode sites, and a small loss of habitat at the base of towers, at the Keewatinoow converter station and Riel converter station;
- small increases to nesting and foraging opportunities for some bird species, and small decreases of nesting and foraging opportunities for other bird species;
- sensory disturbances resulting in temporary displacement into alternate habitats for local birds; and
- small decrease in local movements of some bird species across the RoW mainly along the AC collector lines RoW, and limited to the breeding season.

Such effects will be evident during the construction and operation phases of the Project. While listed residual effects are largely reversible based on decommissioning of Project components, there is a small risk that listed species may be irreversibly affected by the Project if appropriate mitigation measures are not applied, or if recovery actions for listed species are not implemented successfully. However, residual effects are expected to only of small magnitude following the application of appropriate mitigation measures.

Residual effects include decreased productivity, habitat loss or alteration, and habitat avoidance due to sensory disturbance. Residual effects are expected to affect bird species in the Local Study Area. Following required mitigation measures, the restriction of clearing, construction, operation, and maintenance activities during nesting season, from approximately April to the end of July, along the length of the Project route, will eliminate or minimize residual effects. A summary of the residual effects of the Bipole III Project are outlined in Table 5-4 and Appendix F, Table F-20 which indicates the significance of residual effects on bird VECs.

5.3.1 Mallard

Mallard is a common species that is recognized as resilient to environmental changes. Mallard is of moderate ecological importance due it is role as an indicator species for varied wetland habitat areas. These populations are important for domestic resource use and licensed hunting; their societal importance is high.

Residual effects on mallard due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities at the aforementioned locations and the Riel Converter Station, and will act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the converter stations. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on mallard are anticipated.

5.3.2 Sandhill Crane

Sandhill crane is a common species that is recognized as resilient to environmental changes. Sandhill crane is of low ecological importance and of moderate societal importance.

Residual effects on sandhill crane due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the Keewatinoow Converter Station. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on sandhill crane are anticipated.

5.3.3 Great Blue Heron

Great blue heron is a common that which is recognized as resilient to environmental changes. Great blue heron is of moderate ecological importance and of high societal importance due to its general cultural significance and restrictions around construction where great blue heron colonies are located.

Residual effects on great blue heron due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on great blue heron are anticipated.

5.3.4 Bald Eagle

Bald eagle is a common species that is recognized as somewhat resilient to environmental changes. Bald eagle is of moderate ecological importance due to its role as an indicator for various habitat types and its role as an apex avian predator. Bald eagle has a high societal value based on its role in traditional aboriginal culture and due to restrictions on clearing of land in immediate vicinity to eagles' nests.

Residual effects on bald eagle due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the Keewatinoow Converter Station. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on bald eagle are anticipated.

5.3.5 Sharp-tailed Grouse

Sharp-tailed grouse is common and relatively resilient to environmental changes. Sharp-tailed grouse is of high ecological importance due it is role as a VEC and tendency to form population clusters. These populations are important for domestic resource use and licensed hunting; thus their societal importance is high.

Residual effects on sharp-tailed grouse due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the Keewatinoow Converter Station. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on sharp-tailed grouse are anticipated.

5.3.6 Ruffed Grouse

Ruffed grouse is common and relatively resilient to environmental changes. Ruffed grouse is of moderate ecological importance due it is role as a potential indicator for various habitat types. These populations are important for domestic resource use and licensed hunting; thus their societal importance is high.

Residual effects on ruffed grouse due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on ruffed grouse are anticipated.

5.3.7 Pileated Woodpecker

Within Manitoba, pileated woodpecker is relatively common and considered resilient to environmental changes. Pileated woodpecker is of high ecological importance as it often creates habitat for other bird species. Their societal importance is low.

Residual effects on pileated woodpecker due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. Habitat loss will be primarily due to the removal of dead standing trees. During construction, habitat loss or alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat loss or alteration will occur due to vegetation maintenance on the RoWs. Where dead standing trees are removed, potential nesting habitat will be lost. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning; assuming species population trends remain stable. As a result, no significant Project-related residual effects on pileated woodpecker are anticipated.

5.3.8 Least Bittern

Least bittern is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on least bittern due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on least bittern are anticipated.

5.3.9 Yellow Rail

Yellow rail is listed as special concern under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on yellow rail due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on yellow rail are anticipated.

5.3.10 Ferruginous Hawk

Ferruginous hawk is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on ferruginous hawk due to Bipole III development will include habitat alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, transmission towers could increase perching and foraging opportunities. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Overall residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on ferruginous hawk are anticipated.

5.3.11 Burrowing Owl

Burrowing owl is listed as endangered under SARA and MESA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on burrowing owl due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on burrowing owl are anticipated.

5.3.12 Short-eared Owl

Short-eared owl is listed as special concern under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on least bittern due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on short-eared owl are anticipated.

5.3.13 Common Nighthawk

Common nighthawk is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on common nighthawk due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Some foraging and nesting opportunities could be created by open areas on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the Keewatinoow Converter Station. Overall residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on common nighthawk are anticipated.

5.3.14 Whip-poor-will

Whip-poor-will is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on whip-poor-will due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line and AC collector lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the HVdc transmission line and AC collector line RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on whip-poor-will are anticipated.

5.3.15 Red-headed Woodpecker

Red-headed woodpecker is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on red-headed woodpecker due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will be primarily due to the removal of dead standing trees. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat loss or alteration will occur due to vegetation maintenance on the RoWs. Where dead standing trees are removed, potential nesting habitat will be lost. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on red-headed woodpecker are anticipated.

5.3.16 Olive-sided Flycatcher

Olive-sided flycatcher is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on olive-sided flycatcher due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and the Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the Keewatinoow Converter Station. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on olive-sided flycatcher are anticipated.

5.3.17 Loggerhead Shrike

Loggerhead shrike is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on loggerhead shrike due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on loggerhead shrike are anticipated.

5.3.18 Sprague's Pipit

Sprague's pipit is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on Sprague's pipit due to Bipole III development will include slightly decreased productivity, habitat loss and alteration, and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, and ground electrodes and lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, Sprague's pipit productivity could decrease due to brood parasitism by brown-headed cowbirds. Habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on Sprague's pipit are anticipated.

5.3.19 Golden-winged Warbler

Golden-winged warbler is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on golden-winged warbler due to Bipole III development will include slightly decreased productivity, habitat loss and alteration, and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line and AC collector lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, golden-winged warbler productivity could decrease due to brood parasitism by brown-headed cowbirds. Habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on golden-winged warbler are anticipated.

5.3.20 Canada Warbler

Canada warbler is listed as threatened under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on Canada warbler due to Bipole III development will include slightly decreased productivity, habitat loss and alteration, and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line and AC collector lines. Habitat loss will occur at the tower footprints. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, Canada warbler productivity could decrease due to brood parasitism by brown-headed cowbirds. Habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on Canada warbler are anticipated.

5.3.21 Rusty Blackbird

Rusty blackbird is listed as special concern under SARA. As a listed species, its ecological and societal importance is high, and will continue to be treated as such until this species is delisted.

Residual effects on rusty blackbird due to Bipole III development will include habitat loss and alteration and habitat avoidance due to sensory disturbance. During construction, habitat alteration will mainly be on the HVdc transmission line, AC collector lines, ground electrodes and lines, and at borrow areas. Habitat loss will occur at the tower footprints and Keewatinoow Converter Station. Sensory disturbance will occur due to construction activities and act to discourage habitat use in the Local Study Area. Residual effects during construction will be negative, small magnitude, limited to the Local Study Area, short-term, and regular or continuous.

During operation, habitat alteration will occur due to vegetation maintenance on the RoWs. Sensory disturbance during maintenance activities will likely result in temporary habitat avoidance, however line maintenance will occur once per year at any given location, and vegetation management will likely occur less frequently, depending on the area. Habitat avoidance from sensory disturbances associated with human or mechanical activity will likely occur at the

Keewatinoow Converter Station. Residual effects during operation will be negative, small magnitude, limited to the Local Study Area, long-term, and sporadic or intermittent.

Residual effects will be reversible upon Project decommissioning, assuming that population trends are stabilized or increase as a result of federal recovery action plans. As a result, no significant Project-related residual effects on rusty blackbird are anticipated.

Table 5-4. Summary of Residual Effects on Bird Valued Environmental Components

VEC	Project Component	Potential Residual Effect	Phase	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Residual Effect
Waterfowl and Other Waterbird VECs												
Mallard	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas[8]	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Riel Converter Station	Habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Ground Electrodes and Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Sandhill crane	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Low	Moderate	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Low	Moderate	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Low	Moderate	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Low	Moderate	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Low	Moderate	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Low	Moderate	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Low	Moderate	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Low	Moderate	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Colonial waterbird VECs												
Great blue heron	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Bird of Prey VECs												
Bald eagle	HVdc Transmission Line and AC Collector Lines	Habitat alteration in the RoWs, including increased nesting habitat, perches and foraging opportunities; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negligible	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
Bald eagle			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant

[8] Includes excavated material disposal (EMD) sites.

VEC	Project Component	Potential Residual Effect	Phase	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Residual Effect
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Upland Game Bird VECs												
Sharp-tailed grouse	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance and disruption of daily movements near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Ruffed grouse	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance and disruption of daily movements near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negligible	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	Moderate	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	Moderate	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Woodpecker VECs												
Pileated woodpecker	HVdc Transmission Line and AC Collector Lines	Habitat loss and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	Low	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	Low	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	Low	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	Low	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Species at Risk VECs												
Least bittern	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Least bittern	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant

VEC	Project Component	Potential Residual Effect	Phase	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Residual Effect
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Yellow rail	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Ferruginous hawk	HVdc Transmission Line and AC Collector Lines	Habitat alteration in the RoWs, including increased habitat for perches and foraging opportunities; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Burrowing owl	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Short-eared owl	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Common nighthawk	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study	Long-	Sporadic/Intermittent	Reversible	Not

VEC	Project Component	Potential Residual Effect	Phase	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Residual Effect
								Area	term			Significant
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Whip-poor-will	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrode and Lines	No Project effect	Construction									
			Operation									
Red-headed woodpecker	HVdc Transmission Line and AC Collector Lines	Habitat loss and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Olive-sided flycatcher	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Regular/Continuous	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Regular/Continuous	Reversible	Not Significant
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Loggerhead shrike	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Sprague's pipit	HVdc Transmission Line and AC Collector Lines	Decreased productivity and mortality from brood parasitism by brown-headed cowbirds; habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study	Long-	Sporadic/Intermittent	Reversible	Not

VEC	Project Component	Potential Residual Effect	Phase	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Residual Effect
								Area	term			Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Golden-winged warbler	HVdc Transmission Line and AC Collector Lines	Decreased productivity and mortality from brood parasitism by brown-headed cowbirds; habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negligible	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	No Project effect	Construction									
			Operation									
Canada warbler	HVdc Transmission Line and AC Collector Lines	Decreased productivity and mortality from brood parasitism by brown-headed cowbirds; habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	No Project effect	Construction									
			Operation									
	Borrow Areas	No Project effect	Construction									
			Operation									
	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	No Project effect	Construction									
			Operation									
Rusty blackbird	HVdc Transmission Line and AC Collector Lines	Habitat loss primarily at tower footprints and habitat alteration in the RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Keewatinoow Converter Station	Habitat loss at footprints; habitat avoidance near infrastructure from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
	Borrow Areas	Habitat alteration at footprints; habitat avoidance from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant
Rusty blackbird	Riel Converter Station	No Project effect	Construction									
			Operation									
	Ground Electrodes and Lines	Habitat alteration in the footprint and RoWs; fragmentation effects in sensitive areas including habitat avoidance near the RoWs from sensory disturbances associated with human or mechanical activity.	Construction	Negative	High	High	Small	Local Study Area	Short-term	Regular/Continuous	Reversible	Not Significant
			Operation	Negative	High	High	Small	Local Study Area	Long-term	Sporadic/Intermittent	Reversible	Not Significant

5.4 FOLLOW-UP/MONITORING

In order to determine the long-term effects of the Project on birds, the effectiveness of mitigation measures, and where there is higher uncertainty in predicting Project effects, follow-up monitoring will be required. Manitoba Hydro is responsible for ensuring that the mitigation measures prescribed in this report are implemented and verified through follow-up inspections, monitoring, and reporting. Recommended follow-up includes monitoring of species at risk populations, assessment of bird-wire collisions, evaluations of the persistence of sharp-tailed grouse leks, and monitoring of previously identified bird colonies in proximity to the RoW.

Manitoba hydro will monitor threatened and endangered species occurrences at locations where species at risk were observed, or where they may be found during the construction of the HVdc and AC transmission lines. This includes monitoring for bobolink, chestnut-collared longspur, and other species if their status is scheduled or changed. It is recognized that although no significant effects from Bipole III development are expected with mitigation, failure to follow proposed mitigation measures could lead to large and potentially irreversible effects on species at risk.

Pre-project monitoring surveys and nest searches are required in areas where summer construction is anticipated. Evaluation of the effectiveness of buffer zones and set-back distances for species at risk will be assessed where construction occurs during the nesting season. If suggested sizes of buffer zones or set-back distances are determined to be inadequate if measureable effects are found, or where unanticipated effects have occurred, adaptive management will be employed to modify their sizes to eliminate any nest abandonment and to minimize potential effects to fledging success.

Limited increases in local traffic to and from construction sites in southern Manitoba, and low vehicle speeds along the RoW are expected to result in very few bird injuries or mortalities in the Local Study Area. As there is some level of uncertainty regarding this effects prediction due to the paucity of data, and especially as there is a higher risk to potentially affecting Species at Risk populations as noted in numerous reports, Manitoba Hydro will monitor and report vehicle-bird collisions during the construction and operation period. Although substantial effects are unlikely to occur, if bird-vehicle collisions are more frequent than anticipated, Manitoba Hydro will use adaptive management to minimize these effects by potentially applying vehicle speed restrictions along RoWs and as may be necessary, further educating contractors and employees on means to avoid and minimize bird-vehicle collisions.

Very limited numbers of bird-wire collisions are anticipated for this Project, especially where bird deflectors are installed at sensitive sites. However, as there is a paucity of data for Manitoba, and as there is some level of uncertainty with the effects predictions, Manitoba Hydro will monitor and report the number of bird-wire collisions associated with the Project. Searches for dead or injured birds will be performed to determine the efficacy of this mitigation method in higher risk-of-collision habitats (e.g., near great blue heron colonies, Bonaparte's gull colonies). Similar searches are required at sites where effects were not anticipated. If unanticipated effects are encountered such as high numbers of bird-wire strikes, and especially if species at risk are involved even at low numbers detected, Manitoba Hydro will take remedial actions including the placement of bird deflectors at these unanticipated bird mortality sites.

Although highly unlikely to occur with this Project, Manitoba Hydro will report all unanticipated bird electrocutions associated with this Project. If problem areas are identified, Manitoba Hydro will apply corrective actions such as the placement of perch guards, particularly in areas if, and where, species at risk are involved, to prevent future occurrences.

Sharp-tailed grouse are particularly vulnerable to bird-wire strikes and to increased rates of predation near leks where birds of prey use elevated perches such as transmission line towers near the lek to hunt birds. As there is some uncertainty concerning the effects predictions, and where there is uncertainty as to the proximity of sharp-tailed grouse leks to the HVdc transmission line, pre-project monitoring is required. Existing lek locations are needed to implement mitigation measures recommended, such as: 1) the placement of bird perch deterrents (e.g., porcupine wire or triangles) to discourage birds of prey from perching over and hunting at these leks; and 2) locate bird deflectors to minimize bird-wire collisions at these sites. Manitoba Hydro will conduct monitoring during operations to evaluate and report on the efficacy of these prevention measures. Where deterrents or perch guards were not used, Manitoba Hydro will report any mortality. If unanticipated effects are encountered such as high numbers of bird-wire strikes, and/or where large numbers of grouse have been predated, Manitoba Hydro will take remedial actions including the placement of bird deflectors and/or perch guards at these bird mortality sites.

Follow-up monitoring will be required in event of a serious accident or malfunction that involves petrochemicals. Where emergency responses were not effective in containing spills and birds become contaminated with oil or other potentially hazardous chemicals, Manitoba Hydro will monitor and report the extent of these effects.

Finally, if an accidental fire occurs as a result of the Project, Manitoba Hydro will monitor and report the extent of these effects to bird populations in the area.

5.5 CUMULATIVE EFFECTS

The conservation of bird species has a demonstrated importance in maintaining biodiversity and ecosystem function. Other than the maintenance of bird species for aesthetic reasons, bird species play an important role as seed dispersers, pollinators, game species, and insect predators (Sekercioglu 2006). Worldwide, the rate of bird species extinctions is largely unprecedented and is worsened by human activities including habitat loss and alteration (particularly deforestation), climate change, and introduced species (Butchart *et al*. 2006; Pimm *et al.* 2006).

During the route selection process three route alternatives with a number of interconnections were assessed in order to determine which alternative would have the fewest effects on bird populations and their habitats. This included the selection of a route that avoided wildlife management areas, ecological reserves, provincial parks, provincial forests, Ducks Unlimited hotspots, Important Bird

Areas, Protected Areas Initiatives, and areas with high paired density values, where possible. Where it was not possible to avoid these features (e.g., Important Bird Area located near The Pas) routes were selected to minimize potential effects on bird populations, by following pre-existing linear features or developments wherever possible. The final preferred route that was assessed for residual effects had the lowest potential cumulative effects on bird populations and their habitats.

When assessed against other development in Manitoba, and as described geographically in the context of ecoregions, the residual effects of the Project are not expected to be measurable, and should remain within the natural range of variation over the long-term (30 years). As such, it is highly likely that cumulative effects are anticipated to be negligible as a result of the Bipole III Project. Common bird species with robust populations are expected to remain numerous in the Project Study Area while bird species in decline may continue to decline, unless initiatives such as federal recovery plans are successfully implemented, and these declining trends can be reversed.

Many environmental factors may play a role in affecting bird species communities alongside the development of the Bipole III transmission line. These factors could include the association of various anthropogenic practices including farming, forestry and other forms of landscape development including the building of roads, clearing of land, the development of hydro-electric generating stations etc. More naturally induced changes to bird communities could alternately take place through environmental drivers including forest fires, flooding, insect outbreaks, and climate change. For a detailed assessment of potential changes to habitat and food supply, refer to the *Bipole III Mammals Technical Report* and *Bipole III Terrestrial Invertebrates, Amphibians, and Reptiles Technical Report*.

Due to the uncertainty of climate change it is difficult to predict its role in cumulative effects on bird species; however a number of potential effects can be identified. Changes in predictable climate patterns may result in earlier breeding and egg laying (Price and Glick 2002, BirdLife International 2004). Other changes in bird behaviour that are linked to environmental cues may also occur, particularly for birds with long migrations that may respond to a cue in the south and find they are returning to the summering grounds too early (Price and Glick 2002, BirdLife International 2004). Increases in global temperatures are also predicted to result in the northern expansion of bird ranges. A warming climate could result in fewer wetlands holding water, and drought could be more frequent and of longer duration, while in the boreal forest, permafrost thawing could cause wetland drying in some regions (Andrews *et al*. 2008), affecting habitat for waterfowl and other waterbirds. Finally, changes in climate may cause disruption of ecological communities resulting in new predators, competitors, and prey to which a species has not adapted to (Price and Glick 2002, BirdLife International 2004). It is important that ongoing consideration be given to the effects of climate change, for if climate change trends continue, the effects are highly likely to substantially alter the future environment for bird species. As there is limited discussion and treatment of climate change in this report, refer to (Sullivan *et al.* 2011) for a detailed discussion.

Due to the diversity of Manitoba's ecology, particularly related to longitudinal change, the primary drivers influencing bird communities will vary by ecoregion. The following assessment examines how both anthropogenic and natural factors alongside the development of Bipole III could affect avian VECs.

5.5.1 Ecoregion Based Cumulative Effects

5.5.1.1 Lake Manitoba Plain

The Lake Manitoba Plain Ecoregion can be characterized as one of the major agricultural regions in the province. It is dominated by private land. Consequently, considerable forest, grassland, and wetland bird habitat has been converted into arable land, resulting in decreased nesting and feeding habitat for a variety of bird species (Askins 1994; Hamer *et al.* 2006). Registered private land woodlots are found throughout the central and southern portion of the ecoregion. They are managed for various objectives including timber production, wildlife habitat enhancement, and aesthetic purposes. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

In addition to agriculture, other activities occurring in the ecoregion that may influence bird communities include small amounts of mining and forestry. Gypsum mining occurs in the area around Amaranth and Harcus and results in some loss of habitat specific to ongoing mining activities. Louisiana-Pacific's Forest Management License overlaps the northern portion of the Lake Manitoba Plain Ecoregion and may result in some loss of habitat and increases in fragmentation (van Dorp and Opdam 1987) and hunter access along roads. These impacts are often mitigated through such processes as the decommissioning of access roads and provincial regulations around the use of access roads as well as off-season and over-limit hunting.

Other regional concerns may include waterbird by-catch from commercial fishing operations. Although Lake Manitoba is primarily a winter fishery, with some summer production for carp and suckers, there is a summer fishery on Lake Winnipegosis. Although there is little recent information on the potential effects of accidental mortality resulting from waterbirds becoming entangled and drowning in nets, this type of accidental mortality could be a contributing factor to the population decline of horned grebe (COSEWIC 2009d).

Finally, the Lake Manitoba Plain Ecoregion is the most heavily populated ecoregion in the Project Study Area. This has resulted in a large amount of linear features, including roads, transmission corridors, and rail lines, and other anthropogenic features on the landscape, and a corresponding loss in habitat (Fopper *et al.* 1994; Reijnen *et al.* 1995). Associated with the development of roads and transmission lines there is also a higher risk of bird-vehicle (Loos and Kerlinger 1993) and bird-wire collisions (Nobel 1995; Brown and Drewien 1995), respectively. Another effect related to human settlement is the management of fires to minimize the damage on infrastructure, and this has caused additional ecosystem-level changes.

5.5.1.2 Interlake Plain

The Interlake Plain Ecoregion consists of a northern region in proximity to Swan River and a small region east of Winnipeg within the Project Study Area. The small region east of Winnipeg should be considered as facing similar residual effects on the Lake Manitoba Plain Ecoregion due its close proximity to urban and rural centres as well as major agricultural developments. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

The Interlake Plain Ecoregion area, in the vicinity of Swan River, contains the northern limit of concentrated agriculture and the gradual conversion of smaller farms with many landholders to fewer larger farms Agriculture and Agri-food Canada – Agri-Environment Services Branch (AESB) with Manitoba Agriculture Food and Rural Initiatives (MAFRI) 2009). Large-scale intensive agriculture has the potential to create homogenous environments unsuitable to many bird species; particularly in the application of herbicides and fungicides (AESB and MAFRI 2009) to decrease small mammal and invertebrate populations (Smith and Lomolino 2004). There is also a considerable quantity of pasture and grassland habitat in the area east of Duck Mountain Provincial Park (AESB and MAFRI 2009).

Current land cover information for the area of the Interlake Plain Ecoregion east of Duck Mountain identified the existence of deciduous, mixedwood and coniferous forest habitats as existing in an approximate 5:2:1 ratio (based on 2006 information) (AESB and MAFRI 2009). Some loss of forests has occurred from 2002 to 2006 through the conversion of these areas to pasture areas as well as through logging practices (AESB and MAFRI 2009); mostly ongoing in the northern portion of this ecoregion by Louisiana-Pacific. It has been indicated that in the southern portion of the ecoregion, near Swan River, some wetland habitat has also been lost through conversion to pasture areas (AESB and MAFRI 2009).

The development of infrastructure related to human settlement in this ecoregion, including the construction of roads and transmission lines, could be considered to have had a deleterious effect on bird species. Related to the presence of roads is the increased chance of bird-vehicle collision in causing bird mortalities (Loos and Kerlinger 1993). There is also a high-voltage transmission line bisecting the area on a north-south axis which results in increased bird-wire collisions (Brown and Drewien 1995; Nobel 1995). The suppression of fires near settlements and developed infrastructure is also important in changing the suitability of available habitat for bird species; some of which thrive on more natural fire cycles (Vierling *et al.* 2008).

5.5.1.3 Mid-Boreal Lowland

Forest harvesting is ongoing in the Mid-Boreal Lowland Ecoregion by Tolko Industries and can be considered to effect species diversity through the creation of cutblocks and where the loss or alteration of habitat is expected to be ongoing (van Dorp and Opdam 1987). Many of these impacts are mitigated as outlined sustainable forest practises and Forest Managements Plan agreed on jointly by Manitoba Conservation and forestry companies. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

Road and rail corridors centred out of The Pas facilitate ongoing travel and shipment of resources into southern Manitoba and are often used and contribute to habitat alteration in the creation of edge-habitat suitable only to certain species (Foppen and Reijnen 1994; Reijnen *et al.* 1995). Modification of the landscape has also taken place through ongoing Manitoba Hydro development and maintenance of multiple 230 kV transmission lines running in proximity to The Pas where a number of roadways are present (van Dorp and Opdan 1987). Roadways serve to increase the rate of bird-vehicle collisions (Loos and Kerlinger 1993) with transmission lines increasing the rate of bird-wire collisions (Brown and Drewien 1995; Nobel 1995); both of which result in some losses to bird species populations.

In the construction of various linear features on the landscape and the growth of communities is the possibility for increased use of wildlife resources. The increased interaction of people with bird species can have varying effects, some of which are the subject of regulation in regards to the piloting of motorized vehicles in certain areas and restrictions on the hunting of certain species. The potential for forest fires also exists in the Mid-Boreal Lowland Ecoregion where large tracts of forests can precipitate forest fires which lead to a level of landscape disturbance and alter the suitability of habitat to avian species (Vierling *et al.* 2008).

5.5.1.4 Churchill River Upland

Some ongoing alteration of the Churchill River Upland Ecoregion occurs through forestry activities, by Tolko Industries, and mining, by HudBay Mineral Inc. The development of infrastructure related to these projects has altered the landscape through the creation of varied cutblocks and mining sites. Within this ecoregion, active copper and zinc mines are still present at Flin Flon and Snow Lake and will continue to affect bird species diversity as long as they are ongoing. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

The presence of roads and transmission lines associated with settlement of communities in the Churchill River Upland, such as Flin Flon and Snow Lake, and for the shipment of resources west and south has created habitat suitable for some species and changed the viability of habitat for others (Foppen and Reijnen 1994; Kroodsma 1994; Reijnen *et al.* 1995). The presence of roads and transmission line RoWs has the potential to increase hunter and recreational user access to areas which could in turn disrupt or displace avian species. The presence of roads and transmission lines can also precipitate increased bird mortalities through bird-vehicle (Loos and Kerlinger 1993) and bird-wire collisions (Chasko and Gates 1992; Nobel 1995), respectively.

Manitoba Hydro control structures in this ecoregion includes Notigi , which regulates flow of the Rat River into the Burntwood-Nelson system (Manitoba Hydro 2011b). The impact of these projects on avian species has been described elsewhere and various mitigation measures have been proposed in reducing residual effects.

The potential for forest fires also exists in the Churchill River Upland where large tracts of forests can precipitate forest fires and lead to levels of habitat loss and alteration. Such an instance occurred in the summer of 2010 where a fire in proximity to Cranberry-Portage affected an area of approximately 52,000 hectares; reducing the amount of usable habitat to forest bird species but also creating potential habitat for others (Schiek and Hobson 2000).

5.5.1.5 Hayes River Upland

The Hayes River Upland Ecoregion can be characterized as having a substantial level of landscape alteration through anthropogenic related infrastructure projects. Of note, ongoing forestry, by Tolko Industries, alters habitat suitability through cut blocks and the development of access roads. Mining by HudBay Mineral Inc. for nickel and copper out of Thompson and by Crowflight Minerals Inc. for nickel out of Wabowden have also served to alter the native landscape and its use by bird species and will continue to for as long as these processes are ongoing. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

City expansion is associated with population growth in Thompson as it is becoming a regional centre. This has resulted in habitat changes through the clearing of land and development of infrastructure such as roads, transmission lines, trails, a rail line, etc. While some care is often taken to minimize landscape fragmentation through the building of roads and transmission lines alongside one another, it is still expected that some residual effects from these projects exist such as increased bird-vehicle (Loos and Kerlinger 1993) and bird-wire collisions (Chasko and Gates 1992; Nobel 1995).

Construction and development of generating stations in the Hayes River Ecoregion has also contributed to alteration of the landscape through the development of related infrastructure and through flooding once projects have been put into operation. Current generating stations include Jenpeg (135 MW), Kelsey (250 MW with potential for 464 MW), and Kettle (1,220 MW); the proposed Keeyask generating station (965 MW) is under review, and Wuskwatim Generation Project (200 MW) is currently under construction (Manitoba Hydro 2011b). The incorporation of new and existing transmission lines associated with these projects, as well as related converter stations, will further alter habitat and its suitability for varied bird species and contribute to overall level of landscape fragmentation in this ecoregion (Kroodsma 1994), as well increasing the potential for bird-wire collisions.

The potential for forest fires also exists in the Hayes River Upland where large tracts of forests can precipitate forest fires which lead to a level of landscape disturbance and alter the suitability of habitat to avian species (Vierling *et al.* 2008).

5.5.1.6 Hudson Bay Lowland

Resource use in the Hudson Bay Lowland Ecoregion mainly occurs through Manitoba Hydro projects coordinating the construction of generating stations and infrastructure for use in transferring hydro power to southern communities. The development of generating stations by Manitoba Hydro has also served to create linear features on the landscape through the development of roads and occasional work camps; both of which may precipitate increased bird mortalities through bird-vehicle collisions and through hunting. Additional habitat areas are expected to be altered or lost through flooding associated with the completion of the Conawapa generating station (1,485 MW) (Manitoba Hydro 2011b). The development of transmission lines related to Manitoba Hydro projects and infrastructure development also lead to increased bird-wire strikes (Bevanger 1994; Nobel 1995). Mineral exploration is occurring in northern regions, although no mines are located in this ecoregion. This ecoregion is located in a non-commercial forest zone. Due to the stunted and open grown nature of the forest, there is no commercial forest utilization. For a detailed assessment of changes to the landscape from agriculture, forestry and mining operations, and resource use issues, refer to the *Bipole III Forestry Technical Report, Bipole III Land Use Technical Report, Bipole III Agriculture Technical Report, Bipole III Lands of Special Interest and TLE Lands Technical Report, Bipole III Resource Use Technical Report* and the *Bipole III Terrestrial Ecosystems and Vegetation Technical Report*.

5.5.2 Valued Environmental Components

5.5.2.1 Waterfowl and Other Waterbirds (Mallard and Sandhill Crane)

There are a number of species associated as being waterfowl including ducks, geese, swans, loons, coots, rails, and cranes. These species are spring migrants which are only found in Manitoba during breeding season and are primarily affected through the loss or alteration of wetland habitat areas and, for some species, instances of overhunting. Seasonal weather conditions can play an important role in the general nesting success of waterfowl including declines in population numbers through droughts and relative increases due to wet spring seasons where exceptional flooding occurs (Johnson and Grier 1988, Sorenson *et al.* 1998). In Manitoba the prairie potholes region, located in the Lake Manitoba Plain ecoregion is in particular associated with high bird densities during breeding season; possibly due to their consistency in being readily available high productivity habitat (Johnson and Grier 1988, Sorenson *et al.* 1998, Carey *et al.* 2003).

MALLARD

Mallards are relatively extensive within Manitoba and have the potential to be in every ecoregion where the development and maintenance of Bipole III is ongoing (Newman *et al.* 2000). Common threats to mallard are typically assessed as effects on wetland habitat areas as well as seasonal overhunting. Conversion of wetlands to agriculture and wetland degradation or disturbance due to surrounding land use affects the use of these areas by ducks (Ringelman *et al.* 2005). The maintenance of wetland habitat areas, particularly in the prairie potholes region in the Lake Manitoba Plain and Interlake Plain Ecoregions, has benefitted conservation efforts aimed at this species while also promoting sustainable hunting practices (Johnson and Grier 1988, Sorenson *et al.* 1998).

Impacts on mallards from varying development projects can include the removal of wetland habitat areas as well as the introduction of environmental contaminants in areas where waterfowl are encountered; such as wetlands, ponds and various aquatic areas (Cox *et al.* 1998). The dispersal of environmental contaminants can occur through various practices including the use of pesticides, herbicides, and fertilizers as well through forestry processes and leaching techniques used in mining and the creation of tailings ponds (Cox *et al.* 1998). Flooding of reservoirs from hydro-electric projects in northern areas may also have small beneficial and adverse effects on local mallard populations. Hunter access to areas with mallards can also be considered a key determinant in the continued survival of groupings and where limits are often placed on the harvesting of birds to protect population numbers. Climate change could impact mallards through rainier spring seasons which could create wetland and flooded areas used in nesting and foraging (Rotella and Ratti 1992, Drilling *et al.* 2002). This could possibly be mitigated, however, through hotter, drier summers where wetland areas may experience drought and leave birds more vulnerable to habitat change (Sorensen *et al.* 1998).

Through the development of Bipole III only small, negative and local residual effects on mallard populations are expected; such as mortality from bird-wire collisions (particularly those lines extending over wetland areas) (Drilling *et al.* 2002). These residual effects, however, are not expected to be measurable at the population-level. The clearing of forest areas and the periodic maintenance of cleared transmission line RoWs may facilitate hunter movement to areas where mallards are located also. Access management and provincial and federal harvest management strategies and regulations, however, will continue to play a large role in sustainable mallard population management. Wetland conservation initiatives, waterfowl management partnerships such as the North American Waterfowl Management Plan, and waterfowl harvest and other mortality thresholds are well known, and they will continue to be managed by private industries such as Duck Unlimited, and in partnerships with the Federal and Provincial governments, As such, the residual cumulative effects of the Project on mallard populations are expected to be negligible and where baseline population parameters will remain unchanged.

SANDHILL CRANE

Sandhill crane is a species which has a province-wide distribution in Manitoba, during the breeding season, and will therefore encounter a wide range of threats based around ecoregion-specific development efforts and environmental factors (Tacha *et al.* 1992). Common threats to sandhill crane include hunting and habitat degradation however no substantial declines in Manitoba have been established (Holland *et al.* 2003b).

Varying factors and their influence on sandhill crane populations include the removal or alteration of wetland areas and habitats with some standing water (Tacha *et al.* 1992). While there are a high number of occurrences of sandhill crane in relation to agricultural and pasture areas (Tacha *et al.* 1992), there is a general avoidance for those agricultural areas where intensive farming has taken place (Holland *et al.* 2003b) as well as large tracts of intact forest habitat (Holland *et al.* 2003b). Agricultural activities can affect the **turbidity** of wetland water and alter the composition of vegetation, affecting wetlands' ability to support waterbirds (Niemuth 2005). In years with considerable spring flooding, the availability of suitable habitat for this species increases; particularly when agricultural and pasture areas are flooded (Iverson *et al.* 1987, Tacha *et al.* 1992). Flooding of reservoirs through hydroelectric developments in northern ecoregions has the potential to remove habitat and in some cases increase habitat availability. Climate change would have variable impacts on sandhill crane based on species presence in varied ecoregions across Manitoba. Notably, an expansion of wetland and flooded areas may benefit sandhill crane although hotter, drier summer conditions may threaten population persistence (Sorensen *et al.* 1998).

Residual effects of Bipole III on sandhill crane are expected to be small, negative, and local and will likely include a few individual bird wire-strikes as well as increased hunter access. Access management and provincial and federal harvest management strategies and regulations, however, will continue to play a large role in sustainable sandhill crane population management. Wetland conservation initiatives, sandhill crane harvest, and other mortality thresholds are known, and they will continue to be managed through partnerships and by Federal and Provincial governments. These residual effects are expected to have a negligible effect on the population as a whole. As large continuous forest tracts are avoided by sandhill crane, the maintenance of transmission line RoWs may increase usable habitat; particularly in lowland areas where flooding can occur (Iverson *et al.* 1987, Tacha *et al.* 1992). As such, the residual cumulative effects of the Project on sandhill cranes are likely to be negligible with no noticeable changes in population numbers and life-history characteristics occurring on these populations.

5.5.2.2 Colonial Waterbirds (Great Blue Heron)

There are a number of species associated as being colonial waterbirds including gulls, terns, grebes, pelicans, cormorants, herons, bitterns, and shorebirds. Colonial waterbirds are primarily affected through the loss or alteration of riparian areas (Parnell *et al.* 1988). The breeding and foraging habitat commonly utilized by colonial water birds consists of islands, swamps, marshes, forest stands (in and/or adjacent to marshes) and steep cliffs (Parnell *et al.* 1988; Warnock and Warnock 2001). Significant declines in many colonial water bird species are a result of loss and degradation of nesting and feeding habitat (Parnell *et al.* 1988) and can occur through such activities as the clearing of land for anthropogenic reasons and due to environmental circumstances including forest fires and large storms (Gibbs and Kinkel 1997). The formation of colonies results in species' susceptibility to drastic population declines in the event of severe weather, competition, predation, habitat degradation or loss, and human disturbance (Parnell *et al.* 1988).

GREAT BLUE HERON

The breeding-range distribution of great blue heron in Manitoba is largely restricted to the southern half of the province and could be found in the entire range of ecoregions affected by Bipole III development. Common threats faced by great blue heron can be associated with the loss of wetland habitat areas, the presence of environmental contaminants and disturbance caused by human interaction with the environment (Butler 1992).

Development impacts of note which alter the distribution and life-history characteristics of great blue heron are mainly topical in considering those factors which reduce viable wetland habitat areas or alter those lowland areas where flooding sometimes occurs. This alteration of habitat has been largely prevalent in southern Manitoba, although conservation efforts aimed at maintaining wetland habitats have largely sustained a wide range of wetland and shorebird species. As great blue heron are a relatively large species which feeds on relatively large numbers of fish and amphibians, bioaccumulation of environmental contaminants introduced through industrial and farming processes may impact this species (Gibbs and Kinkel 1997). Such contaminants can impact on eggshell thickness, reproductive success and growth rates (Butler, 1992) and would be thought to be more common in areas where pesticides and herbicides are utilized. Flooding associated with hydroelectric developments in northern ecoregions could play a role both in increasing or decreasing available habitat for this species. Great blue heron life-history characteristics would be affected through climate change in the increase of wetland and flooded areas although the gains in nesting and foraging areas may be short-lived through seasonal droughts occurring each summer.

Potential residual effects of Bipole III development are expected to be negative and local, with mortality associated with a few individual bird-wire collisions. Ongoing maintenance of RoW may occasionally disrupt great blue heron colonies where buffering of these areas should take place according to the timing of RoW use and maintenance (Manitoba Conservation 2010a). Known thresholds that may be related to the sustainability of local great blue heron populations include these buffer management practices (Manitoba Conservation 2010a). Accordingly, the residual effects of Bipole III development are expected to be negligible with cumulative effects from other development projects being largely unchanged.

5.5.2.3 Birds of Prey (Bald Eagle)

There are a number of species associated as being birds of prey including accipiter (hawks, eagles, ospreys, and harriers), falcons, and owls. These species have a range of habitat use characteristics but are similar in typically having relatively large hunting grounds and being largely responsive to changes in prey density (Janes 1984, Casey *et al.* 2003). The maintenance of foraging areas therefore often includes perching areas as well as open ground where birds of prey can ambush prey items (Kirk and Hyslop 1998; Smith *et al.* 2003). The removal of stands through such practices as forestry and forest fires can therefore possibly remove perch stands, while increasing open area, and affect bird of prey distribution (Kirk and Hyslop 1998; Smith *et al.* 2003). Anthropogenic use of chemical deterrents i.e. pesticides and herbicides which cause decline in the abundance of potential prey items (i.e. rodents) can also be linked with limiting bird of prey distribution and where other chemical deterrents have been linked with deformations and decreased eggshell thickness (e.g., the impact of DDT) on bald eagles (Buehler 2000).

BALD EAGLE

Bald eagle range extends over much of Manitoba and is expected in all ecoregions where Bipole III development occurs (Koonz 2003a). Impacts of anthropogenic development on bald eagles are often associated with the removal of large trees potentially used as nesting areas and as perches overlooking hunting areas (Buehler 2000). Previously, pesticide use, specifically DDT, was linked with population declines and was a primary determinant in this species being listed in the United States under the *Endangered Species Act* (Buehler 2000; Koonz 2003a).

Particular developments that could affect bald eagle presence include forestry practices in the Interlake Plan and Mid-Boreal Lowland ecoregions and other development projects that reduce the quantity of usable forest stands. The bioaccumulation of toxins present in the food chain can have marked effects on bald eagles; particularly where the consumption of fish species is prevalent (Buehler 2000; Koonz 2003a). To this extent, industries utilizing environmental contaminants such as pesticides can play a negative role in bald eagle life-history characteristics; although these types of contaminants have become more carefully regulated provincially and federally. The impact of climate change on bald eagles is likely variable and based on the extent of seasonal climatic extremes where changes in the available prey items may affect life-history characteristics. Milder winters may benefit this species, as it may become a more frequent year-round resident in Manitoba.

The residual effects of Bipole III on bald eagles can be associated with increasing nesting habitats and perching areas on transmission line towers as well as creating open areas that may be used in hunting. There is minor potential for wire-strikes by this species (Buehler 2000); although bald eagles are generally considered adept and manoeuvrable flyers where wire-strikes will likely not affect overall population numbers. The clearing of forest areas and the periodic maintenance of cleared transmission line right-of-ways should be done with caution and according to those guidelines and thresholds set by Manitoba Conservation (2010a) where nests are avoided by 50-200 m based on season. Access management and Manitoba Conservation (2010a) forest harvesting strategies will continue to play an important role in bald eagle management and future sustainability of these populations. The residual effects of Bipole III development will be negligible or slightly positive with cumulative effects from other development projects indicating current population trends will remain unchanged or increase slightly.

5.5.2.4 Upland Game Birds (Ruffed Grouse and Sharp-tailed Grouse)

There are a number of species associated as being upland game birds including partridges, pheasants, and turkeys. There are varying habitat characteristics for these species but their presence is often associated with shrubby areas or those habitats that provide sufficient cover to evade predators (Holechek 1981; Delehanty 2001). Some upland game birds retain unique mating rituals requiring very specific habitat requirements Stauffer and Peterson 1985 i.e. sharp-tailed grouse leks being slightly elevated but retaining some cover (Taylor 2003a). Upland game birds are often hunted by people where increased hunter access to habitat areas through the creation of roads and trails affiliated with resource use projects may facilitate overhunting. As upland game birds are year-round residents, they are prone to seasonal environmental extremes relative to other bird groupings.

RUFFED GROUSE

The range of ruffed grouse extends over much of Manitoba and occurs within all ecoregions where the Bipole III transmission line will be developed and constructed (Holland and Taylor2003d). There are a number of threats to ruffed grouse, notably being an actively hunted species (Rusch *et al.* 2000). Ruffed grouse can be attracted to roadsides for foraging purposes and are prone to vehicle collisions (Clevenger *et al.* 2003, Holland and Taylor 2003b). Other threats faced by ruffed grouse include insect outbreaks and predation by varied bird and mammal species. Despite these threats ruffed grouse numbers are considered relatively stable (Holland and Taylor 2003d).

Anthropogenic activities involved in clearing deciduous and mixedwood forest areas will reduce the amount of usable ruffed grouse habitat (Blanchette *et al.* 2007). This could include the clearing of forests through forestry activities in the Interlake Plain and Mid-Boreal Lowland Ecoregions and clearing of land for houses, roads and other infrastructure projects in all ecoregions (Blanchette *et al.* 2007). It should be noted that cleared (edge) areas where willow, alder and aspen grow can serve as food sources for ruffed grouse as well as secluded cultivated gardens (Holland and Taylor 2003d). Ruffed grouse maintaining their presence within cleared areas may, however, have higher rates of predation by species which utilize these areas for hunting purposes. Climate change conditions including wetter spring seasons and drier, hotter summer seasons could negatively impact ruffed grouse through ecosystem level changes in the food web and the availability of forage items for this species. Milder winters may however benefit this year-round resident (Marshall 1965).

Residual effects of Bipole III development on ruffed grouse are not anticipated where long-term effects on ruffed grouse could occur through cleared right-of-ways acting as potential forage areas. The clearing of forest areas and the periodic maintenance of cleared transmission line right-of-ways may facilitate hunting of this species by raptors (Eng and Gullion 1962; Larson *et al.* 2001) and, potentially, humans. Some mortality may be associated with a few individual bird-wire collisions. Access management and provincial harvest management strategies that regulate mortality will therefore play a large role in the future sustainability of ruffed grouse populations in Manitoba. As such, the residual cumulative effects of the Project on ruffed grouse populations are expected to be negligible.

SHARP-TAILED GROUSE

Sharp-tailed grouse occurrence in Manitoba extends over all of southern Manitoba and over much of northern Manitoba; including the northern extent reached by Bipole III (Taylor 2003a). Habitat degradation through the encroachment of early successional stage forest species, notably aspen, as well the alteration of grassland habitats has been linked to declines of this species (Berger and Baydack 1993). Hunting of this species by humans is also a consideration in its persistence as well as the disturbance of leks where species breeding rituals occur.

It has been noted by Manitoba Conservation (2010b) that sustainable agricultural practices and preservation of grassland habitat are required for long-term stability of sharp-tailed grouse populations. This is mainly in reference to more southern ecoregions including Lake Manitoba Plain, Interlake Plain, and Mid-Boreal Lowland where agricultural and grassland areas are present. Active fire suppression in these ecoregions also likely negatively affects the persistence of sharp-tailed grouse populations in southern Manitoba (Berger and Baydack 1993, Taylor 2003a). Alternately the impact of forestry and mining projects in northerly ecoregions, including Mid-Boreal Lowland, Churchill River Upland, and Hayes River Upland may create access roads making sharp-tailed grouse more accessible to hunters. To a limited extent the use of recreational trails in the Mid-Boreal Lowland may serve a similar purpose. The flooding of habitat areas in conjunction with climate change possibilities would likely further limit available habitat for this species although milder winters and drier summers may be advantageous where, in the case of the latter, a natural fire-cycle may be resumed.

Long-term impacts indicative of Bipole III development on sharp-tailed grouse are consistent with those listed for ruffed grouse and include the possibility for increased hunter access and some mortality associated with a few individual bird-wire collisions. The maintenance of transmission line right-of-ways may produce habitat conditions similar to grassland, shrubland and agricultural areas selected for by sharp-tailed grouse and could possibly improve habitat and lead to local increases in population numbers; particularly if suitable lek areas exist. Ongoing clearing of vegetation and RoW maintenance facilitate hunting of this species by raptors and humans. Access management and provincial harvest management strategies that regulate mortality will therefore play a large role in the future sustainability of sharp-tailed grouse populations in Manitoba. As such, the residual cumulative effects of Bipole III on sharp-tailed grouse populations are expected to be negligible.

5.5.2.5 Woodpeckers (Pileated Woodpecker)

Habitat use by woodpeckers is limited to forested stands where typically dead stands are preferentially selected (Reed 2001; Taylor 2003b). This is due to insect species being the key forage item for woodpeckers where their bills, among other features, are uniquely adapted for boring and rooting in trees. Trees also provide important nesting habitats. The disruption and alteration of treed areas though human development, forest fires, and large storms can therefore reduce usable habitat for woodpeckers while remediation efforts utilizing the planting of new trees can recover available habitat.

PILEATED WOODPECKER

Pileated woodpecker presence is recorded across southern Manitoba and portions of central Manitoba where it is considered a yearly resident (Bull and Jackson 1995). Factors influencing species demography typically revolves around the availability of nesting and roosting sites as well as forage availability and can take place across all ecoregions.

Natural nesting sites for pileated woodpeckers include dead deciduous trees although wooden telephone and transmission line poles have also been used (Holland and Curtis 2003). The removal of tree stands occurs for varying reasons and based around regional land uses and priorities. In southern Manitoba, including the Lake Manitoba Plain and Interlake Plain ecoregion, the removal of dead stands occurs through landscape alteration, agriculture, and land-use development. In northern ecoregions where pileated woodpecker are encountered less than in southern areas, forestry can alternately be seen as reducing habitable tree species as would forest fires (Bull and Jackson, 1995). Climate change could potentially also alter usable habitat through hotter, drier conditions being present in the summer season which may lead to increased forest-fires and possible changes in available prey-items such as carpenter ants.

The maintenance of the Bipole III transmission line right-of-ways will retain smaller, younger tree species unsuitable as pileated woodpecker habitat. In addition, the removal of danger trees near the RoW edges may remove a small amount of additional foraging and nesting opportunities. As pileated woodpeckers require mature forests, sustainable forest industry harvesting practices, and refugia such as Federal and Provincial parks, will continue to play an important role in the future maintenance of these populations. The residual cumulative effects on pileated woodpeckers in the province therefore, are likely to be negligible given the relatively small area anticipated to be affected by the Project.

5.5.3 Species at Risk

Species at risk are affected through anthropogenic and environmental factors to varying degrees based on situational and demographic factors. Many species are negatively impacted through the removal or alteration of habitat. Species at risk in the Manitoba context have been largely addressed in terms of the reducing availability of prairie and native tall-grass habitat areas and where the reduction of wetland areas was once also considered a key issue. Human caused introduction of environmental contaminants and food web level changes has also been associated with species declines. In circumstances where the causes of population decline can be established, corrective action is sometimes taken through private and public sources. These actions can include the protection of habitat (including the establishment of parks and protected areas), education initiatives on the causes of species decline, regulations of potential environmental deterrents, etc.

5.5.3.1 Least Bittern

Least bittern is primarily found in portions of the southern Manitoba and has the potential to be impacted through habitat alteration taking place in the Lake Manitoba Plain and Interlake Plain ecoregions (Koes 2003a). Of note, the alteration and degrading of wetland habitat areas is the proximal cause for declines of this species (Gibbs *et al.* 1992).

Potential causes of population decline for least bittern in Manitoba primarily occurs through the clearing or alteration of wetland habitat areas through the conversion of these areas for agricultural purposes (COSEWIC 2009b). Attempts to protect wetland habitat areas in maintaining biodiversity will generally have a positive effect on this species. The accumulation of environmental toxins in wetland areas through agricultural practices, however, is likely to negatively impact least bittern species distribution through reducing the viability of wetland habitat areas; as would the ongoing proliferation of purple loosestrife (Weller 1961; Gibbs *et al.* 1992). In considering climate change, increased flooding of areas through seasonally wetter spring seasons would likely increase the availability of habitat although food-web level changes in prey species distribution may have a negative effect if least bittern are not able to adapt accordingly.

The residual effects of Bipole III development is some mortality associated with a few individual bird-wire collisions and the occasional disruption of nesting areas in ongoing RoW use and maintenance. These residual effects are expected to have a largely negligible effect on the province-wide least bittern population. As such, residual effects from Bipole III development will not provide additive or synergistic effects in respect to outstanding cumulative impacts from varied anthropogenic and environmental sources. Ongoing participation of conservation organizations with Federal and Provincial government agencies should continue to develop wetland habitat areas for use by this, and other, wetland bird species. If ongoing threats to the least bittern populations are not reversed, population levels are likely to remain low or decline as indicated by COSEWIC (2009b).

5.5.3.2 Yellow Rail

Almost the entire province of Manitoba lies within the breeding range of yellow rail where any expected or completed developments could impact this species. In particular the conversion of wetland habitat areas for other purposes has been the primary cause of habitat loss (Eddleman *et al.* 1988; Bookhout 1995).

Within Manitoba, development projects or naturally occurring phenomena which disrupt wetland areas, or alternately create wetland areas, will impact the availability of yellow rail habitat (COSEWIC 2009a). In the southern portion of the province, particularly the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland ecoregions farming and ranching may impact species distribution through the alteration of wetland areas. The impacts of mining and forestry in the Mid-Boreal Lowlands, Churchill River Upland, Hayes River Upland, and Hudson Bay Lowland may also impact yellow rail abundance through the introduction of chemical toxicants into the environment which often accumulates in wetland habitat areas. As the range of yellow rail extends over much of Manitoba, potential effects of climate change are variable with the expectation that increased precipitation in the spring season may occasionally increase usable breeding habitat during extended wetter periods.

The impact of Bipole III development on yellow rail is not likely to have long-term residual effects on yellow rail populations. There however may be some small increases in predation of yellow rail through increases in raptor populations associated with the creation of potential perching and hunting areas along the Bipole III transmission line right-of-way as well as some mortality associated with a few individual bird-wire collisions (Bookhout 1995). At the population level, however, residual effects of Bipole III development are expected to be negligible and not compound cumulative effects from other anthropogenic activities and environmental circumstances. Ongoing participation of conservation organizations with government departments should continue to develop wetland habitat areas for this, and other, wetland bird species and where, if ongoing threats to these populations continue, population levels are likely to remain low or decline (COSEWIC 2009a).

5.5.3.3 Ferruginous Hawk

Ferruginous hawks in Manitoba only occur in the extreme southwestern portion of the province during breeding season (Bechard and Schmutz 1995; De Smet 2003a). Limiting factors and threats to ferruginous hawk populations have been identified as degradation of habitat, loss of habitat to agricultural activities, declines in critical prey species, and disturbance of nests by human activities (Hoffman and Smith 2003).

The alteration of short-grass prairie habitats, particularly through agricultural practices and the development of prairie habitats for alternate purposes may further reduce the amount of viable habitat for ferruginous hawks; particularly in the Aspen Parkland ecoregion (Leary *et al.* 1998, Schmutz 1989). The absence of ground squirrel species, potentially through pest-eradication procedures, can also been linked as a proximal cause of population decline for ferruginous hawks (Schmutz *et al.* 2008; COSEWIC 2008a). The effects of climate change altering the frequency and distribution of prey items through environmental extremes is likely to negatively impact on ferruginous hawks also.

Potential residual effects of Bipole III development on ferruginous hawks could include some mortality associated with a few individual bird-wire collisions and nest disruption through ongoing RoW maintenance; however, there are no known ferruginous hawk occurrences along the Bipole III route. Residual effects from Bipole III development of ferruginous hawks are therefore expected to have negligible effects on the provincial population and not interact with outstanding anthropogenic projects or environmental circumstances. Ongoing participation of conservation organizations with government action and regulation should continue to work at facilitating range expansion and reducing threats to ferruginous hawks where if ongoing threats to this species are not reversed population levels are likely to continue declining (COSEWIC 2008a).

5.5.3.4 Burrowing Owl

Burrowing owls only occur within the southwest corner of the province during breeding season (Haug *et al.* 1993). Declines in burrowing owl numbers is often linked to the loss and degradation of native prairie habitats as well as the reduction of prey species considered as pests to human settlement and economic activities (Haug *et al.* 1993). Burrowing owls are often a target of many mammalian and avian predators also (Haug *et al.* 1993).

Factors affecting burrowing owl distribution is often associated with the development of prairie habitats for alternate land use purposes, primarily agriculture (COSEWIC 2006b). Of note, the mechanized tillage of lands can disrupt nesting and kill resident burrowing owls and would be a factors influence species distribution in the Aspen Parkland and Interlake Plain ecoregions. The introduction of environmental contaminants such as pesticides and rodenticides used in agriculture can also negatively impact burrowing owls, both through the bioaccumulation of toxins from consumed prey items and through a reduction of potential prey items (Haug *et al.* 1993). Increased spring flooding of agricultural areas through the effects of climate change will likely negatively impact on this species through reducing available nesting areas and prey item availability.

Residual effects of Bipole III development include the ongoing disturbances to local populations and habitat from mechanized and periodic clearing of the Bipole III RoW. However, as no burrowing owls are within the perspective preferred route corridor, and unless range expansion occurs, residual effects from Bipole III development are expected to be negligible. Ongoing participation of conservation organizations with government action and regulation should continue to work at facilitating range expansion and reducing global threats to burrowing owls where if ongoing threats to this species are not reversed population levels are likely to continue declining (COSEWIC 2006b).

5.5.3.5 Short-eared Owl

The breeding season range of short-eared owl potentially extends over all Manitoba where any ecoregion-specific environmental impacts may affect short-eared owl distribution and demographics. The irruptive nature of short-eared owl populations and where they may nest in Manitoba however is difficult to predict. Notable threats to short-eared owl include the development of habitat areas for varied development purposes as well as the absence of potential prey species (Holt and Leasure 1993).

Notable impacts on short-eared owls through various development projects is mainly due to the loss of habitat through agricultural and ranching activities (Holt and Leasure 1993; COSEWIC 2008a) which could continue in Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland ecoregions. The introduction of varying environmental contaminants i.e. pesticides, fertilizers, herbicides etc. also likely play a role in altering the availability of prey items used by short-eared owls also. Increased spring flooding of agricultural areas through the effects of climate change will likely negatively impact on this species through reducing available nesting areas and prey item availability.

Residual effects of Bipole III development could affect short-eared owl mortality associated with a few individual bird-wire collisions and increased predation by predators, which benefit from RoW access. These residual effects are expected to be largely negligible on the provincial short-eared owl population and not be additive or synergistic with historical or present effects of anthropogenic projects and environmental exigencies. Collaborative action between conservation organizations with government should continue to facilitate the protection of areas suitable as burrowing owl habitat where if ongoing threats to this species continue population levels are likely to remain low or decline; as indicated by COSEWIC (2008a).

5.5.3.6 Common Nighthawk

The breeding range of the common nighthawk extends over much of Manitoba although it is seldom present above the treeline (Taylor 2003j). Threats to common nighthawk are mainly based on habitat loss and alteration and reductions in insect populations that serve as a primary food source (Behrstock 2001; Savignac 2007).

Foraging by nighthawks generally takes place in areas with water i.e. lakes, rivers and swamps as well forested clearings. The reductions of insect populations through the application of pesticides has a negative impact through reducing of potential prey items in ecoregions where agriculture activities occur including the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland ecoregions (Behrstock 2001; Savignac 2007). The suppression of forest fires in southern Manitoba can also likely be linked with reducing the number of potential open areas for use by common nighthawks. The creation of gravel roads can also serve to attract nighthawks for nesting purposes and have the adverse consequence of increased mortalities through car-strikes (Taylor 2003j). Climate-change effects which would serve to potentially alter common nighthawk distribution includes an expansion of breeding range with the northwards expansion of the treeline as well as increased spring flooding creating usable habitat areas.

Residual effects of Bipole III development on common nighthawks is expected to include some mortality associated with a few individual bird-wire collisions. The Project may create some usable habitat through the maintenance of cleared RoW. With the combination of having an available food source this could lead to increases in local population numbers but where generally the residual effects of Bipole III development should be considered as negligible. To this extent, residual effects from Bipole III development should not negatively impact common nighthawk in addition to or subsequent to varied anthropogenic factors affecting common nighthawk as well as precipitating environmental factors. Ongoing participation of conservation organizations with government action and regulation should continue to work at facilitating range expansion of common nighthawk in Manitoba and maintaining suitable habitat areas. If ongoing threats to this species are not reversed, population levels are likely to remain low or decline as indicated through by COSEWIC (Savignac 2007).

5.5.3.7 Whip-poor-will

Whip-poor-wills, during breeding season, range over the southern half of the province and are frequently impacted through varying developmental projects and environmental effects. Notably the loss and disruption of habitat as well as declines in insect populations are considered causal factors in population declines for this species (Cink 2002; COSEWIC 2009c).

The clearing of forested areas can produce whip-poor-will habitat areas and could include the clearing of land for agricultural and livestock ranges in the Interlake Plain and Mid Boreal Lowland ecoregions as well as forestry practices in ecoregions including Interlake Plain, Mid-Boreal Lowland and Hayes River Upland ecoregions (Wilson and Watts 2008; COSEWIC 2009c). However, agricultural practices can also negatively impact on whip-poor-wills through the application of pesticides which reduce insect species (Cink 2002). Similar to the common nighthawk, the whip-poor-will can also potentially be attracted to gravel roads, which may result in mortalities through bird-vehicle collisions (Cink 2002). Climate change effects may alter whip-poor-will distribution through increased spring flooding reducing available ground nesting areas and potentially altering prey item distribution.

Residual effects of Bipole III development on whip-poor-wills could include some mortality associated with a few individual bird-wire collisions, and include the possible creation of habitat through maintenance of cleared Bipole III RoW. With the combination of having an available food source this could lead to local increases in population numbers but where generally the residual effects of Bipole III development should be considered as negligible. To this extent, residual effects from Bipole III development should not negatively impact common nighthawk in, alongside, or along with varied anthropogenic and environmental factors. Ongoing participation of conservation organizations with government action should continue in order to facilitate range expansion of common nighthawk in Manitoba and maintain suitable habitat. If ongoing threats to this species are not reversed, population levels are likely to remain low or decline as indicated through by COSEWIC (2009c).

5.5.3.8 Red-headed Woodpecker

Red-headed woodpecker range in Manitoba extends over the southern quarter of province and is primarily affected through the relative availability of dead or dying trees (Smith *et al.* 2000; Taylor 2003i; COSEWIC 2007c). The clearing of land through the removal of dead or dying trees used by red-headed woodpeckers is often linked to agriculture and land development projects in southern ecoregions including Lake Manitoba Plain, Interlake Plain, and Mid-Boreal Lowland ecoregions (Smith *et al.* 2000; Taylor 2003i). Forest fire suppression in southern Manitoba also impacts this species through the accumulation of forest understory (Smith *et al.* 2000; COSEWIC 2007c). As forestry practices in Manitoba are small within the limited range of this species, it is not expected to negatively impact this species. Competition of red-headed wood-peckers with European starlings have also been noted which may be thought of as an end result of anthropogenic settlement and expansion (COSEWIC, 2007c). Climate change could potentially also alter usable habitat through hotter, drier conditions being present in the summer season which may lead to increased forest-fires and possible changes in ecosystem function.

Residual effects of Bipole III development on red-headed woodpecker are not expected to be extensive with RoW maintenance, although could potentially disrupt animal movements in the short-term. Large-scale residual effects on red-headed woodpecker populations are expected to be negligible. Accordingly, the combinations of residual effects from Bipole III development are not expected to act cumulatively with pre-existing and continually occurring anthropogenic and environmental situations. Ongoing participation of conservation organizations with government officials should continue to work to facilitate range expansion this species and maintaining suitable habitat areas. If ongoing threats to the red-headed woodpecker populations are not reversed, population levels are likely to remain low or decline as indicated by COSEWIC (2007c).

5.5.3.9 Olive-sided Flycatcher

Olive-sided flycatcher has a breeding range which extends over much of Manitoba and where a great variety of development projects and environmental impacts may alter the life-history of this threatened species. The exact causes for population decline in this species are unknown (COSEWIC 2007d).

There are a variety of factors which may contribute to population declines for this species in Manitoba. Notably the removal of habitat including wetland and coniferous forest areas may have a negative impact on this species alongside reductions in insect populations; its primary food source (Altman and Sallabanks 2000). These could both be caused in the southern range of potential olive-sided flycatcher habitat areas by agricultural practices as well as the pesticides used to reduce insect species. Forestry practices in the north alternately alter forest composition and could also affect species distribution as would forest fires. It is expected that fire suppression of forests in southern Manitoba i.e. Interlake Plain, may reduce overall nest success (Altman and Sallabanks 2000). Increased wetland habitat or flooded area availability through climate change in the spring season, particularly in areas where coniferous forests are present, may increase usable habitat for this species during breeding season.

As much of the reason for population declines for olive-sided flycatcher are unknown (COSEWIC 2007d), the potential residual effects of Bipole III development are difficult to interpret although it is expected that, at a population-level, residual effects of Bipole III development will most likely be negligible. To this extent, residual effects from Bipole III development will not act interactively with past or present cumulative effects on precipitate further declines in population numbers. Accordingly, conservation organizations and government officials should continue to work in concert in order to maintain suitable habitat areas as well as mitigate ongoing threats to this species. As such, the absence of mitigation measures and habitat-recovery strategies may preclude further declines in population numbers as per COSEWIC (2007d).

5.5.3.10 Loggerhead Shrike

Loggerhead shrike presence in Manitoba, during breeding season, is limited to the southwestern portion of the province (Yosef 1996). Limiting factors and threats to loggerhead shrikes primarily revolve around the loss of native prairie habitats as well as the application of pesticides (Fitzgerald *et al.* 1998; COSEWIC 2004).

The alteration of short-grass prairie habitats through continued agricultural development of prairie habitats in the Aspen Parkland and Interlake Plain ecoregions could reduce the amount of viable habitat for loggerhead shrikes (COSEWIC 2004). Much of this can be related to industrialized agricultural processes, particularly where pesticides are applied as a means of pest management (De Smet 2003c; COSEWIC 2004). It has also been noted that reproduction rates of loggerhead shrikes is limited in rainy and wet summers (De Smet 2003c). The tendency for loggerhead shrikes to nest in proximity to roadways has been linked to high rate of mortalities through bird-vehicle collisions (De Smet 2003c). The onset of wet-cold spring climactic conditions through climate change may reduce fledgling recruitment and although where dry summer conditions may increase fledgling recruitment, potential increases in fire conditions could also reduce usable habitat areas.

The residual effect of Bipole III development on loggerhead shrike may create usable habitat through ongoing maintenance of cleared RoW corridors but where, at a population level, changes should have a relatively negligible effect. The effects of Bipole III development will therefore likely not exacerbate those effects created through historical and current anthropogenic projects or varying environmental factors. Ongoing participation of conservation organizations and government officials should continue in maintaining native prairie and grassland areas to create habitat suitable for this species. Not doing so could potentially result in population numbers for this species remaining stable or potentially declining further (COSEWIC 2004).

5.5.3.11 Sprague's Pipit

Sprague's pipit presence in Manitoba, during breeding season, is limited to the southwestern portion of the province despite once being quite common (Holland *et al.* 2003a). Threats to Sprague's pipit primarily include ongoing habitat loss, degradation and fragmentation; primarily when considering the large tracts of intact native grasslands required for breeding (COSEWIC 2010c).

Development projects in Manitoba linked with declines of Sprague's pipit can be associated with the conversion of grassland habitat (COSEWIC 2010c); primarily in the Lake Manitoba Plain and Interlake Plain ecoregions (Davis *et al.* 1999). Overgrazing in these ecoregions also impacts native grassland habitat as would fire suppression where native grassland vegetation dynamics are altered and ecosystem functionality for Sprague's pipit is diminished (Davis *et al.* 1999; COSEWIC 2010c). Impacts of climate change on Sprague's pipit would primarily occur through spring flooding of nesting areas and the potential for dry summer season to increase the occurrence of prairie fires. While prairie fires may be ideal in large-scale naturally regulating prairie habitats sustaining Sprague's pipit populations, the small isolated pockets where Sprague's pipits are currently found may not be as resilient to such environmental changes.

The residual effect of Bipole III development on Sprague's pipits may create usable habitat through ongoing maintenance of cleared RoW corridors but where, at a population level, changes should have a relatively negligible effect; particularly as the range of Sprague's Pipit is not expected to intercept that of Bipole III. Residual effects of Bipole III will therefore not accentuate or supplement those effects precipitated through previous and current anthropogenic development projects or landscape-level changes through environmental factors. Ongoing participation of conservation organizations and government officials should work to maintain native prairie and grasslands as suitable habitat areas. The absence of such actions could result in population numbers in Manitoba staying stable or further decreasing (COSEWIC 2010c).

5.5.3.12 Golden-winged Warbler

Golden-winged warbler range in Manitoba is limited to the southern portion of the province (Confer 1992; Edie *et al.* 2003a). Reductions of this species are often associated with the loss of habitat associated with the advancing successional vegetation stages as well as increased proliferation of the brown-headed cowbird and the blue-winged warbler (a species which actively hybridizes with golden-winged warbler)(Edie *et al.* 2003a). There are also a number of noted occurrences of warbler collisions with radio towers and tall buildings in southern Manitoba (Taylor 2003k).

Within Manitoba fire suppression practices could impact golden-winged warbler habitat through the delaying the onset of early successional stage vegetation species; particularly in Lake Manitoba Plain, Interlake Plain and Aspen Parkland ecoregions. In addition, the proliferation of brown-headed cowbird is closely linked with human development patterns in these ecoregions (Confer 1992). Forestry practices and abandoned farm fields can act to create usable golden-winged warbler habitat (Confer 1992). There have been recorded instances of cold-weather snaps wiping out large numbers of birds also (Taylor 2003k). Increased spring flooding of open areas in conjunction with ongoing climate change could result in reduced nesting success where the onset of hotter, drier summer conditions may also serve to reduce older-stage successional forests that this species utilizes. Through climate change northwards expansion for blue-warbler may occur; a species that actively hybridizes with golden-winged warbler and is seen as a primary determinant in the listing of golden-winged warbler by COSEWIC (2006).

Residual effects of Bipole III development may occur through ongoing and periodic maintenance of the Bipole III transmission line creating usable habitat for the golden-winged warbler; and serve as a refuge area from blue-winged warbler (Edie *et al.* 2003a). Some individual mortality could be associated with a few individual bird-wire collisions. These potential effects are likely to have a negligible to positive effect at the population level. In the context of residual effects from Bipole III development, cumulative effects are not likely to occur in concert with past or present development projects or environmental circumstances. Ongoing participation of conservation organizations with government action and regulation should continue to work at facilitating range expansion of golden-winged warbler in Manitoba and maintaining suitable habitat areas. If ongoing threats to the golden-winged warbler populations are not reversed, population levels are likely to remain low or decline as indicated through by COSEWIC (2006).

5.5.3.13 Canada Warbler

Canada warbler presence in Manitoba is limited to its breeding range which encompasses the southern portion of Manitoba including portions of the Lake Manitoba Plain, Interlake Plain, Aspen Parkland, Mid-Boreal Lowland, and Hayes River Upland ecoregions (Holland *et al.* 2003c). Threats to Canada warbler in Manitoba include habitat loss as well as a propensity for collisions with radio towers and tall buildings in southern Manitoba and brood parasitism from brown-headed cowbirds in fragmented forest areas (Taylor 2003k).

The cause for the decline in Canada warbler is somewhat unknown although it is expected that habitat losses in South America are the primary cause (COSEWIC 2008b). Bird strikes associated with constructed radio towers and buildings is common to all warbler species and are most likely to take place in urban environments i.e. in the Lake Manitoba Plain ecoregion (Taylor 2003k). Climate change could affect Canada warbler distribution through the spring flooding of wooded areas where this bird nests and where the potential for increased hotter and drier conditions may increase forest fire frequency.

Residual effects associated with habitat loss through development of the Bipole III transmission line will not affect Canada warbler distribution. Some mortality may be associated with a few individual bird-wire collisions. At a population level, negligible residual effects are expected. No additive or synergistic relationship exists between the residual effects of Bipole III development and outstanding anthropogenic and environmental factors. Ongoing participation between conservation organizations with government action and regulation should occur in facilitating the habitat needs of this species. If ongoing threats to the Canada warbler populations remain consistent, population levels will remain low or decline as per COSEWIC (2008b).

5.5.3.14 Rusty Blackbird

The range of rusty blackbird potentially extends over the entire province but is often limited to the northern portion where there is limited interaction with Brewer's blackbird. Threats to rusty blackbird include habit loss, particularly wetland areas. Much of the cause of decline for this species has been associated with habitat loss for the winter range of this species occurring in the southern United States and Mexico (COSEWIC 2006a).

The loss of habitat areas associated with anthropogenic activities mainly relates to the drainage of wetland habitat areas for alternate land-use purposes and can be thought of as potentially ongoing in the Mid-Boreal lowland ecoregion and to a lesser extent the Churchill River Upland, Hayes River Upland and Hudson Bay Lowland ecoregions (Greenberg and Droege 1999). Rusty blackbird nest are often found in openings which can be created through forestry practices as well as forest fires in northern environs where this species is found (Avery 1995). Range expansion of beavers in northern ecoregions also likely increases the presence of flooded habitat areas used as potential rusty blackbird habitat (Avery 1995). Spring flooding in conjunction with climate change could also increase usable habitat for this species while the occurrence of hot dry conditions in the summer may result in forest forests which reduce usable habitat areas.

Residual effects related to the construction and maintenance of Bipole III include limited mortality from bird-wire collisions. Overall, these residual effects on rusty blackbirds are considered to be negligible for provincial population numbers and distribution. To this extent, a relationship between Bipole III development and past and present environmental factors, both natural and anthropogenically derived, will not create additional residual effects. The ongoing participation of conservation organizations and government officials aimed at the improvement of wetland habitat areas and regulation of those activities which limit the productivity of these areas should continue to facilitate stable or increasing population trends. Inaction on this may result in further declines in provincial population numbers as indicated by COSEWIC (2006a).

6.0 CONCLUSIONS

During the route selection process, three route alternatives with a number of interconnections were assessed in order to determine which alternative would have the fewest potential effects on bird populations and their habitats. This included the selection of a route that avoided wildlife management areas, ecological reserves, provincial parks, provincial forests, Ducks Unlimited hotspots, Important Bird Areas, Protected Areas Initiatives and areas with high paired density values, where possible. Where it was not possible to avoid these features (e.g., Important Bird Area located near The Pas) routes were selected to minimize potential effects on bird populations, by following pre-existing linear features or developments wherever possible. The final preferred route that was assessed for residual effects had the lowest potential effects on bird populations and their habitats.

As a large number of bird species including numerous species at risk were expected to occur in the Bipole III Project Study Area, a robust effect assessment was conducted for the bird community. Of the 21 VECs selected for assessment, 14 were listed as species at risk. With the exception of a few species at risk, VECs were generally widespread and relatively abundant within their respective ranges in the Local Study Area. The results of the Bipole III Transmission Project effects assessment are summarized in Table 6-1.

Environmentally sensitive sites were identified in areas with high concentrations of waterfowl, colonial waterbirds, and migratory raptors and movement corridors. A total of 134 environmentally sensitive sites for birds have been identified, including 32 point sites, such as gull colonies, and 102 sites sensitive over an expanded area, including waterfowl staging areas. Although not many bird-wire collisions are expected as a result of the project, 68 sites were anticipated to have a high degree of risk for bird-wire strikes, and 66 sites were thought to pose a moderate risk.

Many potential negative effects were mitigated through careful routing of the Project. Mitigation measures have been prescribed to minimize Project related effects on the environment, and specifically, for the identified VECs and for environmentally sensitive sites. The most important legislation considered in the effects assessment and mitigation recommendations for birds included *The Environment Act* (Manitoba), *The Wildlife Act* (Manitoba), *The Endangered Species Act* (Manitoba), *Canadian Environmental Assessment Act, Migratory Birds Convention Act, Species at Risk Act and* the *Canada Wildlife Act*. The following mitigation measures shall apply:

- restrictions of clearing and construction activities (i.e., from April 1 to July 31) and on maintenance activities during the breeding and nesting season for the HVdc line, AC line distribution lines, at converter stations, electrode sites and borrow areas;
- prohibition of harvesting of waterfowl and game birds by workers;
- avoidance and buffering of active nests and large stick nests;
- replacement of large stick nests where appropriate;
- retention of vegetative buffer zones around wetlands;
- installation of bird deflectors and bird perch deterrents where required; and
- maintenance of shrubby vegetation on the RoW to reduce disruption of bird movements.

Even though the effects of the Bipole III Transmission Project bird communities and the related VECs will be present for the life of the Project, residual effects are small, and unlikely to be measurable within the range of natural variation in the environments as discussed. Effects on bird populations, including those for species at risk, and the alteration to bird habitat are manageable, provided that appropriate mitigation measures are strictly adhered to. On the existing landscape, provincial and federal parks, refuge areas and connectivity of habitats will continue to be important to bird survival and dispersal. Many initiatives have an important role in sustaining bird populations in the Bipole III Project Area, including wetland and other habitat conservation programs, waterfowl and other bird species management partnerships, global bird monitoring networks, and partnerships with the Federal and Provincial governments. Manitoba Hydro is actively operating in numerous partnerships, and sponsors private and public agencies to address environmental sustainability issues, including those for birds (e.g., university research on burrowing owl, Manitoba Breeding Bird Atlas).

Many environmental factors play a role in affecting bird species communities alongside the development of the Bipole III transmission line. These factors could include the association of various anthropogenic practices including farming, forestry, mining and other forms of landscape development including the building of roads, clearing of land, the development of hydro-electric generating stations etc. More naturally induced changes to bird communities could alternately take place through environmental factors including forest fires, flooding, insect outbreaks, and climate change. When assessed against other development in Manitoba, and as described geographically in the context of ecoregions, the residual effects of the Project are not expected to be measurable, and should remain within the natural range of variation over the long-term (30 years). As such, it is highly likely that cumulative effects are anticipated to be negligible as a result of the Bipole III Project. Common bird species with robust populations are expected to remain numerous in the Project Study Area while bird species in decline may continue to decline, unless initiatives such as Federal Government recovery plans are successfully implemented, and these declining trends can be reversed.

Limitations of the bird effects assessment included some gaps in the scientific literature, limited site-specific data for species at risk along the FPR for a few species, data limitation for small areas of the route where adjustments occurred after the breeding bird sample season and access-related issues to private land. Some sensitive species (e.g., sharp-tailed grouse) require location data prior to construction so that effective mitigation measure can be applied. Finally, habitat models are limited to landscapes and to broad habitat types; although data are available for sites-specific habitats (e.g., nesting colonies), because only one year of data are available for the FPR, other sensitive sites are expected along the FPR, and these could be affected by the Bipole III Project. Data gaps and potential deficiencies of the effects assessment will be addressed by the application of appropriate mitigation prescriptions where pre-construction surveys allow for the identification of any additional species and sensitive sites that may be present along the FPR. Monitoring and reporting will be used to validate effects predictions and to ensure that unforeseen adverse effects do not occur as a result of the project.

7.0 GLOSSARY

Anthropogenic: a descriptive term used to identify different aspects of nature that have been influenced by human activity or activities.

Biome: a large natural area characterized by its dominant forms of vegetation, physical geography and their associated animal life forms. This is largely a reflection of the dominant climate and soils of the region.

Brood parasitism: a reproductive strategy in which one species lays their eggs in the nest of another species. The young of the parasite egg layer are raised by the host species. *See also* nest parasitism.

Crepuscular: a species whose most active period takes place between sunset and sunrise. *See also* diurnal.

Dabbling duck: a shallow water duck that feeds primarily along the surface of the water or by tipping headfirst into the water to graze on aquatic plants and vegetation

Danger tree: individual tall trees that are close to interfering with transmission line operation and safety.

Diurnal: a species whose most active period takes place between sunset and sunrise. *See also* crepuscular.

Edge: The point at which dissimilar plant communities meet.

Extirpated: the extinction of a species within a given area, with the species still occurring within the remainder of its range.

Fledge: the event at which bird nestlings leave their nest and are capable of flight.

Gallinaceous: a species in the order of Galiformes; the large-bodied, terrestrial birds such as the turkeys, grouse, and pheasants.

Grub (or grubbed): to clear by digging up roots and stumps.

Guild: group of organisms that exhibit similar habitat requirements and that respond in a similar way to changes in their environment.
Hotspots: areas, especially wetlands, where large numbers of waterfowl converge.

Hybridization: interbreeding between two different species, populations or genetically different individuals.

Indicator species: species, groups of species or species habitat elements that focus management attention on resource production, population recovery, population viability or ecosystem diversity; these species often have narrower habitat requirements that can be used to indicate the relative suitability of habitat for other species that share a similar preference e.g., marten is primarily a denizen of mature or overmature forest dominated by spruce.

Interspecific competition: two or more species that utilize and hence compete for similar resources, such as food or habitat space.

Intraspecific competition: two or more individuals within a population that compete for the same or similar resources, such as food or habitat space.

Keystone (management) species: species that have an effect on many other species in an ecosystem disproportionate to their abundance or biomass - can be predators, prey, plants, mutualists and habitat modifiers (e.g., beaver, pileated woodpecker)

Lek: a location in which birds congregate to perform group displays in order to attract and retain a mate.

Moult: the periodic shedding of feathers.

Neotropical migrants: species of birds that winter in tropical climates and breed within the temperate, boreal or arctic regions of North America.

Nest parasitism: a reproductive strategy in which one species lays their eggs in the nest of another species. The young of the parasite egg layer are raised by the host species. *See also* brood parasitism.

Niche: The unique environment needed to sustain the existence of an organism or species.

Organochlorides: organic compounds that contains chlorine, phosphorus and in some cases oxygen. These compounds are often used in pesticides such as DDT and other industrial chemicals such as dioxins.

Passerine: birds from the order Passeriformes; generally songbirds and perching birds. For the purposes of assessment, passerines are birds that do not belong to the other VEC groups outlined.

Proxy species: a species that may be used to replace or represent another species due to its similar functions and roles within an ecosystem.

Raptor: a predatory bird species with the physical traits adapted for grasping prey, sharp talons, and tearing flesh, hooked beak. The group of birds termed raptors includes the owls, falcons, eagles and hawks.

Slashburned: a method of habitat management that involves the deliberate burning of accumulated vegetation on the ground.

Snag: a standing tree which is 3 metres or greater in height and either partially dead, dead, or dying. This is further classified into hard snags and soft snags. A hard snag is a tree in which the wood is predominantly sound (possibly merchantable), covered in bark, and retaining its branches. A soft snag is a tree in which the wood is largely decayed, containing little to no merchantable timber. These trees are of particular importance to a variety of wildlife species, particularly cavity nesters.

Staging (area): an area where birds congregate to rest and occasionally feed, generally during spring and fall migration.

Streamer: A long stream of excrement from large birds such as raptors that are often expelled as a bird leaves a perch.

Setback: general term for buffer zones or more specific zoning requirements where a strip of land is delineated for no or modified activity. The width and configuration depend on the site and purposed intended.

Super canopy tree: a tree that is taller than the canopy.

Threshold: a point at which the ecosystem component of interest undergoes an unacceptable change or reaches an unacceptable level, either from an ecological or social perspective. See also benchmark.

Turbidity: A measure of water clarity, or the degree to which water is opaque due to suspended silt or other sediments.

Umbrella species: species with large area requirements. Conservation of these species should automatically conserve a host of other species e.g., grizzly bear.

7.1 LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AC	alternating current
AIC	Akaike Information Criterion
AN	audible noise
ATK	Aboriginal Traditional Knowledge
BS	black spruce
CCA	Canonical Correspondence Analysis
cm	centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
CWB	colonial waterbird
dbh	diameter at breast height
dc	direct current
EALB	Environmental Assessment and Licensing Branch
EMF	electric and magnetic fields
EOSD	Earth Observation for Sustainable Development of Forests
FPR	final preferred route
FRI	Forest Resource Inventory
ft	feet
GIS	Geographic Information System
GPS	Global Positioning System
GS	generating station
ha	hectare
HVdc	high voltage direct current
IBA	Important Bird Area
JP	jack pine
kg	kilograms
km	kilometres
km/h	kilometres per hour
kV	kilovolt
LCC	Land Cover Classification for Canada
LCCEB	Land Cover Classification of Canada, Enhanced for Bipole
m	metre
MB	Manitoba
MBCA	*Migratory Birds Convention Act*
MBCDC	Manitoba Conservation Data Centre
MESA	*The Manitoba Endangered Species Act*
mi	mile
mm	millimetres

MVA	mega volt amps
NA BBS	North American Breeding Bird Survey
NERC	North American Electric Reliability Corporation
NMS	Nonmetric Multidimensional Scaling
NOS	nocturnal owl survey
OPGW	optical protection ground wire
RI	radio interference
RM	rural municipality
RoW	right-of-way
SARA	*Species at Risk Act*
SSEA	Site Selection and Environmental Assessment
TK	Traditional Knowledge
TL	tamarack
USFWS	United States Fish and Wildlife Service
WMA	Wildlife Management Area
WS	white spruce

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9.0 APPENDICES

APPENDIX A

Legislation

Provincial Statues, Regulations and Guidelines

The Environment Act

The Bipole III development, following current guidelines of 230 kV or greater transmission lines being built, constitutes a "Class 3 development" under the Classes of Development Regulation (MR 164/88) of the *Environment Act* (C.C.S.M. c. E125). As a Class 3 development, Bipole III licensing requirements are as listed under Licensing Procedures Regulation (MR 163/88). Development proposals, (re Environment Act Proposals (EAP)), should indicate "potential impacts of the development on the environment, including… (ii) impact on wildlife" and (vi) impact on cultural resources" when submitted to the Environmental Assessment and Licensing Branch (EALB) for review.

Under the *Environment Act*, fulfilling the licensing requirements for a Class 3 development may:

> "Require the proponent to prepare and submit to the director an assessment report to include such studies, research, data gathering and analysis or monitoring, alternatives to the proposed development processes and locations, and the details of proposed environmental management practices to deal with the issues."

In many cases licensing of a Class 3 development will also entail public consultation to assess development impacts on the public and where resulting issues can be resolved.

The Wildlife Act

The Wildlife Act (C.C.S.M. c. W130) indicates that the destruction or harassment of wildlife outside of licensed activities and pursuant to specific exemptions is a violation of this act and where offences are punishable through summary conviction. The designation and maintenance of Wildlife Management Areas (WMA) in Manitoba is also done through this act which indicates, as section 3(1):

> "Unless otherwise provided by this Act or the regulations, the designation of an area for the better management, conservation and enhancement of the wildlife resource of the province in accordance with section 2 does not limit or affect the uses and activities that may be undertaken in the area, and the Minister may make such regulations as the Minister considers appropriate
>
> (a) respecting the use, control and management of an area;
>
> (b) authorizing, regulating or prohibiting any use, activity or thing in an area;
>
> (c) authorizing the construction, operation and maintenance of any building, structure or thing in a wildlife management area."

This would indicate that the Bipole III development, which is likely not pursuant to the better management, conservation and enhancement of wildlife species, may be limited in transmission line and transformer station placement based on preexisting WMA boundaries and accessibility.

Manitoba Endangered Species Act

The *Manitoba Endangered Species Act* (C.C.S.M. c. e111) protects and enhances the survival of threatened and endangered species listed by the Manitoba government. It is considered binding to the Crown where, under section 10(1),

> "No person shall:
>
> (a) kill, injure, possess, disturb or interfere with an endangered species, a threatened species, or an extirpated species that has been reintroduced;
>
> (b) destroy, disturb or interfere with the habitat of an endangered species, a threatened species or an extirpated species that has been reintroduced; or
>
> (c) damage, destroy, obstruct or remove a natural resource on which an endangered species, a threatened species or an extirpated species that has been reintroduced depends for its life and propagation."

There are however some exceptions, under section 10 (2), where subsection (1)

> "Does not apply to a person:
>
> (a) who acts under the authority of a permit issued by the Minister under section 11;
>
> (b) who is exempted from the application of this Act under section 12; or
>
> (c) who acts under the authority of a licence issued under *The Environment Act*, if the Minister is satisfied with respect to the matters described in clauses 12(1)(a) and (b). "

This would indicate that some possible exceptions are available in the construction of Bipole III in areas where threatened and endangered species are encountered. However, the presence of such species and their abundance should be fully disclosed in conducting environmental assessments where licensing procedures outlined under *The Environment Act* can mitigate any potential impacts on the persistence of these species.

Federal Statues, Regulations and Guidelines

Canadian Environmental Assessment Act

At the federal level, the *Canadian Environmental Assessment Act* (1992, c.37) permits development projects in the use and alteration of crown lands. The Canada-Manitoba Agreement of Environmental Assessment Cooperation has mitigated some overlaps in the environmental assessment process where federal and provincial licensing requirements can be jointly met for Crown lands which fall into each of these jurisdictions.

Migratory Birds Convention Act

The Migratory Birds Convention Act (MBCA) (1994, c.22) is of importance to Bipole III development through the potential for habitat alteration, increased transmission line/migratory bird collisions and increased hunter access. Mitigating these impacts should be considered important in conserving avian fauna as well as facilitating a bilateral relationship with the United States as a 1917 agreement between the Canadian and American governments led to this act's ratification. While the MBCA does entail the protection of migratory bird and songbird species, including through the creation of migratory bird sanctuaries, it does not protect those species that had been once labeled as nuisance species including hawks, owls, crows and cormorants, which are alternately under provincial jurisdiction. There are no federally legislated migratory bird sanctuaries in Manitoba.

Species at Risk Act

The designation of species under the federal *Species at Risk Act* (SARA) (2002, c.29) prohibits the disturbance or destruction of species listed as extirpated, endangered or threatened along with their habitats. The listing of species is based on recommendations by an interdisciplinary Committee on the Status of Endangered Wildlife Species in Canada (COSEWIC) through interpretation of both scientific information and holistic knowledge to the federal Minister of the Environment. Species successfully listed then require recovery strategies be written surrounding their long- and short-term preservation as well as the protection of critical habitat areas.

While the conservation of migratory bird and songbird species is provided for by the MBCA and aquatic species by the *Fisheries Act*, respectively, the conservation of all other species largely falls into provincial jurisdictions. Where provincial standards are not deemed acceptable in the conservation of extirpated, endangered or threatened species, sections 34(2) and (3) of SARA indicate:

- The Minister must recommend (to the Governor in Council) that the order (to apply in lands in a province that are not federal lands) be made if the Minister is of the opinion that the laws of the province do not effectively protect the species or the residences of its individuals.
- The federal Environment Minister can legislate what it deems appropriate management actions in the conservation of listed species residing in a province's jurisdiction. This indicates the relative importance of conducting rigorous environmental assessments with a focus on the impact of development projects and how potential impacts on threatened and endangered species can be mitigated.

The Canada Wildlife Act

The Canada Wildlife Act (1994, c.23) is mainly involved in the provision and maintenance of protected areas for the protection of certain wildlife species. This includes the maintenance of migratory bird sanctuaries under the *Migratory Birds Convention Act*, protected marine areas, and National Wildlife Areas (NWAs). For the conservation of endangered wildlife species under section 9(1), the *Canada Wildlife Act* permits the federal Minster of Environment to lease or purchase land areas of importance to wildlife conservation with the agreement of provincial powers. This limits the usefulness of purchased or leased lands for other purposes, other than those suited to conservation where the proper permission has been granted. Provided acquiescence with federal standards on the treatment of protected areas, the influence of the *Canada Wildlife Act* should not deter ongoing development projects following provincial and federal environmental assessment guidelines.

APPENDIX B

Alternative Route Analysis

General Principles for Evaluating Alternative Routing

An ecosystem-based approach was used to conduct the alternative routing exercise for bird communities. The approach recognized that environmental components such as bird populations and habitats of interest in the Project Study Area are part of much larger ecosystem(s).

The selection of VECs and broad habitats allowed for a more manageable evaluation of the environment. As identified at the time, VECs were those bird species that are protected by legislation, acts or regulations, species with special requirements, species at increased risk of significant and measurable effects from the construction and operation of a transmission line, or those species affected by cumulative effects in their environment. VEC habitats evaluated included potential locations where species were expected to live (i.e., defined by spatial and temporal boundaries). Time and space considerations were used where possible in the assessment of the alternative routes, as birds use different types of habitat and are found at different geographical locations at different times of the year.

Habitat connectivity, bird populations, and the maintenance of existing and future core areas are also important ecological considerations. Habitat connectivity has been defined by Parks Canada (2009) as "allowing for the conservation or maintenance of continuous or connected habitats, so as to preserve movements and exchanges associated with the habitat." It is likely that the Bipole III transmission line may converge with important habitats, such as core areas with high levels of connectivity, resulting in some habitat fragmentation, that is, the breaking apart of connected habitat, independent of habitat loss (Tischendorf 2005). The analysis of core areas and of fragmented habitats allowed for recommendations from the routing process that would take advantage of areas where wildlife and habitat are wide-ranging and common, while avoiding rare or uncommon habitats. See *Bipole III Transmission Project: Summary Report for Alternative Route Analysis* for complete details.

Data Used and General Application for Routing Evaluation

In order to assess the alternative routes for the Bipole III Project, select bird data were consolidated and incorporated into Arc View GIS software for analyses. Data were analyzed in conjunction with the proposed routing options developed for the Bipole III Project. The primary data used to evaluate the route were:

- Route A, B and C (Manitoba Hydro);
- LCCEB (MMM Group Ltd. and Joro Consultants Inc.);
- Waterfowl **hotspot** data (Ducks Unlimited);

- Colonial waterbirds and other bird group concentrations (e.g., **gallinaceous** birds) (Manitoba Conservation Data Centre, Ducks Unlimited and field data);
- Important Bird Areas (IBAs) (Bird Studies Canada);
- Species at risk locations (Manitoba Conservation Data Centre and 2009 field data);
- Bird of prey migration corridors (field data and existing maps);
- Canadian Land Inventory for waterfowl; and,
- LCCEB broad habitat data – broadleaf, coniferous, and mixedwood forests, wetlands, and grasslands.

Evaluation of Alternative Routes

A three-mile buffer was created along the polyline route shapefiles and the resulting polygon was dived into 49 nodes and 81 segments. Nodes were points of intersection between alternative routes while segments were the sections between nodes. Each segment and node was assessed for species habitats, core habitats, and degree of fragmentation in order to determine the potential degree of effect (i.e., categorically rated as low, moderate, high) each would have if the Bipole III Transmission Line was sited at that location.

Features and Species Based Assessment

The criteria for assessing the degree of effect of a segment using various features are outlined below:

- The degree of potential effect was scored at 25 for any segment or node that overlapped any Provincial Park, National Park or Ecological Reserve;
- The degree of potential effect for IBAs, Ducks Unlimited waterfowl hotspots, bird colonies, migration corridors, and predicted pair waterfowl densities was based on the amount of the feature the line overlapped. Where overlap was less than 5% the degree of effect was scored at 1. Where overlap was greater than or equal to 5% and less than 25% degree of effect was scored at 5. Where overlap was greater than or equal to 25% degree of effect was scored at 10; and
- The degree of potential effect was scored at 10 for any segment or node that overlapped Provincial Forests, Wildlife Management Areas, Manitoba Habitat Heritage Corporation lands, Ducks Unlimited projects, Manitoba Wildlife Federation lands, and Nature Conservancy of Canada properties.

Habitat models for the Local Study Area were generated for each VEC using ArcGIS software. Species' ranges and habitat requirements were derived from Altman and Sallabanks (2000), Buehler (2000), Bull and Jackson (1995), Connelly *et al.* (1998), Confer (1992), Conway (1999), Franzmann and Schwartz (2007), Manitoba Avian Research Committee (2003), Mowbray *et al.* (2002), Robbins and Dale (1999), Rusch *et al.* (2000), and Tacha *et al.* (1992). Predictive habitat model criteria were developed using professional judgment. Refer to the *Bipole III Transmission Project Summary Report for Alternative Route Analysis*, Section 3.5 and Appendix B for descriptions of criteria used in the development of each species model.

The amount of habitat for each species overlapped by the buffered segments and nodes was calculated and the proportion of habitat potentially affected was compared to the amount of available habitat in an ecodistrict. Where segments or nodes were found in multiple ecodistricts, the proportion of habitat affected in each ecodistrict was summed to determine the total proportion of habitat affected by the segment or node. A description of ecodistricts in the Project Study Area can be found in Szwaluk *et al.* (2009). The criteria for assessing the degree of effect of a segment using species models are outlined below:

- Where the total segment overlap was less than 5% the degree of effect was scored at 1;
- Where the total segment overlap was greater than or equal to 5% and less than 25% degree of effect was scored at 5; and
- Where the total segment overlap was greater than or equal to 25% degree of effect was scored at 10.

The results were grouped into four categories and the scores for each segment or node were summed for a Total Effect Score for each segment and node. The Total Effect Score was divided by the segment or nodes area, giving a Standardized Effect Score (Total Effect Score/km^2). The four categories were generally grouped in the following manner:

1. Parks and Reserves – National Parks, Provincial Parks, and Ecological Reserves;
2. Bird Focused Areas – IBAs, Ducks Unlimited projects, Ducks Unlimited waterfowl hotspots, bird colonies, migration corridors, and predicted pair waterfowl densities;
3. Other Conservation Areas – Manitoba Wildlife Federation lands, Manitoba Habitat Heritage Corporation lands, Nature Conservancy of Canada lands, Wildlife Management Areas, and Provincial Forests; and
4. VEC – all VEC bird habitats.

Feature and Species Based Segment and Node Assessment

<u>Routes A, B and C and Connector Segments and Nodes</u>

Using the Total Effect Scoring system for birds, very high degrees of potential effect were found on three proposed segment/nodes, seven had a high degree of effect, nine segments/nodes had moderate degrees of effect, and one hundred and eighty-seven segments/nodes had a low degree of effect. Using the Standardized Effect Score for birds, six segments/nodes had very high degree of effect, fourteen had high degrees of effect, twenty had moderate degrees of effect, and one hundred and sixty-six had low degrees of effect.

One hundred and fifty-nine segments or nodes had a low degree of effect based on Total Effect Score and on Standardized Effect Score. These segments/nodes did not overlap parks and reserves or conservation areas considered to be of high importance for bird population refuges. Additionally, these segments/nodes rarely overlapped bird focus areas and when they did it was proportionally small. Finally, these segments/nodes did not overlap significant proportions of bird habitat as identified using the VECs.

Segment Core Communities Assessment

Routes A, B and C and Connector Segments and Nodes

The avoidance ranks of most segments in all five core communities along Route A were low or moderate. Segments with high avoidance ranks were found in all core communities, with the most identified in broadleaf forests and wetlands. Segments with very high avoidance ranks were identified in two to four core communities depending on the route.

Segment Fragmentation Assessment

Routes A, B and C

No segment on any Route had an avoidance rank of very high, twenty seven were high, four moderate and forty-five low.

Connector Segments

Connector Segments and Nodes

For connector segments, one segment had an avoidance rank of very high, six high, zero moderate and 15 low.

Summary of the Final Preferred Route for Birds

The alternative route selection process resulted in the selection of the FPR. In some cases, the creation of new segments, were considered along with the three primary routes. Many considerations were used in the selection process, including considerations for many biophysical and socio-economic elements. The selection process for birds resulted in avoiding bird habitats and populations with the highest level of concern wherever possible. As a result of the overall route selection process, the FPR has one of the lowest potential impacts towards bird populations and habitats, and as may be measured within the constraints of the selection processes. In particular, areas which are important for birds, such as IBAs, WMAs and Ducks Unlimited hotspots, were avoided where possible. The Pas & Surrounding Area IBA and the Tom Lamb WMA was the only case where avoidance was not possible; however the route was adjusted to follow pre-existing linear features through these areas, which is expected to minimize the Project’s footprint and potential effects on bird populations and habitats in these areas. Consequently, one of the most influential mitigation measures for the Bipole III Project was during the preferred route selection process, and together with considering other biophysical and socio-economic concerns, resulted in a route having the least potential effects on the environment.

APPENDIX C

Sample Data Sheets

DATA SHEET C-1: NOCTURNAL OWL SURVEY DATA SHEET

Date	Route	Visit #	Crew	Stop	Time	Odometer Reading	Traffic Count	Noise Level	Species	Direction to Owl	Distance Category	Wpt Name	Comments

DATA SHEET C-2: RAPTOR MIGRATION SURVEY DATA SHEET

OBSERVER ______________________________ MO____DAY____

TIME (24 Hour)	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
Wind Speed														
Wind Dir. (From)														
Temp. (Deg. C)														
Cloud Cover														
Visibility														
Precipitation														

Municipality	RM_ Wpt	Time (Hr Min)	Time Block	Species	Indiv. or Flock	# of indiv.	Sex	Age	ID	Local or Migrant	Flight Direct (From)	Flight Direct (To)	Height of Flight (m)	Height of pass.	Distance from Observer	Direct. from Observer	Other

DATA SHEET C-3: COLONIAL WATERBIRD SURVEY DATA SHEET

Date	Crew	Waypoint	Species	Sign Type	Number	Comments	Weather	Type

Include: aircraft type, speed, height, distance from colony, photograph (as possible).

DATA SHEET C-4: WATERFOWL SURVEY DATA SHEET

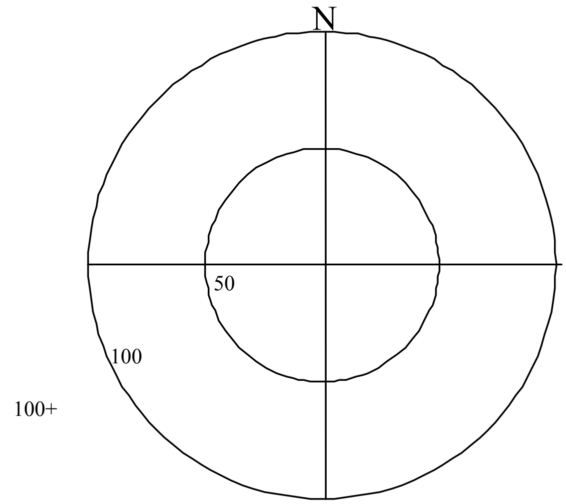
Date	Crew	Waypoint	Species	Sign Type	Number	Comments	Weather	Type

Include: aircraft type, speed, height, distance from group, photograph (as possible).

DATA SHEET C-5: BREEDING BIRD POINT COUNT DATA SHEET

Date: ____________________
Waypoint: ____________________
Time and Initials: ______________
Waypoint Taken: ______________

Habitat and other comments:
____
____
____
____



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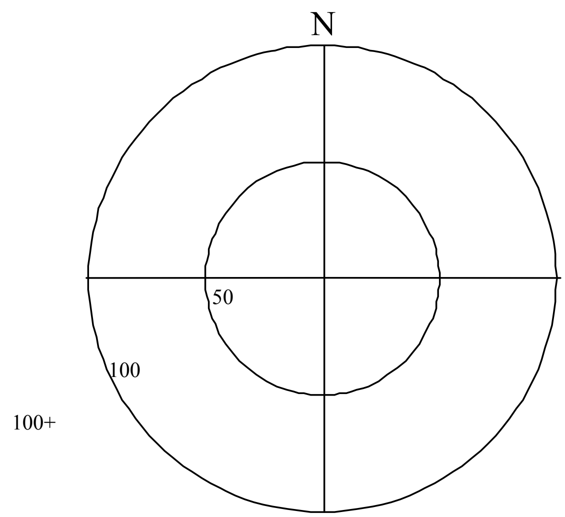
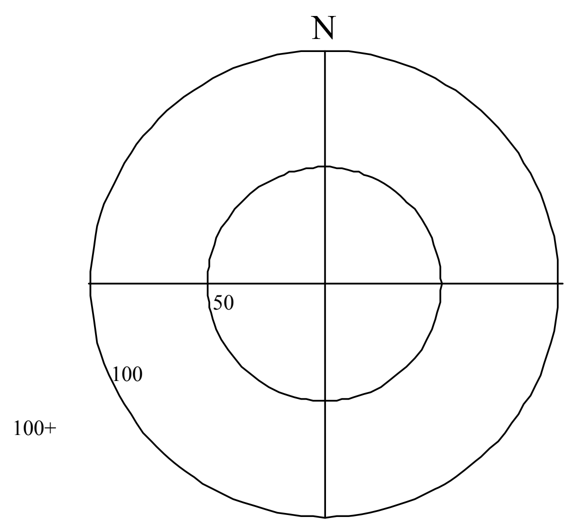
Waypoint: ____________________
Time and Initials: ______________
Waypoint Taken: ______________



Date: ____________________
Waypoint: ____________________
Time and Initials: ______________
Waypoint Taken: ______________



APPENDIX D

Habitat Models

Mallard

Use of study area resources:

The breeding range of mallards is potentially province-wide (Baydack and Taylor 2003) particularly in wetland areas; in particular the prairie pothole region of Manitoba located in the Lake Manitoba Plains and Aspen Parkland Ecoregions.

Habitat requirements:

Mallards typically occupy bodies of water of various sizes throughout their breeding and wintering range (Kowalchuck 2000; Drilling *et al*. 2002). While adaptable (Baydack and Taylor 2003), these birds have been shown to avoid nesting in cropland areas (Greenwood *et al*. 1995); which have been expanding in Canada since the 1950s (Miller 1996). Short-term wetlands created through seasonal precipitation rates has also been linked to increased mallard distributions (Bethke and Nudds 1995); although the monitoring of these areas is often difficult (Miller *et al*. 2000).

Boreal forest wetlands in Canada and Manitoba are important secondary breeding grounds for mallards (Drilling *et al*. 2002). In forested areas mallards tend to nest under low-growing shrubs, fallen logs, dead treetops, at the base of hollow trees, and in abandoned crow or raptor nests (Drilling *et al*. 2002).

Forage:

Mallards are dabbling ducks that often feed on underwater vegetation and surface insects (Gunnarson *et al*. 2006) and utilize shallow wetlands or the shallow margins of deep wetlands for these items (Drilling *et al*. 2002). In addition, agricultural areas are often utilized, particularly in winter ranges, where grain and corn crops are actively foraged (Drilling *et al*. 2002; NatureServe 2010).

Area requirements:

Generally, wetland availability corresponds to higher rates of population growth for mallards in the prairie-parkland region of Manitoba (Miller 1986). Various thresholds have been identified for the potential of ponds and wetland areas to be used as breeding areas based on proportions of agricultural areas located nearby. Higgins (1977) indicated that areas with more than 85% intensive agriculture are unsuitable mallard breeding habitat where Greenwood *et al*. (1995) identified 63% tilled habitat as a threshold. Miller *et al*. (2000) also indicated mallard production, based on habitat quality and varying demographic factors, as varying based on geographic areas; with mallard success in eastern Canada strata (including Manitoba) largely predicated by spring temperature and pond variables in comparison with western Canada strata (agricultural variables) and the United States (pond variables exclusively).

The size of mallard home range varies by sex and habitat type; in forested areas of northern Minnesota females' average home range was 210 ha and 240 ha for males (Gilmer *et al*. 1975). In the prairie pothole region of Minnedosa (Titman 1983) found the average size to be 9.2 ha, with habitat size to be dependent on the density of the mallard population in the area.

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Derived habit modelling for mallard using available LCCEB habitat classes was done where available wet_types were selected to constitute wetland habitat along with LCCEB habitat classes for wetland shrub, wetland herb and water. In indicating the potential for occurrences of mallards based on agricultural areas, LCCEB habitat types for annual crops, perennial crops and pasture and grassland were also used in modelling. As the range of mallards is potentially province-wide (Baydack and Taylor 2003), no geographic restrictions were using in modelling suitable habitat areas along the Bipole III corridor.

The final derived model for mallard contained the following terms based on available LCCEB habitat information:

(("WET_TYPE" = 'Wetland complex (peat and non-peat forming)' OR "WET_TYPE" = 'Patterned, open fen (<10% tree cover)' OR "WET_TYPE" = 'Non-patterned, open to shrubby fen (<10% tree)' OR "WET_TYPE" = 'Marsh' OR "WET_TYPE" = 'Bog and fen complex' OR "WET_TYPE" = 'Shallow open water, marsh and swamp complex') AND ("COVTYPE" = 100 OR "COVTYPE" = 110 OR "COVTYPE" = 121 OR "COVTYPE" = 122)) OR "COVTYPE" = 82 OR "COVTYPE" = 83 OR "COVTYPE" =20.

Photos 1 and 2 (below) are representative of mallard habitat.

Sandhill Crane

Use of study area resources:

Sandhill crane distribution in Manitoba is potentially province-wide where flocks congregate in agricultural-forest transitions areas (Holland *et al*. 2003b) and where suitable wetland nesting areas are available.

Habitat requirements:

During the breeding season, sandhill cranes favour habitat with grain fields interspersed with shallow wetlands for roosting (Iverson *et al*. 1987). Tacha *et al*. (1992) identified areas of tall vegetation adjacent to sloughs, and sedge marshes in otherwise wooded areas as favoured sandhill crane nesting habitat.

Seasonal flooding can enhance the attractiveness of habitat areas including wet hay meadows and ephemeral wetlands although static water levels are often required (Tacha *et al*. 1992). Other areas of potential sandhill crane habitation include sandy and peat soils (Tacha *et al*. 1992).

Forage:

Sandhill cranes feed on small animals as well as plant material with their diet consisting generally of roots, tubers, seeds, berries, mice, birds, small reptiles, amphibians and insects (NatureServe 2010). During the fall migration sandhill cranes roost in shallow water bodies near to agricultural fields for feeding (Tacha *et al*. 1992).

Area requirements:

The nesting success of sandhill cranes is largely dependent on warm spring temperatures combined with suitable water depths (50 to 80 cm) (Ivey and Dugger 2008). Predation has not been found to strongly influence nest success (Ivey and Dugger 2008) although sandhill cranes avoid human disturbance (Tacha *et al*. 1992). Nesting and rearing of young in Manitoba has been predominately observed in fens with nests built of emergent vegetation on the surface of hummocks (Holland *et al*. 2003b).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Sandhill cranes are associated with wetlands and open grasses with pools of standing water. The sandhill crane model is a combination of covertypes and wet_type. The covertypes used for the model include all wetland types as well as grasslands. All wet_types that indicated the presence of a wetland complex, or open water, were also used. These variables are intended to model sandhill crane nesting habitat.

The final derived model for sandhill crane followed the form:

("COVTYPE" =110 AND ("WET_TYPE" = 'Marsh, swamp and shallow open water complex' OR "WET_TYPE" = 'Shallow open water' OR "WET_TYPE" = 'Shallow open water, marsh and swamp complex' OR "WET_TYPE" = 'Wetland Complex (peat and non-peat forming)')) OR "COVTYPE" = 80 OR "COVTYPE" = 81 OR "COVTYPE" = 82 OR "COVTYPE" = 83)

Photos 2, 3, and 4 (below) are representative of sandhill crane habitat.

Great Blue Heron

Use of study area resources:

Great blue heron are present over a large portion of the province (Koonz 2003c) including the Lake Manitoba Plain, Interlake Plain, mid-Boreal Lowland, Churchill River Upland and Hayes River Upland ecoregions. Great blue heron presence in these ecoregions can be based on pre-existing colony locations as well as the availability of viable lake and wetland habitat areas.

Habitat requirements:

Great blue heron breeding areas are associated with wetland habitat as well as sparse and open deciduous and coniferous forest stands (Cottrille and Cottrille 1958; Koonz 2003c). Colony areas, sometimes based in large trees, are potentially used over many years (Koonz 2003c) and are near foraging areas (Gibbs 1991). Breeding habitat and colony locations are more commonly associated with undisturbed marsh, wetlands, and open water bodies than areas disturbed by human activities such as agriculture and residential development (Gibbs and Kinkel 1997).

Forage:

The typical diet of the great blue heron consists of mainly fish and aquatic animal species such as crustaceans and amphibians, however the consumption of small mammals and birds is not uncommon (Butler 1992; Davis 2001).

Area requirements:

The location of colonies is typically associated with the amount and quality of foraging habitat in the area (Gibbs 1991; Gibbs and Kinkely 1997). Although great blue heron can travel substantial distances to foraging areas, Gibbs (1991) found large colonies as often being found in proximity to multiple wetland complexes used for foraging.

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining at least one rookery during this period. The great blue heron model used a number of covertypes including mixedwood and broadleaf forests 60 years of age or older. Wetland treed is another covertype included in the model, however there was no age restriction on this covertype. Geographic restrictions on potential habitat use by this species were used in modelling including limiting habitat areas to only be within certain ecozones and ecodistricts where this species is potentially found.

The final derived model for great blue heron followed the form:

("ZONE_NAME" = 'Prairie' OR "ZONE_NAME" = 'Boreal Plain' OR "ZONE_NAME" = 'Boreal Shield' OR "ECODISTRIC" = 358 OR "ECODISTRIC" = 359 OR "ECODISTRIC" = 353 OR "ECODISTRIC" = 356 OR "ECODISTRIC" = 357 OR "ECODISTRIC" = 363 OR "ECODISTRIC" = 366) AND ("COVTYPE" = 81 OR ("COVTYPE" = 220 OR "COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 230 OR "COVTYPE" = 231 OR "COVTYPE" = 232 AND "LAND_AGE" >= 60))

Photo 5 (below) is representative of great blue heron habitat.

Bald Eagle

Use of study area resources:

Bald eagles are potentially found over the extent of Bipole III development. Nests are typically in old coniferous forest stands and in proximity to large bodies of water (Buehler 2000).

Habitat requirements:

Nests are usually constructed in large trees capable of supporting stick nests while providing eagles with a viewpoint of the surrounding area (Buehler 2000). When available nests are constructed in conifer trees, deciduous trees are utilized when conifers are absent (Buehler 2000).

Forage:

The diet of bald eagles in the boreal region is dominated by fish (Dzus and Gerrard 1993); however bald eagles are opportunistic scavengers and it is not uncommon to observe them feeding on roadkill also (Koonz 2003a).

Area requirements:

Bald eagle nests are commonly found in mature forests, usually within 2 km of a water body (this may be dependent upon the prey availability in the area) (Buehler 2000). When nesting in the vicinity of human activity bald eagles select nest sites at distance from the disturbance often including a visual buffer in the form of existing tree stands (Andrew and Mosher 1982). Territory sizes of nesting bald eagles in boreal regions on Minnesota averaged a distance of 670 m across water bodies and 400 m over land (Mahaffy and Frenzel 1987).

The availability of prey items within the home range of bald eagle pairs has been identified as the dominant factor regarding productivity of eagle nest (Dzus and Gerrard 1993).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover located nearby and is suitable for maintaining at least one nesting pair. The bald eagle model is based on land_age, covertype, and proximity to water. All forest covertypes older than 70 years of age and within 500 m of a lake were included in the model. The choice of 70 years of age was to allow for the development of super canopy trees for nesting. Lakes less than 2,000,000 m^2 in area were removed from the model as they are considered to be too small for bald eagles. While these variables primarily account for bald eagle use during the breeding season there is considerable overlap with habitat use during the rest of the year.

The final derived expert model for bald eagles follows the form:

("LAND_AGE" >= 70 AND ("COVTYPE" = 210 OR "COVTYPE" = 211 OR "COVTYPE" = 212 OR "COVTYPE" = 220 OR "COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 230 OR "COVTYPE" = 231 OR "COVTYPE" = 232))

Photo 6 (below) is representative of bald eagle habitat.

Ruffed Grouse

Use of study area resources:

Ruffed grouse are potentially found over the extent of Bipole III development but are typically concentrated in areas with young deciduous forest stands.

Habitat requirements:

Ruffed grouse are early successional forest specialists (Dessecker and McAuley 2001). Summer and winter habitat for this species is quite similar. However, there is a possible increased reliance on coniferous forest during the winter as it may provide additional cover at this time of the year (Rusch *et al*. 2000). Ruffed grouse are generally thought to avoid open areas where there is an increased potential for predation; particularly by raptors (Rusch *et al*. 2000) and includes clear-cut forest areas of a certain age (Blanchette *et al*. 2007).

Forage:

Typically ruffed grouse diets consist of leaves, seeds, berries and fruits in the spring and summer and twigs and buds in winter months (Rusch 2000). Foraging during breeding season often takes place in wet areas where rich herbaceous vegetation grows and is available as forage (Dessecker and McAuley 2001).

Area requirements:

Deciduous dominance in forested areas has been linked to suitable ruffed grouse habitat; particularly where aspen stands are present (Rusch *et al*. 2000). The loss of ruffed grouse habitat is due to reductions of early successional forests and shrub-dominated habitats (Dessecker and McAuley 2001).

Photo 7 (below) is representative of ruffed grouse habitat.

Model:

Broad habitat areas suitable for maintaining year-round life requisites are represented in the model; there is no expected difference in habitat selection between the breeding season and the rest of the year. The model assumes there is high quality forage and cover in each habitat category, and present in sufficinent quantities suitable for maintaining local sub-populations. Ruffed grouse are closely associated with aspen, particularly aspen dominant or aspen mixedwoods forests, and the model was based on these covertypes (i.e., broadleaf and mixedwood forests).

The final derived expert model for ruffed grouse follows the form:

"COVTYPE" = 220 OR "COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 230 OR "COVTYPE" = 231 OR "COVTYPE" = 232 or “COVTYPE”= 233

Sharp-tailed Grouse

Use of study area resources:

Sharp-tailed grouse are potentially found over the extent of Bipole III development but are typically concentrated in areas with young deciduous forest stands.

Habitat requirements:

Sharp-tailed grouse habitat can be typified through the presence of grassland, shrubland and forested areas (Berger and Baydack 1993, Taylor 2003a). Forested areas where sharp-tailed grouse are encountered are typically younger age with a proportion of aspen stands where this species is known to forage (Berger 1992).

Forage:

The diet of the sharp-tailed grouse shifts somewhat through the seasons. In the fall the sharp-tailed grouse diet consists of a mixture of agricultural grains, native plant seeds, leaves, berries, and some insects (Hamerstrom and Hamerstrom 1951). In winter months foraging is limited to buds, rose hips, and any remaining leaves and seeds while summer months are more diversified, with an abundance of grains, seeds, berries, leaves and insects (Hamerstrom and Hamerstrom 1951).

Area requirements:

Sharp-tailed grouse habitat can be typified through the presence of grassland, shrubland and forested areas (Berger and Baydack 1993, Taylor 2003a). The degradation of lands and land use changes (e.g., encroaching aspen woodlands, conversion to agriculture, and fire suppression) in Manitoba has been identified as the most likely cause of the decline in sharp-tailed grouse in the province (Berger and Baydack 1993).

Model:

Broad habitat areas suitable for maintaining year-round life requisites are represented in the model; there is an expected difference in habitat selection between the breeding season and the rest of the year. Sharp-tailed grouse habitat is typically defined by the presence of dense herbaceous cover and shrubs during the breeding season. Small patches of forest are typically used during winter for foraging and cover. The model assumes high quality forage and cover distributed among each habitat category represented within the habitat patch, and that these patches are suitable for maintaining local sub-populations. The sharp-tailed grouse model used a combination of covertypes including all grasslands, shrublands and forests less than 10 years of age. In addition, a minimum area for each habitat patch was established at 500,000 m^2.

The final derived expert model for sharp-tailed grouse follows the form:

"F_AREA" > 500000 AND (("COVTYPE" = 81 OR "COVTYPE" = 82 OR "COVTYPE" = 50 OR "COVTYPE" = 51 OR "COVTYPE" = 52 OR "COVTYPE" = 100 OR "COVTYPE" = 110 OR "COVTYPE" = 122) OR ("LAND_AGE" <= 10 AND ("COVTYPE" = 210 OR "COVTYPE" = 211 OR "COVTYPE" = 212 OR "COVTYPE" = 213 OR "COVTYPE" = 220 OR "COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 230 OR "COVTYPE" = 231 OR "COVTYPE" = 232)))

Photo 8 (below) is representative of sharp-tailed grouse habitat.

Pileated Woodpecker

Use of study area resources:

Pileated woodpeckers are potentially found over the extent of Bipole III development; particularly in areas with old-growth forest stands (Bull and Jackson 1995).

Habitat requirements:

The optimal habitat for pileated woodpeckers consists of mature and old growth conifer and/or deciduous forests, early successional forests that contain remnant large old growth trees, or standing dead trees also serve as potential habitat areas (Bull and Jackson 1995).

Forage:

The diet of the pileated woodpecker can be somewhat split into winter months, consisting mainly of tree boring ants, beetles and their larva, and in the summer months a more diverse selection of insects including flies, moths, ants, grubs and the remainder (approximately 25%) of the diet consisting of plant material (Hoyt 1957).

Area requirements:

Pileated woodpeckers are cavity nesters with cavities often constructed in poplars with a diameter at breast height of 30 cm and larger (Holland and Curtis 2003). Pileated woodpecker populations are limited through logging operations in mature and old growth forests that are necessary for roosting, foraging, and cover (Bull and Jackson 1995). Bull and Jackson (1995) also identified the fragmentation of old growth and mature forest stands as the likely factor in declining pileated woodpecker densities.

Model:

Broad habitat areas suitable for maintaining year-round life requisites are represented in the model. Pileated woodpeckers prefer forests in later stages of succession with trees with large basal area. The pileated woodpecker model used a combination of land age and covertype. Specifically, the model consisted of broadleaf forests and mixedwood forests equal to or greater than 60 years of age. These parameters are reflective of old growth mixedwood and broadleaf forests where large trees are likely to be found. Although there is an expected difference in habitat selection between the breeding season and the rest of the year, it was assumed that these differences were small. Older growth mixedwood and broadleaf forest at the stand-level are assumed to be suitable for maintaining at least one or more pairs.

The final derived expert model for pileated woodpeckers follows the form:

"LAND_AGE" >= 60 AND ("COVTYPE" = 220 OR "COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 230 OR "COVTYPE" = 231 OR "COVTYPE" = 232)

Photos 7 and 9 (below) are representative of pileated woodpecker habitat.

Least Bittern

Use of study area resources:

Least bittern distribution during breeding is season is limited to the southern extent of the province, notably the Lake Manitoba Plain Ecoregion.

Habitat requirements:

Least bitterns nesting habitat is commonly associated with wetland edges and tall dense emergent woody vegetation (Weller 1961; Gibbs *et al*. 1992).

Forage:

The typical diet of the least bittern consists of small fish, frogs, tadpoles, insects, and arthropods (Weller 1961). The foraging habitat of the least bittern consists of shallow wetlands with emergent vegetation that are used as platforms while preying upon small fish and other prey (Weller 1961).

Area requirements:

Nesting habitat consisting of live and dead emergent vegetation interspersed with open water results in the highest levels of nesting success for least bitterns (Post 1998). The least bittern favours breeding habitat of small wetlands containing dense, tall, emergent vegetation, with some small areas of open water and woody vegetation (Gibbs *et al*. 1992).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Least bitterns are associated with freshwater marshes with dense tall growth, particularly cattails. The least bittern model is geographically limited, with the northern extent along the west side of Lake Manitoba south of Winnipegosis (Ecodistrict 841) and includes only wetland covertypes. The variables used in this model reflect habitat use solely during the breeding season.

The final derived expert model for least bittern follows the form:

("ECODISTRIC" = 841 OR "ECODISTRIC" = 848 OR "ECODISTRIC" = 851 OR "ECODISTRIC" = 849 OR "ECODISTRIC" = 852 OR "ECODISTRIC" = 724 OR "ECODISTRIC" = 726 OR "ECODISTRIC" = 375) AND("COVTYPE" = 80 OR "COVTYPE" = 81 OR "COVTYPE" = 82 OR "COVTYPE" = 83)

Photos 1, 2, and 3 (below) are representative of least bittern habitat.

Yellow Rail

Use of study area resources:

Yellow rails are potentially found over the extent of Bipole III development where marshes and wetland areas are found.

Habitat requirements:

Breeding habitat is described as wet sedge meadows where sedge species are selected for and water depth surrounding the nest is at least 10 cm (Bookhout and Stenzel 1987; Bookhout 1995). In autumn drier habitats such as hay fields, grain fields, wet meadows and interior and coastal wetlands are selected (Bookhout 1995).

Forage:

The typical diet of yellow rail consists of snails, other aquatic invertebrates and seeds (Bookhout 1995).

Area requirements:

During the breeding season the average range of males is 7.8 ha and for females preincubation is 1.2 ha, but is much lower during incubation (0.3 ha) (Bookhout and Stenzel 1987).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Yellow rails are typically found in wet sedge meadows and marshes throughout Manitoba. The yellow rail model is based on a single covertype, wetland herb, and has no other restrictions. This model is based on habitat use by yellow rail during the nesting season.

The final derived expert model for yellow rail follows the form:

"COVTYPE" =83

Photo 3 (below) is representative of yellow rail habitat.

Ferruginous Hawk

Use of study area resources:

Ferruginous hawk distribution during breeding is uncommon and limited to extreme southwest of the province (De Smet 2003); notably the Aspen Parkland and Lake Manitoba Plain

Ecoregions.

Habitat requirements:

The selection of habitat by ferruginous hawks shows a preference for minimal agricultural land use, as areas with a high degree of agricultural activity show a substantial decline in ferruginous hawk populations (Schmutz 1989). Nest sites are commonly located above ground in trees and shrubs; however they will build nests on the ground where suitable locations are unavailable (Bechard and Schmutz 1995).

Forage:

The diet of the ferruginous hawk largely consists of ground squirrels (Schmutz *et al*. 2008); the availability of this prey item has been found to significantly affect nesting success (Bechard and Schmutz 1995).

Area requirements:

The home range of ferruginous hawk pairs has been found to have a mean size of 8.7 km^2, where the area within the home range is utilized for foraging purposes (Learly *et al*. 1998). The size of home ranges of ferruginous hawks is thought to be influenced by the availability of prey in the area. When habitats contain a low density of prey items home ranges may be larger as the hawks must forage further from the nest (Leary *et al*. 1998).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage (e.g., ground squirrel colonies) and suitable nesting trees in each habitat category, and in sufficinent quantities suitable for maintaining at least one pair during this period. Ferruginous hawks are typically found in open grasslands, sage bush, and shrublands, and avoid forest interiors in Manitoba. The ferruginous hawk model is geographically limited to southern Manitoba, with Highway 366 in Ecodistrict 753 representing its most northern range. The covertypes used in the model included shrubland, shrub tall, shrub low, grasslands, and perennial crops and pasture.

The final derived expert model for ferruginous hawk follows the form:

("ECODISTRIC" =753 OR "ECODISTRIC" = 759 OR "ECODISTRIC" = 757 OR "ECODISTRIC" = 847 OR "ECODISTRIC" = 848 OR "ECODISTRIC" = 850 OR "ECODISTRIC" = 758 OR "ECODISTRIC" = 854 OR "ECODISTRIC" = 849 OR "ECODISTRIC" = 851 OR "ECODISTRIC" = 724 OR "ECODISTRIC" = 726 OR "ECODISTRIC" = 375 OR "ECODISTRIC" = 852) AND ("COVTYPE" = 50 OR "COVTYPE" = 51 OR "COVTYPE" = 52 OR "COVTYPE" = 110 OR "COVTYPE" = 122)

Photos 4, 10, and 11 (below) are representative of ferruginous hawk habitat.

Burrowing Owl

Use of study area resources:

Burrowing owl distribution during breeding is uncommon and limited to extreme southwest of the province (De Smet 2003); notably the Aspen Parkland, Southwest Manitoba Uplands, and Lake Manitoba Plain Ecoregions.

Habitat requirements:

The burrowing owl is commonly associated with open landscapes including grasslands, deserts, pastures, and agricultural lands (Haug *et al*. 1993). The breeding habitat associated with burrowing owls includes treeless shortgrass prairies, with an abundance of small mammals (Haug *et al*. 1993). Small mammals almost always dig nest burrows utilized by burrowing owls originally, usually associated with a small hummock and bare ground or short grasses around entrances (Rich 1986).

Forage:

The typical diet of the burrowing owl consists primarily of small arthropods and occasionally small mammals and birds (Haug *et al*. 1993). Foraging behaviour of burrowing owls includes flights from a perch or the ground to flying insects or prey on the ground, hovering flights over prey on the ground and hunting prey by running and walking on the ground (Marti 1974).

Area requirements:

Burrowing owls have been observed nesting in loose colonies with distances between nest burrows ranging from 165 to 351 m and home ranges for breeding pairs averaging 2.41 km^2 (Haug and Oliphant 1990). Only the nest burrow itself is defended against intruders, foraging areas are not defended (Haug *et al*. 1993).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and soils suitable for burrows in each habitat category, and in sufficinent quantities suitable for maintaining at least one pair during this period. Burrowing owls are found in dry, open, short grass, treeless plains where they often use abandoned prairie dog burrows for nests. The burrowing owl model is geographically limited to southern Manitoba, with Highway 366 in Ecodistrict 753 representing its most northern range. The covertypes used in this model were grasslands and perennial crops and pasture.

The final derived expert model for burrowing owl follows the form:

("ECODISTRIC" =753 OR "ECODISTRIC" = 759 OR "ECODISTRIC" = 757 OR "ECODISTRIC" = 847 OR "ECODISTRIC" = 848 OR "ECODISTRIC" = 850 OR "ECODISTRIC" = 758 OR "ECODISTRIC" = 854 OR "ECODISTRIC" = 849 OR "ECODISTRIC" = 851 OR "ECODISTRIC" = 724 OR "ECODISTRIC" = 726 OR "ECODISTRIC" = 375 OR "ECODISTRIC" = 852) AND ("COVTYPE" = 110 OR "COVTYPE" = 122)

Photos 4 and 11 (below) are representative of burrowing owl habitat.

Short-eared Owl

Use of study area resources:

Short-eared owls are potentially found over the extent of Bipole III development where marshes and wetland areas are found (Holland and Taylor).

Habitat requirements:

Short-eared owls nest directly on the ground in sedges or grassland areas; usually with vegetation tall and dense enough to provide suitable cover (Hold and Leasure 1993). The short-eared owl is the only owl species known to construct their own nests, typically by scraping the ground and lining the depression with vegetation (Clark 1975). Short-eared owl presence is largely mediated based on the availability of prey items which most notably consist of small mammal species (Clark 1975).

Forage:

The typical diet of the short-eared owl in Manitoba consists primarily of voles, with other small rodents filling the remainder of the diet (Clark 1975). Typical short-eared owl hunting is done with a low slow flight over open landscapes, diving on prey when spotted (Clark 1975).

Area requirements:

Short-eared owls in Manitoba mainly breed in southern farmland and northern tundra areas (Holland and Taylor 2003c). Alternately, short-eared owls are thought to avoid large forested areas (Holland and Taylor 2003c). During the breeding season the short-eared owl's territory is associated with nesting and foraging behaviours and in Manitoba the mean territory size was reported as 97.65 ha (Clark 1975).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Short-eared owls are found in open country including large expanses of prairie and tundra, where they prey on a number of small mammals. The short-eared owl model had no geographic restrictions and used grassland, perennial crops and pasture, and wetland herb covertypes.

The final derived expert model for short-eared owl follows the form:

"COVTYPE" = 100 OR "COVTYPE" = 110 OR "COVTYPE" = 122 OR "COVTYPE" =83

Photos 1, 4, and 11 (below) are representative of short-eared owl habitat.

Common Nighthawk

Use of study area resources:

Common nighthawks are potentially found over the extent of Bipole III development where marshes and wetland areas are found (Holland and Taylor).

Habitat requirements:

During the breeding season common nighthawks nest in exposed areas; particularly where gravel is available, such as gravel roofs (Poulin *et al*. 2003; Taylor 2003j). Other nesting areas can include beaches, recently burned forests, prairie and sagebrush (Poulin *et al*. 2003). Habitat use by common nighthawk can encompass a range of habitat types including wetlands and open woodland areas (Poulin *et al*. 2003).

Forage:

The typical diet of the common nighthawk consists of flying insects, with a preference towards larger flying insects such as flying beetles, wasps, and moths while avoiding or not responding to small flies (Todd *et al*. 1998).

Area requirements:

The common nighthawk does not build a nest; the female lays her eggs directly on the ground, usually on loose stones or bare rock (Taylor 2003j). The laying of eggs has been documented from mid-June until late-July (Taylor 2003j). During the daytime common nighthawks roost in trees averaging 12 m high, most often on north facing slopes, which allow them to remain in cooler temperatures when compared to south facing slopes (Fisher *et al*. 2004).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Common nighthawks are most often seen overhead foraging for insects at dusk and dawn in both urban and wilderness environments. Common nighthawks nest in exposed areas such as beaches, recently burned forests, prairie, sagebrush, and especially on exposed areas and rock outcrops where they are camouflaged. The common nighthawk model consisted of the following covertypes: wetland herb, low shrub, grasslands, open and sparse coniferous, broadleaf and mixedwood forests, and burns (coniferous, broadleaf, and mixedwood dense covertypes less than 10 years of age).

The final derived expert model for common nighthawk follows the form:

("COVTYPE" =83 OR "COVTYPE" =52 OR "COVTYPE" =110) OR("COVTYPE" = 212 OR "COVTYPE" = 213 OR "COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 232) OR("COVTYPE" = 211 OR "COVTYPE" = 221 OR "COVTYPE" = 231 AND ("LAND_AGE" <= 10))

Photos 1, 4, 7, 9, 10, and 12 (below) are representative of common nighthawk habitat.

Whip-poor-will

Use of study area resources:

Whip-poor-will distribution during breeding is fairly common and limited to southern portion of the province including the Lake Manitoba, Interlake Plain and Mid-Boreal Lowland Ecoregions along the Bipole III project areas west of the (Taylor and Holland 2003a).

Habitat requirements:

Whip-poor-wills are common breeders throughout the southern boreal region of the province, extending from the southeastern corner of the province up to central Saskatchewan (Taylor and Holland 2003a). The favoured habitat of the whip-poor-will consists of deciduous and/or mixed-woods forests with a fairly open understory (Cink 2002).While nests are rarely observed during breeding season, calling adults are typically found in dry deciduous or mixed forests with little to understory (Cink 2002; Taylor and Holland 2003a).

Forage:

The whip-poor-will are most active at night, foraging for flying insects with the aid of moonlight, in the absence of moonlight the foraging behaviour of the whip-poor-will decreases and they may be inactive on especially dark nights (Cink 2002).

Area requirements:

Whip-poor-will’s habitat preference has been shown to be significantly associated with edge habitat of regenerating woodlands (Wilson and Watts 2008). The territory size of whip-poor-wills is not well studied but an average of 5.1 ha has been reported (Cink 2002).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Whip-poor-will are rarely observed visually, however their call is often heard. While nests are rarely observed, calling adults are typically found in dry deciduous or mixed forests with little to understory. The whip-poor-will model consisted of the following open and sparse broadleaf and mixedwood forests and a mineral wet_type. As whip-poor-will distribution in Manitoba is primarily limited to southern portions of the province (Taylor and Holland 2003a), viable habit areas were limited to those areas based on more southerly occurring ecoregions and ecodistricts.

The final derived expert model for whip-poor-will follows the form:

("REGION_NAM" = 'Interlake Plain' OR "REGION_NAM" = 'Lake Manitoba Plain' OR "REGION_NAM" = 'Aspen Parkland' OR "REGION_NAM" = 'Boreal Transition' OR "REGION_NAM" = 'Mid-Boreal Uplands' OR "REGION_NAM" = 'Southwest Manitoba Uplands' OR "ECODISTRIC" = 672 OR "ECODISTRIC" = 668) AND ("WET_TYPE" = 'Mineral') AND("COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 231 OR "COVTYPE" = 232 OR "COVTYPE" = 220 OR "COVTYPE" =230)

Photos 7 and 9 (below) are representative of whip-poor-will habitat.

Red-headed Woodpecker

Use of study area resources:

Red-headed woodpecker distribution during breeding is fairly common and limited to southern portion of the province including the Lake Manitoba, Interlake Plain and Mid-Boreal Lowland Ecoregions (Taylor 2003b).

Habitat requirements:

The red-headed woodpecker is uncommon in Manitoba, found in south of the boreal forest, preferring deciduous woodlands (Taylor 2003i). Nesting habitat favoured by red-headed woodpeckers includes relatively open deciduous woodlands with little to no understory (Conner 1976).

Forage:

The typical diet of the red-headed woodpecker consists of insects, wild fruits and seeds (Smith *et al*. 2000; Taylor 2003i). The red-headed woodpecker has also been observed storing food items such as seeds underneath bark of nearby trees in its foraging habitat (Pinkowski 1977).

Red-headed woodpeckers typically utilize the upper portions of the canopy in large trees when foraging (Williams 1975) and where nesting increases have been shown in areas following selective logging, and prescribed burns (King *et al*. 2007).

Area requirements:

The red-headed woodpecker requires relatively open deciduous woodland habitat containing mature trees with an open understory and canopy (King *et al*. 2007). Red-headed woodpeckers habitat use within Manitoba, during breeding season, is often associated with open woodland areas with little understory (Smith *et al*. 2000, Taylor 2003i).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining at least one or more pairs during this period. Red-headed woodpeckers prefer open woods, groves, and areas with scattered large trees in open places in southern Manitoba. As red-headed woodpecker distribution in Manitoba is geographically limited to southern portions of the province (Taylor 2003i), the red-headed woodpecker model was geographically limited, with the Red Deer River in Ecodistrict 717 marking the northernmost limit of their range. The covertypes used in this model included open and sparse mixedwood and broadleaf forests, with dense mixedwood forest included only in Ecodistrict 849 to account for forests along the Red, Rat, and Marsh rivers.

The final derived expert model for red-headed woodpecker follows the form:

("REGION_NAM" = 'Southwest Manotoba Uplands' OR "REGION_NAM" = 'Lake of the Woods' OR "REGION_NAM" = 'Interlake Plain' OR "REGION_NAM" = 'Boreal Transition' OR "REGION_NAM" = 'Lake Manitoba Plain' OR "ECODISTRIC" = 716 OR "ECODISTRIC" = 715 OR "REGION_NAM" = 'Aspen Parkland' OR "ECODISTRIC" =725 OR "ECODISTRIC" =726 OR "ECODISTRIC" =375) AND ("COVTYPE" = 222 OR "COVTYPE" = 223 OR "COVTYPE" = 220 OR "COVTYPE" = 232 OR "COVTYPE" = 233) OR ("ECODISTRIC" =849 AND "COVTYPE" =221)

Photograph 13 (below) is representative of red-headed woodpecker habitat.

Olive-Sided Flycatcher

Use of study area resources:

Olive-sided flycatcher distribution during breeding is uncommon in the boreal forest and could potentially be found throughout the length of Bipole III development (Koonz and Taylor 2003)

Habitat requirements:

Olive-sided flycatchers are found sparsely distributed south of the boreal forest tree-line in Manitoba and are usually found nesting and foraging near boreal forest bogs, wet areas, or recently burned stands (Altman and Sallabanks 2000; Koonz and Taylor 2003). In northern conifer forests the olive-sided flycatcher is most commonly found in edge habitats such as meadows, bogs, and clear-cuts, this appears to correspond with the availability of standing dead trees and remnant live trees that are important for singing and foraging perches (Altman and Sallabanks 2000).

Forage:

The typical diet of the olive-sided flycatcher consists of insects (ranging from bees and wasps to grasshoppers and dragonflies) (Altman and Sallabanks 2000). Foraging is exclusively done from a perch; a short flight to capture the prey item and a return to the same perch is common (Altman and Sallabanks 2000).

Area requirements:

Nesting pairs of olive-sided flycatchers have relatively large territories stretching to approximately 1.6 km/pair (Bent 1942). In habitat with dense visual buffers pairs were found nesting approximately 200 metres apart (Altman 1998).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Olive-sided flycatchers are found along the edges of natural and anthropogenic openings in coniferous, broadleaf, and mixedwood early successional forests. The olive-sided flycatcher model used covertypes for open and sparse coniferous, broadleaf and mixedwood forests with a land age of 20 years at most.

The final derived expert model for olive-sided flycatcher follows the form:

("COVTYPE" = 80 OR "COVTYPE" = 81 OR "COVTYPE" = 82 OR "COVTYPE" = 83 OR "COVTYPE" = 212 OR "COVTYPE" = 213 OR "COVTYPE" = 233 OR "COVTYPE" = 232 OR "COVTYPE" =223 OR "COVTYPE" =222 OR ("LAND_AGE" <= 20 AND ("COVTYPE" = 211 OR "COVTYPE" = 221 OR "COVTYPE" = 231)))

Photos 7, 9, and 12 (below) are representative of olive-sided flycatcher habitat.

Loggerhead Shrike

Use of study area resources:

Loggerhead shrike distribution during breeding is uncommon and limited to extreme southwest of the province (De Smet 2003c); notably the Aspen Parkland and Lake Manitoba Plain Ecoregions.

Habitat requirements:

The favoured breeding habitat of the loggerhead shrike consists of open landscapes such as pastures with fence/hedgerows, roadsides, agricultural fields, golf courses, and riparian areas (Yosef 1996). This open habitat is often associated with interspersed woody vegetation utilized for perching and foraging (Michaels and Cully 1998). During breeding loggerhead shrikes typically are found in grasslands (Yosef 1996; De Smet 2003c). Within Manitoba loggerhead shrike are not averse to some anthropogenic developments including fences and roads and are sometimes found in forest-lined croplands (De Smet 2003c).

Forage:

The typical diet of the loggerhead shrike consists predominately of insects, supplemented with larger prey items including small mammals, birds, amphibians and reptiles (Yosef 1996). The loggerhead shrike exhibits unique foraging and hunting behaviour in that upon capture, the prey is impaled on thorns, sharp branches, or barbed wire fences (Yosef 1996). Foraging by the loggerhead shrike is often undertaken by short flights to capture prey from a nearby perch, or less commonly from a hovering flight (Yosef and Grubb 1993).

Area requirements:

The loggerhead shrike typically nests in woody vegetation such as shrubs and trees that provide suitable cover and protection from predators (Porter *et al*. 1975). Loggerhead shrike may utilize nests constructed in previous years in pairs due to site fidelity and ease of maintenance compared to building a new nest (Yosef 1996).

The loggerhead shrike displays a strong tendency towards territorial behaviour with territory sizes averaging 9.3 ha with a range from 0.77 to 17.6 ha (Yosef and Grubb 1994). The size of loggerhead shrike territories is associated with the size of the prey base and suitable hunting perches within the local habitat (Yosef and Grubb 1994).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining one or more pairs during this period. Available LCCEB habitat class information used in deriving expert models included grassland and perennial crops & pastures. As loggerhead shrike distribution in Manitoba is primarily limited to southern portions of the province (De Smet 2003c), viable habit areas were limited to those areas based on more southerly occurring ecoregions and ecodistricts.

Loggerhead shrikes prefer open country with hedgerows, copses, scattered trees and tall shrubs, and fence posts. Their range is limited to southern Manitoba. As loggerhead shrike distribution in Manitoba is primarily limited to southern portions of the province (De Smet 2003c), the northernmost modelled limit was the Red Deer River in Ecodistrict 717 and only grassland and perennial crops and pasture covertypes were used. The known eastern loggerhead shrike population in Manitoba is currently limited to the urban areas of St. Paul, near the outskirts of Winnipeg. This limited range does not spatially overlap with the preferred route.

The final derived expert model for loggerhead shrike follows the form:

("COVTYPE" =110 OR "COVTYPE" = 122) AND ("ZONE_NAME" = 'Prairie' OR "REGION_NAM" = 'Boreal Transition' OR "REGION_NAM" = 'Mid-Boreal Uplands' OR "ECODISTRIC" = 717)

Photos 4 and 11 (below) are representative of loggerhead shrike habitat.

Sprague's Pipit

Use of study area resources:

Sprague's pipit distribution during breeding is rare and sporadic in the southwest portion of the province with some localized areas being relatively abundant (Holland *et al*. 2003a). To this extent the known Sprague's pipit range would interact with Bipole III to some extent, although minimally, across the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland Ecoregions.

Habitat requirements:

The Sprague's pipit inhabits the southwest of Manitoba as a common mixed-grass songbird most often associated with open grasslands (Holland *et al*. 2003a). Within pastures the Sprague's pipit is more often found in moderately to lightly grazed pastures as compared to heavily grazed pastures (Davis *et al*. 1999). The Sprague's pipit typically constructs their nests on the ground in dense, grasses with low forb densities; the nests are almost always constructed with a dome of grasses (Sutter 1997).

Sprague's pipit breeding habitat is often associated with undisturbed grassland and prairie areas (Robbins and Dale 1999) or mixed-grass prairies (Holland *et al*. 2003a). Sprague's pipit has also been identified as preferring well-drained habitat areas (Robbins and Dale 1999).

Forage:

The typical diet of the Sprague's pipit consists of insects such as moths (mainly larvae), grasshoppers, spiders, and flies (Maher 1979). The Sprague's pipit forages for insects on the ground by walking or running along the ground, gleaning insects off of vegetation (Robbins and Dale 1999).

Area requirements:

Territory sizes of the male Sprague's pipit in prime breeding habitat with high densities of pipits can be tightly packed (e.g. 5 territories in 5 ha in grasslands with no grazing) (Robbins 1998; Robbins and Dale 1999).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Sprague's pipits are open grassland birds endemic to dry grasslands in North America. While agricultural fields can be used by Sprague's pipit, native prairie grasses are preferred. In addition, the presence of shrubs, even in low densities, will result in Sprague's pipits avoiding the area. For the Sprague's pipit model, covertypes for grasslands and perennial crops and pasture were used along with a mineral wet_type.

The final derived expert model for Sprague's pipit follows the form:

("COVTYPE" =110 OR "COVTYPE" =122) AND "WET_TYPE" = 'Mineral'

Photos 4 and 11 (below) are representative of Sprague's pipit habitat.

Golden-Winged Warbler

Use of study area resources:

Golden-winged warbler distribution during breeding is rare and sporadic in the southwest portion of the province with some localized areas being relatively abundant (Edie *et al*. 2003a). To this extent the known golden-winged warbler range would interact with Bipole III to some extent, although minimally, across the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland Ecoregions.

Habitat requirements:

The habitat utilized by the golden-winged warbler consists of mainly edge habitat in forests, shrubby fields, bogs, and marshes (Confer 1992). Favoured nesting habitat consists of early succession of abandoned farmland, and recently cut forest areas (e.g., clear cuts of mature forest, power line rights-of-way that are not mowed), recent forest fires and blowdowns (Buehler *et al*. 2007).

Golden-winged warblers typically construct their nests at the base of forbs or stems of herbaceous plants, utilizing the leafy material as a form of cover (Confer 1992). Golden-winged warblers are forest edge species that nest in patches of scattered trees, herbs, and shrubs in grasslands, agricultural fields and wetlands (Confer 1992). Within Manitoba, golden-winged warblers have been categorized as inhabiting prairie-forest transition areas.

Forage:

The typical diet of golden-winged warblers consists of insects and grubs which are gleaned from the surface of plants while the warbler is in flight or from a perch from where the warbler probes plant material for grubs and caterpillars (Ficken and Ficken 1968).

Area requirements:

Golden-winged warbler territories are established and defended by males and typically range in size from 0.4 to 6.0 ha; the boundaries of these territories are formed by habitat features (such as dense stands/rows of trees) and/or by the proximity of other males (Confer 1992).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Golden-winged warblers are forest edge specialists that nest in patches of scattered trees, herbs, and shrubs in grasslands, agricultural fields and wetlands. The golden-winged warbler model used covertypes for all grassland types, open and sparse broadleaf forests, and wetlands with shrubs on mineral soils. In order to account for the broadleaf forest edge habitat, a 500 m buffer was created around the edge of forests adjacent to grasslands or wetlands. This created a 250 m edge into the forest and a 250 m edge into the adjoining habitat.

As golden-winged warbler distribution in Manitoba is primarily limited to southern portions of the province (Edie *et al*. 2003a) this model is also limited geographically and includes all ecodistricts south of The Pas.

The final derived expert model for golden-winged warbler follows the form:

("ECODISTRIC" = 375 OR "ECODISTRIC" = 672 OR "ECODISTRIC" = 674 OR "ECODISTRIC" = 709 OR "ECODISTRIC" = 714 OR "ECODISTRIC" = 715 OR "ECODISTRIC" = 716 OR "ECODISTRIC" = 717 OR "ECODISTRIC" = 718 OR "ECODISTRIC" = 724 OR "ECODISTRIC" = 726 OR "ECODISTRIC" = 751 OR "ECODISTRIC" = 753 OR "ECODISTRIC" = 757 OR "ECODISTRIC" = 758 OR "ECODISTRIC" = 759 OR "ECODISTRIC" = 766 OR "ECODISTRIC" = 839 OR "ECODISTRIC" = 840 OR "ECODISTRIC" = 841 OR "ECODISTRIC" = 843 OR "ECODISTRIC" = 844 OR "ECODISTRIC" = 847 OR "ECODISTRIC" = 848 OR "ECODISTRIC" = 849 OR "ECODISTRIC" = 850 OR "ECODISTRIC" = 851 OR "ECODISTRIC" = 852 OR "ECODISTRIC" = 854) AND ("COVTYPE" = 34 OR "COVTYPE" = 100 OR "COVTYPE" = 110 OR "COVTYPE" = 121 OR "COVTYPE" = 122 OR "COVTYPE" = 221 OR "COVTYPE" = 223 OR ("COVTYPE" = 82 AND "WET_TYPE" = 'Mineral'))

Photos 2, 4, and 7 (below) are representative of golden-winged warbler habitat.

Canada Warbler

Use of study area resources:

Canada warbler distribution during breeding in Manitoba is uncommon in the southern half of the boreal forest although fairly common in west-central Manitoba. To this extent Canada warbler range would interact with Bipole III in the Mid-Boreal Lowland Ecoregions and Churchill River Upland Ecoregions and, to a lesser extent in the Lake Manitoba Plain and Interlake Plain Ecoregions.

Habitat requirements:

The Canada warbler inhabits moist mixed-woods forests with dense and diverse understory growth often near to open water such as a lake or river (Conway 1999). Nesting habitat is usually associated with wet, mossy, forested areas; the nest itself is usually located in tree stumps, fallen logs, and dense ferns (Conway 1999). Nests are very well hidden and thus are usually inferred from adult behaviour, such as territorial singing, alarm calls, and carrying food (Holland *et al*. 2003c).

Forage:

The typical diet of the Canada warbler consists of insects and larvae at the lower levels of forest trees and shrubs, with an apparent reliance on spruce budworm populations (Sleep *et al*. 2009).

Area requirements:

Within their breeding range, Canada warbler habitat consists of forested deciduous and coniferous forest areas; particularly those areas with well developed understory (Conway 1999). Territory sizes of Canada warblers vary according to regional habitat conditions (Conway 1999); Martin (1960) observed territories of Canada warblers in black spruce dominated stands averaging 0.2 ha.

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Canada warblers are found in deciduous forests and to a lesser extent coniferous forests; however they are most prominent in mixedwood forests with a well developed understory. The Canada warbler model incorporated both open and dense broadleaf and mixedwood forests. As the range of Canada warbler is limited geographically (Holland *et al*. 2003c), the Canada warbler model is limited geographically, where the area around Snow Lake is the northern extent and the area around Pine Creek is the southern limit.

The final derived expert model for Canada warbler follows the form:

("COVTYPE" = 221 OR "COVTYPE" = 222 OR "COVTYPE" = 232 OR "COVTYPE" = 231) AND ("ECODISTRIC" = 716 OR "ECODISTRIC" = 717 OR "ECODISTRIC" = 718 OR "ECODISTRIC" = 709 OR "ECODISTRIC" = 840 OR "ECODISTRIC" = 674 OR "ECODISTRIC" = 839 OR "ECODISTRIC" = 715 OR "ECODISTRIC" = 714 OR "ECODISTRIC" = 674 OR "ECODISTRIC" = 672 OR "ECODISTRIC" = 668 OR "ECODISTRIC" = 669 OR "ECODISTRIC" = 667 OR "ECODISTRIC" = 666 OR "ECODISTRIC" = 665 OR "ECODISTRIC" = 664 OR "ECODISTRIC" = 358 OR "ECODISTRIC" = 359 OR "ECODISTRIC" = 357 OR "ECODISTRIC" = 663 OR "ECODISTRIC" = 843 OR "ECODISTRIC" = 844)

Photos 7 and 9 (below) are representative of Canada warbler habitat.

Rusty Blackbird

Use of study area resources:

Canada warbler distribution during breeding in Manitoba is uncommon in the central and northern boreal forest and would therefore be though to interact with Bipole III development in the Mid-Boreal Lowland, Churchill River Upland, Hayes River Upland and Hudson Bay Lowland Ecoregions.

Habitat requirements:

The rusty blackbird is an uncommon breeder in south central Manitoba, with favoured breeding habitat in wet boreal forest regions (Nero and Taylor 2003). These wet boreal forest habitats include the mixed woods regions north to the edge of the tundra, usually found near to wet areas such as bogs, fens, and riparian areas (Avery 1995).

Rusty blackbirds construct their nests in close proximity to water, above ground on stumps, shrubs and trees (Avery 1995). The nest itself is commonly constructed close to the trunk of a tree or shrub with dense foliage surrounding the nest to provide concealment (Avery 1995). In Manitoba rusty blackbirds are more commonly found nesting in the muskegs of the northern boreal forests (Nero and Taylor 2003). In Manitoba these birds are not colonial nesters, but may group together when disturbances are experienced (Nero and Taylor 2003).

Forage:

The typical diet of the rusty blackbird consists of insects, crustaceans, snails, amphibians, fish, seeds, and fruit (Hannah 2005). The foraging of the rusty blackbird is done predominately on the ground in the close vicinity of water bodies (Avery 1995).

Area requirements:

Rusty blackbirds are typically found in wet coniferous and mixedwood forests, particularly in open wet areas such as lake and stream edges, including areas affected by beaver flooding (Avery 1995).

Model:

Broad habitat areas suitable for nesting and brood-rearing are represented in the model. The model assumes there is high quality forage and cover in each habitat category, and in sufficinent quantities suitable for maintaining local sub-populations during this period. Rusty blackbirds are typically found in wet coniferous and mixedwood forests, particularly in open wet areas such as lake and stream edges, and beaver floods. In addition, rusty blackbirds can be seen in open areas in forests caused by burns. As the range of rusty blackbird is largely limited to northern Manitoba (Nero and Taylor 2003), the rusty blackbird model is geographically limited, with the southern limit in the area around Duck Mountain Provincial Park (Ecodistrict 715). The covertypes used in the model include all wetland types and all forest types less than 20 years of age to include burns.

The final derived expert model for rusty blackbirds follows the form:

("ECODISTRIC" = 715 OR "ECODISTRIC" = 714 OR "ZONE_NAME" = 'Boreal Shield' OR "ZONE_NAME" = 'Hudson Plain' OR "ZONE_NAME" = 'Taiga Shield' OR "REGION_NAM" = 'Interlake Plain' OR "REGION_NAM" = 'Mid-Boreal Lowland') AND("COVTYPE" = 80 OR "COVTYPE" = 81 OR "COVTYPE" = 82 OR "COVTYPE" = 83 OR ("LAND_AGE" <= 20 AND ("COVTYPE" = 210 OR "COVTYPE" = 212 OR "COVTYPE" = 213 OR "COVTYPE" = 233 OR "COVTYPE" = 232 OR "COVTYPE" =223 OR "COVTYPE" =222 OR "COVTYPE" = 211 OR "COVTYPE" = 221 OR "COVTYPE" = 231)))

Photos 9 and 13 (below) are representative of rusty blackbird habitat.

PHOTO 1: WETLAND HERB HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 2: WETLAND SHRUB HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 3: WETLAND TREED HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 4: PRAIRIE HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 5: CONIFEROUS MIXEDWOOD HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 6: RIPARIAN HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 7: DECIDUOUS HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 8: GRASSLAND/SHRUBLAND HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 9: MIXEDWOOD HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 10: SHRUBLAND HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 11: PASTURE HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 12: BLACK SPRUCE OPEN HABITAT FOUND IN THE PROJECT STUDY AREA

PHOTO 13: DECIDUOUS OPEN HABITAT FOUND IN THE PROJECT STUDY AREA

APPENDIX E

Statistical Analysis

METHODS

To assess the importance habitat classes on bird species in the Project Study Area a number of statistical tests were used on sampling data acquired from the 2010 breeding bird survey. These statistical tests were methodologically different and were used to validate results as well as provide a basis for inference on the importance of modelled habitat classes. Statistical techniques used included linear regression, nonmetric multidimensional scaling (NMS), hierarchical clustering and logistic regression.

DENSITY ESTIMATES

Bird density estimates were calculated by dividing the number of birds recorded in each plot by total area (3.14 ha) sampled. Data from the breeding bird survey were used where the estimated distance from the observer to an individual bird was less than or equal to 100 m. Calculations were specific to each ecoregion, habitat class, and a combination of these. Habitat-based density estimates were based on habitat found precisely at the centre of point count plots rather than the mosaic of habitats potentially present in the 100 m radius sampling circle. Density estimates were calculated as the number of birds per hectare for VECs.

LINEAR REGRESSION

Linear regression was used to interpret how habitat and geographic location affect species diversity. The number of bird species observed during bird bird surveys at plots for which LCCEB habitat class and geographic coordinate information was available was calculated. To account for geographic separation in the selection of habitat by species, regression calculations were done for each of six ecoregions. LCCEB habitat classes were grouped to avoid colinearity of data, which can lead to difficulties in correctly interpreting results (Zar 2010). Grouped variables used in linear regression can be found in Table E-1.

Table E-1. Variables modeled in linear regression analysis of species richness

Variable	Description
northing	Geographic location of sampling site (north-south axis)
easting	Geographic location of sampling site (east-west axis)
water	LCCEB class 20
open	Combination of LCCEB classes 33 & 34
shrub	Combination of LCCEB classes 50 & 51
wetland	Combination of LCCEB classes 80, 81, 82 & 83
herb	LCCEB class 100
grassland	LCCEB class 110
cropland	Combination of LCCEB classes 121 & 122

Variable	Description
coniferous	Combination of LCCEB classes 211, 212 & 213
broadleaf	Combination of LCCEB classes 221, 222 & 223
mixedwood	Combination of LCCEB classes 231, 232 & 233

A cube root transformation of species richness estimates was done to obtain a normal distribution and a Kolmogorov-Smirinov test for normality (Massey 1951) was used and indicated p-values ≥ 0.05. Constructed habitat variables and geographic variable considered for discussion were identified as significant at the $p \leq 0.05$ level where negative terms (-) indicated the variable having a negative impact on species richness and positive terms (+) having a positive impact on species counts. All calculations were performed in SYSTAT 11 (SYSTAT 2004).

NONMETRIC MULTIDIMENSIONAL SCALING

Nonmetric Multidimensional Scaling (NMS) was used to summarize species occurrences based on habitat availability at breeding bird survey plots. Bird species utilizing similar habitats were grouped based on their co-occurrence at survey plots or based on shared habitat characteristics. Identification of potential bird communities where then assessed by grouping birds on ordination plots.

The program PC-ORD (McCune and Grace 2002) was used for NMS calculations where bird species' presence was associated with habitat quantities at survey plots. NMS calculations performed on 2010 breeding bird survey data where LLCEB habitat information was available for the 3,351 point count plots surveyed and buffered to 250 m. As these plots were located in the six ecoregions in the Project Study Area, NMS calculations were performed at the ecoregion level to account for some variability in changing habitat and bird species distributions. To more accurately assess bird species' habitat relationships, only those species recorded at more than ten sampling locations were considered (Clarke 1993). A breakdown of LLCEB habitat class information can be found in Table 5.4-2.

Various PC-ORD settings were used for NMS calculations. The Beals smoothing transformation (McCune 1994) was applied to the data to account for variation in results due to the limited number of bird species recorded at individual plots. For NMS, the 'medium' autopilot mode used the best of 40 runs with the real data along with 50 runs of randomized data for a Monte Carlo test of significance (McCune and Urban 2002). The Sorensen (Bray-Curtis) distance measure was used. Monte Carlo tests were also used to indicate the relative 'stress level' in fitting ordination plots to bird species that are considered in assessing the general usefulness of developed ordination plots (McCune and Urban 2002).

CLUSTERING

Hierarchical clustering techniques were also used to assess the degree of similarity of bird species based on available habitat information. Dendrograms provided a visual representation of bird species community relationships in order to assess the relative degree of separation between groups. Clustering followed an agglomerative approach where from a starting point of considering all sampled species separately, groups were formed based co-occurences of species recorded at breeding bird survey plots in 2010 (Goodall 1973).

Clustering was done in the program PC-ORD. The distance measure setting was 'Sorensen distance' and the group linkage method was the 'Flexible Beta' method, as recommended by McCune and Urban (2002). Beals smoothing was used to interpret the data, as suggested in the use of presence/absence matrices where many zeros are present and datasets are sufficiently large (McCune 1994; De Caceres and Legendre 2008). Only those bird species recorded at a minimum of 10 plots were used in clustering to avoid spurious groupings (Clarke 1993).

Binary logistic regression analysis was conducted for bird species in each ecoregion; the most preferred habitat type for each species was selected and expressed using dendrograms.

LOGISTIC REGRESSION

Logistic regression calculations were used to identify the selection of specific habitat classes by bird species. Logistic regression calculations were based on ecoregion in order to account for changing habitat quantities and geographic variation. LLCEB habitat class information at plots surveyed during the 2010 breeding bird survey with point count locations buffered to a 250 m limit was used (Table E-2) .

Logistic regression habitat models were produced using a stepwise approach where habitat classes were added or removed when they provided useful information at a $p \leq 0.05$ statistical significance threshold (Peduzzi *et al.* 1980). Model selection incorporating a number of habitat variables was also validated using calculated Akaike Information Criterion (AIC) values in S 13 where low AIC scores were selected as better-fitting models (Burnham and Anderson 2002). All logistic regression calculations were performed in SYSAT 13.

Table E-2. Percentage of LCCEB habitat classes present at 2010 breeding bird survey point count locations (buffered to 250 m)

LCCEB Habitat Class	Lake Manitoba Plain (n=493)	Interlake Plain (n=628)	Mid-Boreal Lowland (n=677)	Churchill River Upland (n=246)	Hayes River Upland (n=807)	Hudson Bay Lowland (n=500)
’11-cloud’	0.1	0.0	0.0	0.0	0.0	0.0
’12-shadow’	0.0	0.0	0.1	0.0	0.0	0.0
’20-water’	2.5	0.5	1.8	1.7	2.3	0.8
’33-exposed’	0.1	1.1	1.7	0.9	1.8	1.0
’34-developed’	0.8	0.8	0.3	0.0	0.0	0.0
’50-shrubland’	0.0	0.0	0.0	0.0	0.0	0.0
’51-shrub-tall’	0.0	1.1	12.2	22.4	12.1	32.6
’80-wetland’	0.0	0.0	0.0	0.0	0.0	0.0
’81-wetland-treed’	0.3	7.3	7.3	7.2	8.1	2.6
’82-wetland-shrub’	12.7	18.3	16.6	12.3	9.6	19.2
’83-wetland-herb’	15.3	5.9	28.0	7.7	5.7	8.4
‘100-herb’	1.2	5.1	0.2	0.0	0.0	0.0
‘110-grassland’	29.0	6.2	0.3	0.0	0.0	0.0
‘121-annual-crops’	2.1	0.8	0.0	0.0	0.0	0.0
‘122-perenial crops & pasture’	0.2	1.9	0.0	0.0	0.0	0.0
‘211-coniferous-dense’	0.1	3.7	12.6	15.1	21.8	8.8
‘212-coniferous-open’	0.4	2.0	6.1	16.8	19.5	15.2
‘213-coniferous-sparse’	0.0	0.0	0.2	5.7	0.9	9.9
‘220-broadleaf’	2.6	0.0	0.0	0.0	0.0	0.0
‘221-broadleaf’-dense’	5.8	23.1	7.0	0.6	7.5	0.0
‘221-broadleaf’-open’	26.9	13.0	0.6	0.0	0.0	0.0
‘231-mixedwood-dense’	0.0	9.1	4.9	9.6	10.7	1.4
‘232-mixedwood-open’	0.0	0.0	0.0	0.0	0.0	0.0

Interpretation of results from logistic regression analysis occurred in habitat classes selected for by VEC species. Surveys considered for this purpose included the 2010 breeding bird and colonial waterbird surveys. Data from the 2010 breeding bird survey were used for nine VECs (Table E-3). Two species were considered based on in the 2010 colonial waterbirds survey data (Table E-4).

Table E-3 Number of sites with sampled VECs , including species at risk. based on 2010 breeding bird survey

	Sampling locations					
	Lake Manitoba Plain (n=493)	**Interlake Plain (n=628)**	**Mid-Boreal Lowland (n=677)**	**Churchill River Upland (n=246)**	**Hayes River Upland (n=807)**	**Hudson Bay Lowland (n=500)**
Mallard	67	37	17	< 10	< 10	< 10
Sandhill crane	51	38	57	< 10	21	16
Ruffed grouse	93	60	14	-	< 10	-
Pileated woodpecker	12	32	19	< 10	12	-
Olive-sided flycatcher	< 10	11	50	23	70	27
Canada warbler	< 10	30	23	-	< 10	-
Golden-winged warbler	-	20	-	-	-	-
Rusty blackbird	-	< 10	46	11	30	45
Yellow rail	24	< 10	16	-	-	-

Table E-4. Number of sites with sampled VECs based on 2010 colonial waterbirds survey

	Sampling locations						
	Lake Manitoba Plain (n=136)	**Interlake Plain (n=132)**	**Mid-Boreal Lowland (n=146)**	**Churchill River Upland (n=47)**	**Hayes River Upland (n=154)**	**Hudson Bay Lowland (n=17)**	**All Eco-regions (n=630)**
Bald eagle	3	2	18	3	27	0	53
Great blue heron	4	17	3	0	8	0	32

Assessment of habitat variables and their effect on population indicators and listed bird species was done using logistic regression analysis where habitat variables of importance could be assessed using calculated r^2 scores. r^2 scores demonstrate the extent of variability in species presence and absence based on tested variables. Naglekerke's r^2 was used as it adjusts calculated scores to be between 0 and 1 (Naglekerke 1991).

HABITAT MODELING

LCCEB-derived, literature-based, and expert opinion models that identify high quality habitat (e.g., semi-open forest and natural edge adjacent to wetlands) were developed for each VEC. Low quality habitats are not identified in these models. Most models were non-spatial in the sense that they did not incorporate the adjacency of other habitat types. Few exceptions include bald eagle (e.g., consideration for proximity to water) and golden-winged warbler (e.g., forests adjacent to grasslands or wetlands). Other variables used to define the models included land age, to accommodate for old growth and successional forest habitats, and wet_type, to account for habitats with specific degrees of wetness. Finally, in instances where bird ranges did not occur throughout the Local Study Area, habitat models were limited by ecodistrict or ecoregion.

Piping plover, Ross's gull, peregrine falcon, whooping crane, chimney swift, barn owl, and red knot are species at risk that may occur in Manitoba. Habitat models were not developed for these species because they are not expected to occur in the Local Study Area due to their breeding range limits, because they are rare transients, or because of particular habitat preferences, such as urban areas, where spatial overlap with the Footprint was highly unlikely to occur.

Habitat models were validated by examining species presence and absence within modeled habitat areas. This was done by counting survey points inside and outside modeled areas where species were observed as well as those where species were not found. This allowed a 2 x 2 contingency table to be constructed and used in demonstrating the predicative power of modeled habitat areas. The statistical test used in demonstrating model validity was a McNemar test (Zar 2010) where statistical significance was indicated at the $p \leq 0.05$ level.

Appendix D describes the assumptions used in each model and provides the SQL Query used for each model.

RESULTS

Habitat selection by sampled bird species were studied through investigation of LCCEB habitat information present at sampling sites surveyed during the 2010 breeding bird survey.

DENSITY ESTIMATES

The distribution of bird species based on habitat class information was assessed through the calculation of density estimates (Table E-5). In using LCCEB classes to describe habitat variables present several were omitted including ’11-cloud,’ ’12-shadow,’ ’20-water,’ ‘33-exposed land,’ ’34-developed,’ ’50-shrubland,’ ’80-wetland,’ ’220-broadleaf,’ and ‘232-mixedwood open’ based on the absence of these classes in some ecoregions. Calculated density estimates were based on number of birds by hectare by using observer data only within the 100 metre radius sampled.

Calculated density estimates indicated that, based on available habitat quantities over the FPR, the highest concentration of birds were found in habitats indicated as ‘perennial crops and pasture,’ ‘broadleaf open,’ and ‘grassland’; although in the value of these habitats should also be considered based around sampling at the ecoregion level.

It should be noted that population density does not always indicate habitat quality however. Some populations exist at low densities even when the environment is capable of supporting more birds. For example, during some years densities of migratory species may be lower than expected on the breeding grounds, because many individuals died on the wintering grounds or during migration (Temple 2001).

Table E-5. Density of birds from the 2010 breeding bird survey in six ecoregions using LLCEB-derived habitats

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
51-shrub tall'	-	6.28 **(0.30)**[1]	1.96 **(1.40)**	2.11 **(1.18)**	2.93 **(1.16)**	3.53 **(1.35)**	2.92**(1.49)**
81-wetland treed'	-	4.80 **(2.18)**	2.19 **(0.86)**	1.70 **(0.79)**	3.09 **(2.12)**	3.44 **(1.46)**	3.38**(2.09)**
82-wetland shrub'	4.42 **(2.06)**	5.00 **(3.38)**	3.06 **(1.81)**	2.52 **(0.87)**	2.85 **(1.28)**	2.58 **(1.34)**	3.61**(2.39)**
83-wetland herb'	4.45 **(2.38)**	5.00 **(1.67)**	3.29 **(1.62)**	2.07**(1.27)**	2.75 **(1.73)**	2.25 **(1.05)**	3.49**(1.99)**
100-herb'	4.13 **(1.91)**	3.62 **(2.52)**	2.33 **(0.80)**	-	-	-	3.58**(2.20)**
110-grassland'	4.61 **(2.09)**	4.27 **(1.65)**	4.13 **(1.35)**	-	-	-	4.56**(2.02)**
121-annual crops'	4.13 **(2.03)**	4.53 **(2.08)**	-	-	-	-	4.22**(1.97)**
122-perennial crops & pasture'	4.77 **(N/A)**	5.31 **(1.32)**	-	-	-	-	5.24**(1.24)**
211-softwood dense'	-	3.89 **(1.42)**	2.64 **(1.54)**	1.90 **(1.00)**	2.23 **(1.41)**	2.54 **(1.09)**	2.46**(1.44)**
212-softwood open'	-	3.46 **(1.51)**	0.64 **(0.49)**	2.54 **(2.12)**	2.45 **(1.17)**	2.50 **(0.96)**	2.52**(1.39)**
213-softwood sparse'	-	-	-	2.14 **(0.65)**	3.97 **(2.97)**	2.56 **(1.40)**	2.65**(1.63)**
221-hardwood dense'	4.13 **(1.50)**	3.84 **(1.44)**	3.05 **(1.47)**	3.81 **(N/A)**	2.93 **(1.39)**	-	3.48**(1.50)**
222-hardwood open'	4.51 **(1.96)**	5.09 **(1.78)**	-	-	-	-	4.65**(1.93)**
231-mixedwood dense'	-	3.44 **(0.90)**	4.01 **(1.89)**	2.40 **(0.99)**	2.79 **(1.60)**	2.26 **(1.90)**	2.99**(1.59)**
All habitats	4.48 **(2.06)**	4.48 **(2.24)**	2.92**(1.66)**	2.22 **(1.28)**	2.72 **(2.11)**	2.90 **(1.36)**	3.38**(2.07)**

[1]Density per hectare. Standard deviation in brackets.

LINEAR REGRESSION

Linear regression analysis indicated some variation between species richness and habitat class and geographic variable information. This ranged from r^2 = 3% in Lake Manitoba Plain to 21% in the Mid-Boreal Lowland ecoregions (Table E-6). Alternately, the Interlake Plain, Churchill River Upland, Hayes River Upland, and Hudson Bay Lowland ecoregions had 9, 8, 8 and 9% of species richness explained through the linear regression, respectively. This amount of variation was found significant at the < 0.001 level for Lake Manitoba Plain and < 0.0005 level for all other ecoregions using statistical F-tests. All calculations were performed in SYSTAT 11 (SYSTAT 2004).

Some variable classes were not present in all sampled ecoregions; notably the presence of variables 'herb,' 'grassland,' and 'cropland' in the Churchill River Upland, Hayes River Upland and Hudson Bay Lowland ecoregions. Alternately, the variables 'coniferous' and 'shrub' were not present in the sampled Lake Manitoba Plain Ecoregion.

Lake Manitoba Plain

The sampled Lake Manitoba Plain Ecoregion indicated the highest calculated species richness estimates after conducting the breeding bird survey at an average of 11.54 species identified per plot. Sampling sites in this ecoregion, however, also indicated the lowest amount of variability for calculated species richness based on modelled variables. The linear model selected as the best fit-model '**y = (0.045)broadleaf + (0.164)water'** explained only some variation (r^2 = 3%) in species richness for sampling sites in this ecoregion. This model indicates a positive linear effect in increasing the presence/availability of broadleaf and water habitat areas on species richness where, although broadleaf is considered a more significant indicator, water has a proportionally stronger effect on overall species richness.

Interlake Plain

Calculated species richness for plots inside the FPR corridor for the Interlake Plain Ecoregion averaged 10.35. Nine percent of variability in species richness is due to modeled variables where the '**y = (-0.210)mixedwood + (0.138)open + (0.137)water + (-0.077)coniferous'** is selected as the best fit model. This model indicates a positive linear relationship in the proportion of 'open' and 'water' areas within sampling sites and a negative linear relationship corresponding to the amount of 'mixedwood' and 'coniferous' habitat present. This ecoregion was the second of two where geographic coordinate information (the northing or easting variables) were not selected as part of the final best-fit model; indicating average species richness may be less variable throughout this ecoregion.

Mid-Boreal Lowland

Species richness estimates for the mid-Boreal Lowland Ecoregion indicated an average of 6.68 species per point count location inside the FPR corridor. The **'y = (-0.408)coniferous + (-0.175)shrub + (-0.437)easting + (0.303)northing'** model was originally selected as the best fit model but due to assumed colinearity between the easting and northing variables (r^2 **=** -0.872**)** the '**y = (-0.378)coniferous + (-0.203)shrub + (-0.159)easting'** was alternately selected where the 'northing' term was omitted. The former model indicates a negative linear relationship between the 'coniferous,' 'shrub,' and 'easting' variables where species richness is expected to decline with increasing portportions of these habitat types. The association of these variables in explaining variation in species richness was relatively high (r^2 = 21%) in comparison with other ecoregions.

Churchill River Upland

The Churchill River Upland Ecoregion had an average of 6.08 species at plots along the FPR. The best fit model for these sampling areas, in explaining species richness, was determined through fitting two variables in the '**y = (0.293)northing + (-0.119)shrub'** model. Together these variables accounted for some variation (r^2 = 8%) in calculated species richness estimates where the 'northing' variable indicated a positive linear association and 'shrub' indicating a negative linear association with species richness. The difference in variation explained by the two models '**y = (0.293)northing + (-0.119)shrub'** and **'y = (0.267)northing**' should be considered relatively minor as the calculated ΔAIC values indicate a difference of less than 2.00 in the ranking of these two models.

Table E-6. Results of linear regression for modeled habitat variables and geographic coordinates based on estimated species richness for sampling locations in the 2010 Local Study Area. Adjusted r^2 indicates likely proportion of variation explained in response variable using model. Model ranking based on calculated AIC values. Degrees of freedom (df) and p-values based on calculations of statistical F-tests. Models in bold represent best-fit models calculated with variables fit using p ≤ 0.05 standard.

Ecoregion	Model	Rank	AIC	ΔAIC	r^2	Adjusted r^2	df	p-value
Lake Manitoba Plain	**y = (0.045)broadleaf + (0.164)water**	**1**	**359.45**	**0.53**	**0.03**	**0.03**	**2**	**< 0.001**
	y = (0.044)broadleaf	2	359.98	10.24	0.03			
	y = e (intercept only model)	3	370.22					
Interlake Plain	**y = (-0.210)mixedwood + (0.138)open + (0.137)water + (-0.077)coniferous**	**1**	**543.61**	**1.98**	**0.09**	**0.09**	**4**	**< 0.0005**
	y = (-0.210)mixedwood + (0.138)open + (0.137)water	2	545.58	10.53	0.09			
	y = (-0.218)mixedwood + (0.132)open	3	556.12	9.56	0.07			
	y = (-0.225)mixedwood	4	565.68	30.54	0.05			
	y = e (intercept only model)	5	596.21					
Mid-Boreal Lowland	y = (-0.408)coniferous + (-0.175)shrub + (-0.437)easting + (0.303)northing*	1	703.64	14.41	0.23			
	y = (-0.378)coniferous + (-0.203)shrub + (-0.159)easting	**2**	**718.05**	**14.61**	**0.21**	**0.21**	**3**	**< 0.0005**
	y = (-0.346)coniferous + (-0.278)shrub	3	732.66	57.22	0.19			
	y = (-0.346)coniferous	4	789.88	82.92	0.12			
	y = e (intercept only model)	5	872.80					

Ecoregion	Model	Rank	AIC	ΔAIC	r^2	Adjusted r^2	df	p-value
Churchill River Upland	**y = (0.293)northing + (-0.119)shrub**	**1**	**200.12**	**1.52**	**0.09**	**0.08**	**2**	**< 0.0005**
	y = (0.267)northing	2	201.64	16.06				
	y = e (intercept only model)	3	217.70					
Hayes River Upland	**y = (0.121)northing + (-0.178)coniferous + (0.092)shrub + (-0.074)open + (- 0.102)mixedwood**	**1**	**486.67**	**1.05**	**0.08**	**0.08**	**5**	**< 0.0005**
	y = (0.115)northing + (-0.150)coniferous + (0.115)shrub + (-0.068)open	2	487.71	1.95	0.08			
	y = (0.124)northing + (-0.145)coniferous + (0.114)shrub	3	489.66	7.05	0.08			
	y = (0.145)northing + (-0.187)coniferous	4	496.71	15.26	0.08			
	y = (-0.211)coniferous	5	511.97	34.50	0.05			
	y = e (intercept only model)	6	546.47					
Hudson Bay Lowland	**y = (2.172)shrub + (0.137)open + (0.074)northing**	**1**	**230.87**	**0.61**	**0.10**	**0.09**	**3**	**< 0.0005**
	y = (1.98)shrub + (0.124)open	2	231.48	5.78	0.09			
	y = (1.72)shrub	3	237.26	37.72	0.09			
	y = e (intercept only model)	4	274.98					

Hayes River Upland

Calculated species richness estimates for plots along the FPR in the Hayes River Upland Ecoregion indicated an average of 6.59 species observed at each. A total of five variables were used in fitting the best-fit '**y = (0.121)northing + (-0.178)coniferous + (0.092)shrub + (-0.074)open + (- 0.102)mixedwood'** model where some variation (r^2 = 8%) in species richness is explained. The 'northing' and 'shrub' variables all indicated a positive linear association with species richness where the variables 'coniferous,' 'open' and 'mixedwood' corresponded to negative linear relationships. As the variable initially selected in stepwise construction of models was the 'coniferous' variable it is expected that, in general, changes in landscape composition affecting this variable will have the highest net effect on sampled species richness levels (which in this case is inversely proportional).

Hudson Bay Lowland

Sampling of sites along the FPR for this ecoregion indicated an average of 7.27 species per plot. The selected best-fit model was the '**y = (2.172)shrub + (0.137)open + (0.074)northing'** model where all variables had positive linear associations with calculated species richness where some (r^2 = 9%) of variation in calculated estimates is explained. While this was one of the simpler models fit to sampling data within an ecoregion, the change in calculated AIC values (ΔAIC) associated with fitting each additional variable was substantial (37.72 after adding second variable and 5.78 after adding the third). This indicates all modeled variables should be considered important in identifying variables affecting species richness although the first variable modeled, 'shrub,' should be considered by amount as the most important.

NONMETRIC MULTIDIMENSIONAL SCALING

Calculated 'stress-levels' through NMS calculations (Table E-7) indicated estimates ranging from 9.8 (Interlake Plain) to 17.78 (Hudson Bay Lowland). While these levels are not optimal, the placement of species in ordination plots was non-random and can be considered as statistically significant at the $p \leq 0.05$ level. McCune and Grace (2002) indicate, using 'Clarke's rules of thumb', that stress levels ranging from 5 -10 indicate a good ordination with no risk of drawing false inferences where with stress level 10-20 still potentially providing a usable picture but to be more carefully considered in drawing inferences. The use of two axis to interpret the results of bird species ordination for each ecoregion was recommended following analysis.

Examination of plotted species ordinations (Figures E-1 to E-6) requires additional consideration of AOU birding codes as plotted bird entries are present as species acronyms only. LCCEB habitat class designations were placed on ordination plots to identify habitat patterns in the sampling of bird species. The association of 'joint-plots,' indicating the relationship between habitat class information and bird species, was used where habitat classes played a role in the ordination of bird species and range from r^2 values of 0.05 to 0.20; based on the ecoregion being reviewed. Those species appearing within demarcated joint-plot axis (as indicated by red lines on ordination plots) indicate species with strong associations with these habitat classifications relative to species relatively removed from joint-plot axis.

Table E-7. Calculated stress values for nonmetric multidimensional scaling in forming bird species communities based on sampled bird species from sampling areas in six ecoregions

Ecoregion	Stress in Real Data			Stress in Randomized Data			
	Min.	Mean	Max	Min.	Mean	Max	p-value
Lake Manitoba Plain	6.95	13.90	41.94	34.70	35.60	41.94	0.02
Interlake Plain	6.88	9.80	41.98	35.23	36.64	41.98	0.02
Mid-Boreal lowland	9.47	11.17	42.02	33.83	35.10	41.99	0.02
Churchill River Upland	15.72	16.26	17.79	31.83	33.04	41.75	0.02
Hayes River Upland	10.52	14.82	42.02	33.96	34.96	42.02	0.02
Hudson Bay Lowland	14.84	17.78	41.95	32.48	33.79	41.95	0.02

*Graphical ordination and associated correlations can only be represented by a maximum of 3 axes

Lake Manitoba Plain

In ordination of bird-species based on habitat variables for this ecoregion a cut-off an r^2 cut-off of 0.05 was used (Appendix G-1). Along the first axis, bird species ordination is explained by broadleaf-open (r^2 = 31%), wetland-herb (r^2 = 22%) and wetland-shrub (r^2 = 14%) habitat classes. Along the second axis, variation in bird-species placement was explained by wetland-shrub (r^2 = 8%) and grassland (r^2 = 7%) habitat classes.

Ordination of bird species communities mirror high correlation values associated with quantities of broadleaf open, wetland-herb, wetland-shrub and grassland habitat classes in this ecoregion. Species were associated with specific habitat classes or with a range of habitat classes i.e. as being in-between joint-plot axis. Species associated with broadleaf-open habitat included downy woodpecker, least flycatcher, ruffed grouse and cedar waxwing. Species associated with wetland-shrub included mallard and red-winged blackbird. Species associated with wetland-herb habitat are less clear to differentiate. Species encountered within the range of both wetland-shrub and wetland-herb included sandhill crane, pied-billed grebe and American bittern. Species identified as grassland predominately included vesper sparrow but where other species could only be partially associated with this habitat class.

Interlake Plain

In using the joint-plot axis to describe species spresence based on habitat information species an r^2 cutoff of 0.10 was used (Appendix G-2). Habitat relationships assigned to the first axis included broadleaf-open (r^2 = 16%), herb (r^2 = 16%) and mixedwood-dense (r^2 = 9%). Habitat relationships on the second axis included wetland-treed (r^2 = 10%), developed (r^2 = 12%), herb (r^2 = 15%) and mixedwood dense (r^2 = 10%).

Indication of species communities mirror the high correlation values associated with quantities of wetland-treed, herb, mixedwood-dense, broadleaf-open and developed habitat classes. Most species are not clearly associated with any one of these habitat classes but appear to be influenced by multiple habitats. For example a number of species are associated with both broadleaf-open and developed habitat classes and includes yellow-shafted flicker, common rail, black and white warbler and Philadelphia vireo. Species more strictly associated with the developed habitat class include American robin, least flycatcher and American godwit. Species jointly associated with broadleaf-open and mixedwood-dense include ruffed grouse, pileated woodpecker and cedar waxwing. Species associated with both wetland-treed and mixedwood-dense include blue jay, Tennessee warbler and white-throated sparrow.

Mid-Boreal Lowland

To describe species relationships with sampled habitat classes an r^2 cutoff of 0.20 was used in the placement of joint-plot axis (Appendix G-3). Habitat relationships assigned to the first axis included wetland-herb (r^2 = 54%) and coniferous-dense (r^2 = 21%) habitat classes. Along axis 2, broadleaf-dense (r^2 = 22%) was the only habitat class that met the r^2 cutoff and was considered.

Bird species presence in this ecoregion appears strongly associated with quantities of coniferous-dense, wetland-herb and broadleaf dense habitat classes present. Bird species appear not to be associated with singular habitat classes but instead fall in the range of varying habitat classes. Species found between coniferous-dense and broadleaf-dense habitat classes includes hairy woodpecker, cedar waxwing and common rail. Species associated as between broadleaf-dense and wetland-herb habitat classes include yellow warbler, black-capped chickadee, and alder flycatcher.

Churchill River Upland

In using joint-plot axis to describe species relationships with habitat class information an r^2 cutoff of 0.05 was used (Appendix G-4). Habitat classes assigned to the first axis included wetland-herb (r^2 = 15%) and mixedwood-dense (r^2 = 6%). Along axis 2, wetland-treed (r^2 = 9%), coniferous-dense (r^2 = 9%) and shrub-tall (r^2 = 6%) habitat classes are primarily considered.

For the Churchill River Upland Ecoregion, using NMS, species are mainly associated with wetland-herb, mixedwood-dense, wetland-treed, coniferous-dense and shrub-tall habitat classes. While some species can be associated with one particular habitat class, more species show varying habitat class use. Species associating with shrub-tall and mixedwood-dense habitat include gray jay, white-throated sparrow and fox sparrow. Alternately, species associating with wetland-herb and shrub-tall habitat areas include northern waterthrush, alder flycatcher and greater yellowlegs. Fewer species were indicated to be present through the interactions of wetland-herb and wetland-treed, wetland-treed and coniferous-dense and coniferous-dense and mixedwood-dense habitat classes.

Hayes River Upland

In using the joint-plot axis to describe species presence in sampling areas based on habitat class information an r^2 cutoff of 0.10 was implemented (Appendix G-5). Habitat classes assigned to the first axis includes broadleaf-open (r^2 = 21%), mixedwood-dense (r^2 = 11%) and wetland-shrub (9%). On the second axis, wetland-herb (r^2 = 11%) and coniferous-dense (r^2 = 11%) habitat classes were present.

Species use of habitat classes in this ecoregion can be largely described by quantities of broadleaf-dense, mixedwood-dense, coniferous-dense, wetland-shrub and wetland-herb habitat classes. Most species appear to group in an area where wetland-herb and wetland-shrub habitat classes interact with an alternate group present where broadleaf-dense, mixedwood-dense and coniferous-dense habitat classes interact. Species associated with the former grouping consist of red-winged blackbird, hermit thrush and ruby-crowned kinglet and species associated with the latter include hairy woodpecker, Tennessee warbler and Nashville warbler.

Hudson Bay Lowland

In using the joint-plot axis to describe species interactions with habitat classed in this ecoregion an r^2 cutoff of 0.10 was used (Appendix G-6). Habitat relationships indicated by the first axis includes wetland-shrub (r^2 = 10%) and shrub-tall (r^2 = 10%). Alternately, the second axis represents shrub-tall (r^2 = 17%) and coniferous-dense (r^2 =17%) habitat classifications.

Bird species presence for this ecoregion is primarily associated with quantities of wetland-shrub, shrub-tall and coniferous-dense habitat classes. Bird species appear not to strongly associate with singular habitat classes but rather fall between varying habitat classes. Species found between coniferous-dense and wetland-shrub habitat class includes olive-sided flycatcher, gray jay and unidentified dark eyed junco. Species associated as having habitat characteristics between wetland-shrub and shrub-tall habitat classes include fox sparrow, pine siskin, blackpoll warbler and, a species of species concern under SARA, rusty blackbird. Species in between the shrub-tall and coniferous-dense habitat classes include northern flicker, American robin, and Wilson's warbler.

HABITAT SELECTION

The varying habitat requirements of sampled bird species was evaluated through multiple forms of statistical analysis to reveal patterns of habitat selection and indicate the extent habitat availability plays a role in determining species presence. Sampled species were studied using logistic regression analysis to determine selection of LCCEB habitat classes Table E-8. Similarly, NMS was used to model species presence based on sampled habitat information at sampling locations where species were seen. Also, linear regression calculations were done to determine the extent to which habitat classes played a role in maintaining overall species richness.

There were various ways of testing the extent to which habitat information could be used as in indicator of bird species presence. Notably, the calculation of r^2 scores allowed the determination of the extent of variation explained by habitat variables through NMS and linear regression analysis. Clustering of bird species also provided an *ad hoc* method of testing the reliability of logistic regression in determining if primary selection for habitat variables guides the formation of bird communities (Figures E-7 to E-12). Similarly, NMS also provided an illustrated means of observing bird species communities and how closely these could be associated with sampled habitat class information.

Lake Manitoba Plain

Logistic regression analysis done to determine habitat classes of importance in the Lake Manitoba Plain Ecoregion indicated bird species selection for broadleaf open (19.7%), grassland (18.4%), wetland herb (18.4%), broadleaf (14.5%), and wetland shrub (13.2%) habitat classes Table E-8. Similarly, NMS analysis for this ecoregion (Figure E-1) indicated broadleaf-open, wetland-herb, wetland-shrub and grassland habitat classes as explaining considerable variation in bird species presence at the $p \leq 0.05$ level of statistical significance. Linear regression analysis for this ecoregion Table E-6 indicated broadleaf, as a combined habitat class, positively influencing species richness, but where combined habitat variables as a whole only played a small role ($r^2 = 0.03$) in determining overall species richness.

Interlake Plain

Use of logistic regression analysis for bird species sampled in the Interlake Plain Ecoregion indicated a large number of birds preferring the 'developed' habitat class (10.9%) as well as the herb (13.0%), broadleaf dense (13.0%) and broadleaf open (13.0%) habitat classes (Table E-8). The association of birds for these habitat classes was also seen through NMS analysis for this ecoregion (Figure E-2) where ordination of bird species based on habitat variables indicated the broadleaf-open, herb, developed and mixedwood-dense habitat variables. In addition, NMS plots also indicated the wetland-treed habitat class as important to bird species. Referring back to logistic regression analysis for this ecoregion (Table E-8), it is also evident that this habitat class is selected for by 8.7% of bird species. Results from linear regression analysis for this ecoregion indicate that some variation (r^2 = 9%) in species richness can be associated with the modelling of habitat class information (Table E-6). The linear regression results indicate 'open' habitat area, constituting 'exposed land' and 'developed' habitat classes, as important in improving species richness whereas combined mixedwood and coniferous habitat classes indicated a negative impact on species richness.

Mid-Boreal Lowland

The use of logistic regression analysis for bird species from the Mid-Boreal Lowland Ecoregion indicated species selection of wetland herb (30.9%), broadleaf-dense (16.2%) and broadleaf-open (14.7%) habitat classes (Table E-8). Results of NMS analysis for this ecoregion (Figure E-3) similarly indicate wetland-herb and broadleaf-dense habitat areas as important as being selected as well as coniferous-dense; although to a lesser extent. In referencing results from logistic regression analysis for this ecoregion (Table E-8), the coniferous-dense habitat class appears as the fourth highest selected habitat (10.3%). Linear regression analysis for this ecoregion (Table E-6) did not indicate any habitat classes as positively affecting bird species richness although amounts of coniferous and shrub areas may limit species richness. This would indicate that the amounts of these habitat classes through smaller numbers of species selecting for these areas.

Table E-8. Primary habitat selection for LCCEB habitat classes by sampled birds in 2010 breeding bird survey.

LCCEB Habitat Class	Lake Manitoba Plain		Interlake Plain		Mid-Boreal Lowland		Churchill River Upland		Hayes River Upland		Hudson Bay Lowland	
	Count[1].	%	Count.	%	Count.	%	Count.	%	Count.	%	Count.	%
'20-water'	1	1.3%	3	3.3%	1	1.5%	-		-		2	5.0%
'33-exposed'	-		1	1.1%	-		-		5	7.9%	3	7.5%
'34-developed'	1	1.3%	10	10.9%	-		-		-		-	
'50-shrubland'	-		-		-		-		-		-	
'51-shrub-tall'	-		1	1.1%	2	2.9%	6	18.2%	12	19.0%	10	25.0%
'80-wetland'	-		-		-		-		-		-	
'81-wetland-treed'	-		8	8.7%	2	2.9%	4	12.1%	3	4.8%	3	7.5%
'82-wetland-shrub'	10	13.2%	1	1.1%	4	5.9%	4	12.1%	5	7.9%	5	12.5%
'83-wetland-herb'	14	18.4%	3	3.3%	21	30.9%	8	24.2%	5	7.9%	4	10.0%
'100-herb'	1	1.3%	12	13.0%	1	1.5%	-		-		-	
'110-grassland'	14	18.4%	5	5.4%	1	1.5%	-		-		-	
'121-annual-crops'	4	5.3%	4	4.3%	-		-		-		-	
'122-perenial crops & pasture'	-		3	3.3%	-		-		-		-	
'211-coniferous-dense'	2	2.6%	5	5.4%	7	10.3%	1	3.0%	10	15.9%	5	12.5%
'212-coniferous-open'	-		6	6.5%	-		1	3.0%	4	6.3%	6	15.0%
'213-coniferous-sparse'	-		-		-		3	9.1%	3	4.8%	1	2.5%
'220-broadleaf'	11	14.5%	-		-		-		-		-	
'221-broadleaf'-dense'	2	2.6%	12	13.0%	11	16.2%	3	9.1%	11	17.5%	-	
'221-broadleaf'-open'	15	19.7%	12	13.0%	10	14.7%	-		-		-	
'231-mixedwood-dense'	1	1.3%	4	4.3%	6	8.8%	1	3.0%	5	7.9%	1	2.5%
'232-mixedwood-open'	-	-	1	1.1%	-	-	-		-		-	
No model	0	0.0%	1	1.1%	2	2.9%	0	0.0%	0	0.0%	0	0.0%
Total	**76 (100%)**		**92 (100%)**		**68 (100%)**		**33 (100%)**		**68 (100%)**		**40 (100%)**	

[1] Counts represent results of binary logistic regression indicating primary habitat type selected for by sampled bird species.

Churchill River Upland

Logistic regression analysis for bird species sampled in the Churchill River Upland indicated bird species selection for wetland herb (24.2%), shrub-tall (18.3%), wetland-treed (12.1%) and wetland-shrub (12.1%) habitat classes (Table E-8). NMS analysis of habitat characteristics for this ecoregion (Figure E-4) similarly indicated bird species being found primarily in wetland-herb, mixedwood-dense, wetland-treed , coniferous dense and shrub tall habitat areas. Linear regression analysis to indicate how varying habitat classes affect overall species richness showed shrub areas may limit species richness; potentially through smaller numbers of species selecting for this habitat class in comparison to other habitat classes.

Hayes River Upland

Logistic regression analysis of habitat classes selected for by bird species in this ecoregion indicated the selection for shrub-tall (19.0%), broadleaf dense(17.5%) and coniferous dense (15.9%) habitat classes (Table E-8). NMS analysis for sampled birds species in this ecoregion (Figure E-5) indicated some similar habitat use patterns with quantities of broadleaf-dense and coniferous-dense habitat class use but where quantities of mixedwood-dense, wetland-herb and wetland-shrub habitat classes are also important. In considering the latter three habitat classes, corresponding results from logistic regression analysis indicated these habitat classes as selected for by 7.9% of birds each. Linear regression analysis to determine the impact of habitat classes on species richness in this ecoregion (Table E-8) indicated only increased quantities of shrub habitat classes as increasing species richness in comparison to increased quantities of coniferous, open and mixedwood habitat areas causing declines in species richness.

Hudson Bay Lowland

The use of logistic regression analysis for bird species sampled in this ecoregion indicated the selection for shrub-tall (25%), coniferous-open (15%), coniferous-dense (12.5%) and wetland-shrub (12.5%) habitat classes (Table E-6). NMS calculations (Figure E-6) similarly indicated the positioning of bird species in ordination space according to coniferous-dense, wetland-shrub and shrub-tall habitat variables. Linear regression results for this ecoregion indicated as positively affecting species richness in this ecoregion only included constructed shrub and open habitat classes.

Habitat Selection by VECs

Mallard

Mallards were sampled in all ecoregions in the duration of the 2010 breeding bird survey (Table E-9). Based on Ecoregion, the highest density of mallards was found in the Lake Manitoba Plain ecoregion at 0.06 birds per hectare, mainly due to high densities of 0.10 birds per hectare in wetland treed, wetland shrub and grassland habitat areas. After Lake Manitoba Plain, mallard density was highest in the Interlake Plain (0.03 birds/ha) and lowest in Hudson Bay Lowland (< 0.01 birds/ha).

Sampling of mallard in the Lake Manitoba Plain Ecoregion indicated wetland-shrub habitat as the only habitat actively selected for at a statistically significant $p \leq 0.05$ level (Table E-10). This habitat type accounted for 8.3% of the variation of mallard presence seen across sampling sites for this ecoregion. Incorporating all available habitat variables for this ecoregion in modelling, 22.4% of total variation in mallard presence was explained.

Table E-9. Density of mallards (number per hectare) in sampled ecoregions based on sampled LLCEB habitat characteristics*

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregions
51-shrub tall	-	0.16	-	-	-	<0.01	<0.01
81-wetland treed	-	0.03	-	-	-	-	0.01
82-wetland shrub	0.10	0.04	-	-	-	-	0.03
83-wetland herb	0.10	0.12	0.02	0.02	0.03	-	0.04
100-herb							
110-grassland	0.10	0.02	-	-	-	-	0.06
121-annual crops	0.05	-	-	-	-	-	0.04
213-coniferous sparse	-	-	-	-	0.42	-	0.06
221-broadleaf dense	-	-	-	-	0.01	-	<0.01
222-broadleaf open	0.04	0.01	-	-	-	-	0.03
231-mixedwood dense	-	0.02	-	-	-	-	<0.01
All habitats	0.06	0.03	0.01	0.01	0.01	<0.01	0.02

From breeding bird survey conducted May to July 2010

In considering logistic regression analysis of habitat variables in the context of derived expert models there are a number of similarities. Notably the best fitting habitat variables in explaining mallard presence in the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland Ecoregions of wetland shrub, wetland herb and perennial crops and pasture, respectively, were all included in the expert model. Unlike expert models use of best-fit models, through logistic regression analysis, indicated the selection of varying habitat types; notably broadleaf dense and mixedwood dense forest areas in the Interlake Plain Ecoregion. Alternately, the best-fit model for the Mid-Boreal Lowland Ecoregion also contained broadleaf open habitat. The inclusion of this habitat variable as selected for by mallards may be due to a high number of sightings of this species as flyovers seen in proximity to this habitat type or the potential for flooded broadleaf open habitat areas to function as habitat.

Table E-10. Variation explained (r^2) in mallard presence based on logistic regression of mapped habitat features

Ecoregion	Model Type	Model Variables*	r^2
Lake Manitoba Plain	Best variable, Best-fit model	Wetland Shrub	8.3%
	Global model	Water + exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf + broadleaf dense + broadleaf open + mixedwood dense	22.4%
Interlake Plain	Best variable	Wetland herb	5.2%
	Best-fit model	Wetland Herb + broadleaf dense (-) + mixedwood dense(-)	13.9%
	Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	21.8%
Mid-Boreal Lowland	Best variable	Pasture	5.2%
	Best-fit model	Pasture + broadleaf open + wetland herb	32.7%
	Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	36.0%

* ***Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)***

Sandhill Crane

Sandhill crane density was generally low ranging from < 0.01 birds/ha to 0.02 birds/ha (Table E-11). Overall the highest concentration of sandhill cranes based on habitat class and ecoregion was in the Interlake Plain ecoregion where wetland shrub habitat areas had 0.05 birds/ha. Over all ecoregions were highest concentrations in wetland shrub areas also (0.02 birds/ha).

Table E-11. Density of sandhill crane (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregions
51-shrub tall	-	-	-	-	-	<0.01	<0.01
82-wetland shrub	0.01	0.05	-	0.01	-	0.01	0.02
83-wetland herb	0.01	0.01	0.02	-	0.03	0.02	0.01
110-grassland	<0.01	-	-	-	-	-	<0.01
212-coniferous open	-	-	-	-	-	0.01	<0.01
222-broadleaf open	<0.01	-	-	-	-	-	<0.01
All habitats	<0.01	0.02	0.01	<0.01	<0.01	0.01	0.01

From breeding bird survey conducted May to July 2010

Sandhill crane presence was modeled in five of six ecoregions (Table E-12). The habitat classes selected for in the Lake Manitoba Plain ecoregion included wetland herb and herb habitat classes. When modeled, wetland herb alone accounted for 6.5% of variation in sandhill crane presence and when combined with the herb habitat class accounted for 7.3% of variation. In considering all available habitat classes for this ecoregion, 13.0% of variation was explained.

In the Interlake Plain Ecoregion, habitat classes selected for included herb, grassland, wetland shrub and broadleaf open habitat areas. Modeling of herb habitat independently accounted for 10.5% of variation whereas incorporating habitats in the best-fit model accounted for 18.0% of variation. All available habitat variables modeled together for this ecoregion, 17 habitats in total, accounted for 26.2% of variation.

In the Mid-Boreal Lowland Ecoregion, six habitat classes were selected for by sandhill crane including broadleaf open, wetland herb, wetland shrub, mixedwood dense, wetland treed and water. The most influential variable, broadleaf open, when modeled independently, explained 4.4% of variation in sandhill crane presence in sampling areas. The best-fit model alternately explained 19.2% of variation and all available habitat variables explained 20.9% of sandhill crane presence within sampling areas (for this ecoregion).

In Hayes River Upland, shrub tall, coniferous open and coniferous sparse habitat types were selected for by sandhill cranes in selected sampling areas in the Local Study Area. The shrub tall habitat variable, when modeled alone, accounted for 1.7% of variation in species presence. The best-fit model alternately accounted for 5.6% of variation and the use of all available habitat variables in this ecoregion accounted for 11.6% of variation.

In Hudson Bay Lowland coniferous open and wetland herb habitat areas were selected for. Together these variables account for 5.9% of the expected variation in sandhill crane presence in sampling areas whereas coniferous open alone accounted for 4.3% of variation. Modeling of all 10 available habitat variables in this ecoregion accounted for 11.2% of variation in sandhill crane presence in surveyed sampling areas.

Table E-12. Variation explained (r^2) in sandhill crane presence based on logistic regression of mapped habitat features

Ecoregion	Model Type	Model Variables*	r^2
Lake Manitoba Plain	Best variable	Wetland herb	6.5%
	Best-fit model	Wetland herb + herb	7.3%
	Global model	Water+ exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf + broadleaf dense + broadleaf open + mixedwood dense	13.0%
Interlake Plain	Best variable	Herb	10.5%
	Best-fit model	Herb + Wetland Herb +Grassland + Wetland shrub + Broadleaf open	18.0%
	Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	26.2%
Mid-Boreal Lowland	Best variable	Broadleaf open	4.4%
	Best-fit model	Broadleaf open + wetland herb + wetland shrub +mixedwood dense + wetland treed + water	19.2%
	Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	20.9%
Hayes	Best variable	Coniferous sparse	1.7%

Ecoregion	Model Type	Model Variables*	r^2
River Upland	Best-fit model	Coniferous sparse + mixed dense(-)	5.6%
	Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	11.6%
Hudson Bay Lowland	Best variable	Coniferous open	4.3%
	Best-fit model	Coniferous open + wetland herb	5.9%
	Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + mixedwood dense	11.2%

* ***Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)***

Comparison of habitat variables selected for in the use of logistic regression analysis and expert models identified differing habitat variables as selected for by sandhill cranes. Notably, the expert models indicated wetland habitat as important to sandhill cranes. Using logistic regression analysis it was only the Lake Manitoba Plain that had a wetland habitat class as the primary habitat variable selected for. In considering ecoregions with non-wetland habitat variables as the primary habitat variable selected for i.e. Interlake Plain, Mid-Boreal Lowland, Hayes River Upland and Hudson Bay Lowland, habitat types selected for may be due to the high occurrence of flyovers in proximity to these habitat areas or these areas, when flooded, becoming suitable habitat. It should be noted that in considering the best-fit models for these ecoregions, with exception to Hayes River Upland, all include a wetland habitat type within the overall best-fit model.

Great Blue Heron

Density estimates for great blue heron indicated low concentrations existing in the Interlake Plain and Hayes River Upland ecoregions where 0.01 birds/ha and <0.01 birds/ha were calculated, respectively (Table E-13).

Table E-13. Density of great blue heron (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregions
83-wetland herb	-	0.02	-	-	-	-	<0.01
212-coniferous open	-	-	-	-	<0.01	-	<0.01
all habitats	-	0.01	-	-	<0.01	-	<0.01

From breeding bird survey conducted May to July 2010

Sampling of great blue heron in the Interlake Plain ecoregion indicated habitat preference for wetland treed areas in constituting the habitat variable most selected for by great blue heron as well as being the sole habitat variable incorporated in a best-fit model for this species Table E-14). Wet-land treed habitat accounted for 3.1% of variation in the presence of great blue heron in sampling areas whereas all habitat variables combined accounted for 17.1% of variation.

In considering all instances of presence and absence of great blue heron over all ecoregions, wetland treed habitat was actively selected for and accounted for 1.5% of variation in species presence. The best-fit model for this species alternately considered wetland treed as well as herb, perennial crops & pasture, coniferous dense and mixedwood dense habitats and accounted for 7.9% of variation in species presence across sampling areas. Together, all available habitat variables for this ecoregion accounted for 11.2% of variation in species presence.

Table E-14. Variation explained (r^2) in great blue heron presence based on logistic regression of mapped habitat features

Ecoregion	Model type	Model variables	r^2
Interlake Plain	Best variable, Best-fit model	Wetland treed	3.1%
	Global model	Water+ exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense	17.1%
All Ecoregions	Best variable	Wetland treed	1.5%
	Best-fit model	Wetland treed + herb + perennial crops & pasture + coniferous dense + mixedwood dense	7.9%
	Global model	Water+ exposed + developed +shrub tall + wetland + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense	11.2%

In examining habitat characteristics selected for by great blue heron there was congruence between habitat types identified in expert models and logistic regression. This should be considered in the context of sufficient great blue herons only being sampled in the Interlake

Plain Ecoregion, allowing logistic regression analysis, where sampling results from all ecoregions was also made available as a secondary assessment. In the case of both the Interlake Plain Ecoregion and all ecoregions combined, wetland treed habitat was selected for as the primary habitat variable using logistic regression analysis; which was a habitat type also identified as important using experts models.

Bald Eagle

Logistic regression analysis on the presence of bald eagles in sampled areas based on LCCEB habitat characteristics indicated the 'water' habitat variable as actively selected for (Table E-15). This was demonstrated in conducting analyses of sampled ecoregions where the number of eagles sampled ≥ 10 including Mid-Boreal Lowland, Hayes River Upland and all ecoregions combined.

When considering the sampled Mid-Boreal Lowland ecoregion the water habitat variable explained 12.8% of bald eagle presence in sampled areas whereas the best-fit model, considering also the mixedwood dense, broadleaf dense and coniferous open habitat variables, accounted for 26.5% of variation. Together all habitat variables, used together in logistic regression analysis, accounted for 30.0% of variation in eagle presence across sampling areas for this ecoregion.

The Hayes River Upland ecoregion alternately had 17.4% of variation in bald eagle presence explained through the LCCEB water habitat variable. The best-fit model for this ecoregion in combining habitat variables selected for bald eagles also indicated coniferous dense and shrub tall, along with water, as accounting for 25.8% of variation. All habitat variables together accounted for 38.7% of variation in the presence of bald eagles in sampling areas for this ecoregion.

The selection of habitat by bald eagles over all sampling areas, from all ecoregions combined, indicated the selection of water habitats as accounting for 17.7% of variation in species presence. The best-fit model of water, coniferous dense, broadleaf dense and mixedwood dense together accounted for 23.8% of variation where all habitat variables together accounted for 27.7% of the variation.

Table E-15. Variation explained (r^2) in bald eagle presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables	r^2
Bald Eagles	Mid-Boreal Lowland	Best variable	Water	12.8%
		Best-fit model	Water + mixedwood dense + broadleaf dense + coniferous open	26.5%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	30.0%
	Hayes River Upland	Best variable	Water	17.4%
		Best-fit model	Water + coniferous dense + shrub tall	25.8%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	38.7%
	All Ecoregions	Best variable	Water	17.7%
		Best-fit model	Water + coniferous dense + broadleaf dense + mixedwood dense	23.8%
		Global model	Water+ exposed + developed +shrub tall + wetland + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense	27.7%

The habitat type selected for in the use of logistic regression analysis indicated the primary selection of habitat areas where water in the Mid-Boreal Lowland, Hayes River Upland and all ecoregions combined. This varies from the expert models although it is expected that in deriving the expert models using LCCEB habitat information, ‘water’ as a habitat class may not be an informative prior where it can no differentiation of small water areas and large lakes occurs. Habitat variables indicated in expert models included a range of forest habitat classifications as habitat for bald eagles. This assessment was largely mirrored in logistic regression analysis in these habitat features being incorporated in the best-fit models; with the exception of shrub tall habitat also indicated in the best-fit model for the Hayes River Upland Ecoregion.

Ruffed Grouse

Density estimates for ruffed grouse based on sampling locations surveyed during the 2010 breeding bird survey indicated the highest concentration of grouse in broadleaf open habitats at 4.65 birds/ha, but is only of consequence in considering Lake Manitoba Plain and Interlake Plain ecoregions (Table E-16). It was also demonstrated that Lake Manitoba and Interlake Plain ecoregions have the highest densities of ruffed grouse at 4.48 birds/ha.

Sampling of ruffed grouse in the Lake Manitoba Plain Ecoregion indicated this species primarily utilizing broadleaf open, broadleaf dense and herb habitat areas (Table E-17). The broadleaf open habitat alone accounted for 13.6% of variation in the presence of ruffed grouse in sampling areas in this ecoregion while, when combined with broadleaf dense and herb habitats, 20.5% of variation was explained. Utilizing all available habitat types for this ecoregion, 16 in total, accounted for 28.6% of variation in ruffed grouse presence within sampling areas.

Table E-16. Density of ruffed grouse (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
51-shrub tall'	-	6.28	1.96	2.11	2.93	3.53	2.92
82-wetland shrub'	4.42	5.00	3.06	2.52	2.85	2.58	3.61
83-wetland herb'	4.45	5.00	3.29	2.07	2.75	2.25	3.49
100-herb'	4.13	3.62	2.33	-	-	-	3.58
110-grassland'	4.61	4.27	4.13	-	-	-	4.56
211-coniferous dense'	-	3.89	2.64	1.90	2.23	2.54	2.46
221-broadleaf dense'	4.13	3.84	3.05	3.81	2.93	-	3.48
222-broadleaf open'	4.51	5.09	-	-	-	-	4.65
231-mixedwood dense'	-	3.44	4.01	2.40	2.79	2.26	2.99
all habitats	4.48/ha	4.48/ha	2.92/ha	2.22/ha	2.69/ha	2.90/ha	3.38/ha

From breeding bird survey conducted May to July 2010

Sampling of ruffed grouse in the Interlake Plain ecoregion alternately indicated ruffed grouse selection for broadleaf open, shrub-tall, broadleaf-dense and wetland herb habitat areas. Independently, broadleaf open accounted for 8.1% of variation in the presence of ruffed grouse while these four variables together accounted for 11.3% of variation in sampling areas. These amounts can be compared to the 16.9% of variation explained by all available habitat variables for this ecoregion (17 in total).

The Mid-Boreal Lowland Ecoregion indicated having a range of habitat types selected for by ruffed grouse, including: mixedwood dense, broadleaf open, developed, broadleaf dense and wetland treed. Mixedwood-dense habitat alone accounted for 13.2% whereas the best-fit model accounted for 37.2% of variation. Alternately, the modeling of all available habitat types for this ecoregion accounted for a study-high of 49.7% of variation explained.

Table E-17. Variation explained (r^2) in ruffed grouse presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables	r^2
Ruffed Grouse	Lake Manitoba Plain	Best variable	Broadleaf open	13.6%
		Best-fit model	Broadleaf open + broadleaf dense + herb	20.5%
		Global model	Water+ exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf + broadleaf dense + broadleaf open + mixedwood dense	28.6%
	Interlake Plain	Best variable	Broadleaf open	8.1%
		Best-fit model	Broadleaf open + shrub tall + broadleaf dense + wetland herb	11.3%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	16.9%
	Mid-Boreal Lowland	Best variable	Mixedwood dense	13.2%
		Best-fit model	Mixedwood dense + broadleaf open + developed + Broadleaf dense	37.2%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	49.7%

Selection of habitat by ruffed grouse indicated some agreements between expert and logistic models. Expert models indicated all varieties of broadleaf and mixedwood forest areas as being selected for where logistic regression analysis of sampling information from ruffed grouse also indicated the selection of these habitat areas; when considering the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland Ecoregions. Other habitat classes, outside of those in indentified in expert models, identified in best-fit models includes herb (Lake Manitoba Plain), shrub tall and wetland herb (Interlake Plain) and developed (Mid-Boreal Lowland).

Sharp-tailed Grouse

Density estimates for sharp-tailed grouse were calculated for wetland shrub habitat where they were found during the 2010 breeding bird survey (Table E-18). In particular sharp-tailed grouse were sampled in wetland shrub areas in Lake Manitoba Plain (0.01 birds/ha), Interlake Plain (0.05 birds/ha), Churchill River Upland (0.01 birds/ha) and Hudson Bay Lowland (0.01 birds/ha).

Table E-18. Density of sharp-tailed grouse (number per hectare**) in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregions
82-wetland shrub	0.01	0.05	-	0.01	-	0.01	0.02
all habitats	<0.01	0.02	0.01	<0.01	-	<0.01	<0.01

From breeding bird survey conducted May to July 2010

Pileated Woodpecker

Density calculations for pileated woodpecker indicated being most highly concentrated in the Interlake Plain and Mid-Boreal Lowland ecoregions at 0.01 birds/ha (Table E-19). Within these two ecoregions, pileated woodpeckers were seen in the same varieties of habitats although the portion seen in 'shrub-tall' in the Interlake Plain was much higher (0.08 birds/ha vs. 0.01 birds/ha) whereas, in Mid-Boreal Lowland, Mixedwood dense was much higher (0.04 birds/ha vs. 0.01 birds/ha).

Pileated woodpecker presence in sampling areas in the Lake Manitoba Plain ecoregion was most discernable through the presence of broadleaf habitat, which accounted for 4.5% of variation in the presence of this species (Table E-20). When incorporated with developed and wetland shrub habitats, with the latter variable actively selected against, 16.2% of variation was explained. All 16 available habitat variables for this ecoregion when modeled together accounted for 27.2% of variation.

Table 5.4-19. Density of pileated woodpecker (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
51-shrub tall'	-	0.08	0.01	-	< 0.01	-	< 0.01
82-wetland shrub'	-	0.01	0.01	-	-	-	< 0.01
211-coniferous dense'	-	-	-	0.01	0.01	-	< 0.01
221-broadleaf dense'	-	0.01	0.02	-	0.01	-	0.01
231-mixedwood dense'	-	0.01	0.04	-	0.01	-	0.02
all habitats	-	0.01	0.01	< 0.01	< 0.01	-	< 0.01

From breeding bird survey conducted May to July 2010

For sampling areas within the Interlake Plain ecoregion, shrub tall was selected as the habitat variable most selected for by pileated woodpeckers within selected sampling areas and accounted for 4.2% of variation. Alternately, the best-fit model, consisting of shrub tall, coniferous open and grassland habitats (which was selected against) accounted for 10.7% of variation and the global model, consisting of all available habitat variables for this ecoregion, accounted for 18.2% of variation in the presence of pileated woodpeckers in sampled areas.

Within the Mid-Boreal Lowland, sampling of pileated woodpeckers indicated their preference for mixedwood dense areas where 5.3% of variation in the presence of this species was explained. The best-fit model consisting of mixedwood dense, broadleaf open, wetland herb and wetland shrub habitat areas, with last two variables selected against, accounted for 13.8% of variation in pileated woodpecker presence. The global model, alternately consisting of 17 habitat variables for this ecoregion, explained 18% of variation for this ecoregion.

Sampled pileated woodpeckers in the Hayes River Upland ecoregion indicated a habitat preference for exposed areas although the portion of variation explained by this variable is not significant at the $p < 0.05$ level using logistic regression analysis. Accordingly, there was also no best-fit model for the sampling of this species within sampling areas within this ecoregion. The amount of variation in pileated woodpecker presence as explained by all habitat variables was also relatively low (6%).

Table 5.4-20. Variation explained (r^2) in pileated woodpecker presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables*	r^2
Pileated Woodpecker	Lake Manitoba Plain	Best variable	Broadleaf	4.5%
		Best-fit model	Broadleaf + developed + wetland shrub(-)	16.2%
		Global model	Water+ exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf + broadleaf dense + broadleaf open + mixedwood dense	27.2%
	Interlake Plain	Best variable	Shrub tall	4.2%
		Best-fit model	Shrub tall + coniferous open + grassland(-)	10.7%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	18.2%
	Mid-Boreal Lowland	Best variable	Mixedwood dense	5.3%
		Best-fit model	Mixedwood dense + broadleaf open + wetland herb(-) + wetland shrub(-)	13.8%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	18.0%
	Hayes River Upland	Best variable	Exposed land	<1%
		Best-fit model	no best fit model available	-
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	6.0%

* ***Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)***

Habitat selection by pileated woodpeckers, in the context of derived expert models, indicated the selection for broadleaf, broadleaf dense, broadleaf open, mixedwood, mixedwood dense and mixedwood open habitats. These habitat variables were indicated through logistic regression analysis as also being important in considering the Lake Manitoba Plain and the Mid-Boreal Lowland Ecoregions where alternately Interlake Plain indicated the alternate selection of shrub-tall habitat areas. This is a questionable result but could be associated with a habitat containing limited tree stands where pileated woodpeckers are perhaps noticeable and easily sampled. In considering the Hayes River Upland Ecoregion, exposed habitat was selected as the most important habitat variable, using logistic regression, but where the amount of variation explained was low (<1%) and no best-fit habitat model was available.

Least Bittern

Sampling of least bittern based on habitat classes used in density estimate calculation took place solely in the Lake Manitoba Plain ecoregion where a density of <0.01 birds/ha was calculated (Table E-21). Sampling of least bittern in this ecoregion took place in wetland herb and broadleaf open habitat areas where densities of <0.01 birds/ha were calculated.

Table E-21. Density of least bittern (number per hectare) in sampled ecoregions based on sampled LLCEB habitat characteristics*

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
83-wetland herb'	<0.01	-	-	-	-	-	<0.01
222-broadleaf open'	<0.01	-	-	-	-	-	<0.01
all habitats	<0.01	-	-	-	-	-	<0.01

From breeding bird survey conducted May to July 2010

Yellow Rail

Calculation of density estimates for least bittern occurred for sampling areas in the Lake Manitoba Plain, Interlake Plain and Mid-Boreal Lowland ecoregions where densities of 0.02 birds/ha, 0.01 birds/ha and 0.03 birds/ha were calculated (Table E-22). Habitat types where least bittern had the highest densities were 0.05 birds/ha in the Lake Manitoba Plain, 0.04 birds/ha in Interlake Plain and 0.07 birds/ha in the Mid-Boreal Lowland ecoregion.

Table E-22. Density of yellow rail (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
82-wetland shrub'	0.03	0.02	-	-	-	-	0.01
83-wetland herb'	0.02	0.04	0.07	-	-	-	0.04
100-herb'	-	0.02	-	-	-	-	0.01
110-grassland'	0.05	-	-	-	-	-	0.04
222-broadleaf open'	<0.01	-	-	-	-	-	<0.01
all habitats	0.02	0.01	0.03	-	-	-	0.01

From breeding bird survey conducted May to July 2010

Sampling of yellow rail sufficient for modeling habitat selection occurred in two ecoregions: Lake Manitoba Plain and Mid-Boreal Lowland (Table E-23). The variable that represented occurrences of yellow rail the most diligently was grassland where 5.1% of variation was explained. The best-fit model for habitat variables indicated the selection of yellow rail for alternate habitat types including wetland shrub, exposed, wetland herb and herb habitat areas where the best-fit model, incorporating grassland habitat also, accounted for 15.8% of variation in yellow rail presence. The sampling of yellow rail based on all available habitat variables for this ecoregion, 16 variables in total, accounted for 19.0% of variation in yellow rail presence within sampling areas.

Within the Mid-Boreal Lowland Ecoregion, the selection of habitat types by yellow rail indicated wetland herb habitat as the most important as explaining 38.0% of variation in yellow rail presence. This is the highest amount of variation explained by a single variable in reviewing habitat variables of importance for VECs sampled during the 2010 breeding bird survey. The herb habitat variable, alongside wetland herb, was selected within the best-fit model and increased the amount of variation explained to 38.1%. The global model, incorporating habitat information from 17 habitat variables, explained 47.3% of variation of yellow rail presence in sampling areas within this ecoregion.

Table E-23. Variation explained (r^2) in yellow rail presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables	r^2
Yellow rail	Lake Manitoba Plain	Best variable	Grassland	5.1%
		Best-fit model	Grassland+ wetland shrub + exposed + wetland herb + herb	15.8%
		Global model	Water+ exposed + developed + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf + broadleaf dense + broadleaf open + mixedwood dense	19.0%
	Mid-Boreal Lowland	Best variable	Wetland herb	38.0%
		Best-fit model	Wetland herb + herb	38.1%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	47.3%

Habitat identified as used by yellow rail using expert models indicated the sole selection of wetland herb habitat areas. This was also indicated through the use of logistic regression analysis to identify habitat variables linked to species presence in the Mid-Boreal Lowland Ecoregion. Alternately, grassland habitat was identified as the habitat type primarily selected for in the Lake Manitoba Plain Ecoregion but where wetland herb was included in the best-fit model. Alternate selection for grassland habitat in this ecoregion may have been due to seasonal flooding where grassland areas were wetter than usual and provided usable yellow rail habitat.

Common Nighthawk

Density estimates for common nighthawk were calculated for the Lake Manitoba Plain, Churchill River Upland and Hudson Bay Lowland ecoregions where these birds were found at <0.01 per/ha (Table E-24).

Table E-24. Density of common nighthawk (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
83-wetland herb'	-	-	-	-	-	0.01	<0.01
110-grassland'	0.01	-	-	-	-	-	<0.01
231-mixedwood dense'	-	-	-	0.01	-	-	<0.01
all habitats	<0.01	-	-	<0.01	-	<0.01	<0.01

From breeding bird survey conducted May to July 2010

Olive-sided Flycatcher

Olive-sided flycatcher density estimates were highest in the Churchill River Upland and Hayes River Upland ecoregions at 0.02 birds/ha where, within these ecoregions, the highest density by habitat type was coniferous open, at 0.05 birds/ha, and coniferous sparse, at 0.11 birds/ha (Table E-25). Concentrations of olive-sided flycatcher were alternately lowest in the Lake Manitoba Plain ecoregion at <0.01 birds/ha.

Sampling of olive-sided flycatcher occurred in five of six sampled ecoregions where counts occurred in more than 10 sampling plots (Table E-26). In the Interlake Plain Ecoregion, coniferous dense was the most selected for habitat and accounted for 10.1% of variation in the presence of olive-sided flycatchers. The best-fit models, including shrub tall and exposed habitats with coniferous dense, accounted for 20.7% of variation and the global model, consisting of all available habitat variables for this ecoregion, explained 29.2% of variation.

Table E-25. Density of olive-sided flycatchers (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregions
51-shrub tall'	-	0.08	0.01	0.03	0.01	0.02	0.02
81-wetland treed'	-	-	-	-	0.03	-	0.01
82-wetland shrub'	-	<0.01	0.02	0.01	0.07	-	0.02
83-wetland herb'	-	0.01	<0.01	0.02	0.05	-	0.01
211-coniferous dense'	-	0.03	0.01	0.02	<0.01	-	0.01
212-coniferous open'	-	-	-	0.05	0.01	0.01	0.02
213-coniferous sparse'	-	-	-	-	0.11	-	0.02
221-broadleaf dense'	0.01	<0.01	-	-	0.01	-	<0.01
222-broadleaf open'	<0.01	-	-	-	-	-	<0.01
231-mixedwood dense'	-	0.02	-	0.01	0.01	-	0.01
All Habitats	<0.01	0.01	0.01	0.02	0.02	0.01	0.01

From breeding bird survey conducted May to July 2010

Sampling of olive-sided flycatcher in the Mid-Boreal Lowland Ecoregion indicated their habitat preference was water which explained 2.5% of variation in their presence in sampling areas selected in this ecoregion. The best-fit model for olive-sided flycatchers alternately identified 13.7% of variation in species presence as explained through a combination of water, wetland herb, shrub tall habitat areas with broadleaf dense habitat actively being selected against. This is in contrast to 16.8% of variation as explained using the global model incorporating all available habitat information for this ecoregion (17 variables total).

In the Churchill River Upland Ecoregion the shrub tall habitat variable explained the most variation in olive-sided flycatcher presence at 6.0%. With other habitat variables, modeled as the best-fit model for this ecoregion, 20.3% of variation was explained compared to the global model for this ecoregion which indicated 29.8% of variation explained.

Sampling of olive-sided flycatchers in the Hayes River Upland Ecoregion indicated 6.9% of variation as explained by wetland shrub habitat. The best-fit model also consisted of wetland treed and wetland herb habitat areas with coniferous open habitat being actively selected against. The best-fit model accounted for 12.9% of variation in olive-sided flycatcher presence in sampled areas while the global model alternately accounted for 20.1% of variation.

In the Hudson Bay Lowland Ecoregion, exposed habitat areas were selected for by olive-sided flycatchers and explained 2.8% of variation. The best-fit model for olive-sided flycatcher alternately included shrub tall, coniferous open and coniferous sparse and accounted for 6.0% of variation and the global model, through modeling of 10 habitat variables, accounted for 16.6% of variation.

Table E-26. Variation explained (r^2) in olive-sided flycatcher presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model Type	Model Variables*	r^2
Olive-sided flycatcher	Interlake Plain	Best variable	Coniferous dense	10.1%
		Best-fit model	Coniferous dense + shrub tall + exposed	20.7%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	29.2%
	Mid-Boreal Lowland	Best variable	Water	2.5%
		Best-fit model	Water + wetland herb + shrub tall + broadleaf dense(-)	13.7%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	16.8%
	Churchill River Upland	Best variable	Shrub tall	6.0%
		Best-fit model	Shrub tall + coniferous open + wetland shrub + coniferous sparse(-)	20.3%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	29.8%
	Hayes River Upland	Best variable	Wetland shrub	6.9%
		Best-fit model	Wetland shrub + wetland treed + wetland herb + coniferous open(-)	12.9%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + mixedwood dense	20.1%
	Hudson Bay Lowland	Best variable	Exposed	2.8%
		Best-fit model	Exposed + shrub tall + coniferous open + coniferous sparse	6.0%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + mixedwood dense	16.6%

** Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)*

Varying habitat types were identified as being potentially important in the use of expert derived models including wetland habitat classes as well as broadleaf open and sparse and mixedwood open and sparse forest habitats. Logistic regression analysis indicated the primary selection of these habitat variables when considering the Hayes River Upland Ecoregion which indicated wetland shrub habitat as a habitat type of primary importance. Other ecoregions had varying habitat types selected for including coniferous dense (Interlake Plain), water (Mid-Boreal Lowland), shrub tall (Churchill River Upland) and exposed (Hudson Bay Lowland). Some selection for wetland areas was alternately indicated in the best-fit models for Mid-Boreal Lowlands and the Churchill River Upland Ecoregions. Variation in habitat areas selected for by Olive-sided flycatcher based on expert and logistic regression models could be due to uncertainty on the specific habitat attributes of this species and its potentially being a habitat generalist where specific habitat use is not easily discerned.

Golden-winged Warbler

Sampling of golden-winged warbler only occurred in the Interlake Plain ecoregion where the calculated density of this bird was <0.01 birds/ha which were distributed in wetland herb (0.02 birds/ha) and broadleaf dense (0.01/ha) habitats (Table E-27).

Sampling of golden-winged warbler to the extent required for modeling habitat variables occurred only in the Interlake Plain Ecoregion where this species was observed across 20 different sampling sites (Table E-28). The best-fit variable for golden-winged warbler was broadleaf open which explained 25.9% of variation in this ecoregion. Alternately the best fit model had broadleaf open and developed areas selected for and wetland shrub areas selected against and explained 30.2% of the variation. The global model, alternately, explained 38.0% of variation in describing the presence and absence of golden-winged warblers in sampling sites in this ecoregion.

Table E-27. Density of golden-winged warbler (number per hectare**) in sampled ecoregions based on sampled LLCEB habitat characteristics***

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
83-wetland herb'	-	0.02	-	-	-	-	<0.01
221-broadleaf dense'	-	0.01	-	-	-	-	<0.01
all habitats	-	<0.01	-	-	-	-	<0.01

From breeding bird survey conducted May to July 2010

Table E-28. Variation explained (r^2) in golden-winged warbler presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables*	r^2
Golden-winged warbler	Interlake Plain	Best variable	Broadleaf open	25.9%
		Best-fit model	Broadleaf open + developed + wetland shrub (-)	30.2%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	38.0%

* ***Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)***

A range of habitat types were identified as being potentially meaningful indicators of golden-winged warbler presence using expert models including both broadleaf dense and broadleaf sparse habitat areas. Despite this, the selection for habitat in considering the results of logistic regression analysis indicated the selection for broadleaf open habitat in the Interlake Plain Ecoregion. Alternate to the expert model provided for this species which indicated some use of wetland shrub habitat by this species, using logistic regression analysis this class was indicated as being actively selected against.

Canada Warbler

Calculated Canada warbler density estimates indicated the highest concentrations of this species in the Mid-Boreal Lowland (0.03 birds/ha) and Lake Manitoba Plain (0.02 birds/ha) (Table E-29). Density estimates also indicated concentration of < 0.01 birds/ha being sampled in the Lake Manitoba Plains and Hayes River Upland ecoregions with no birds sampled in the Churchill River Upland or Hudson Bay Lowland ecoregions. The highest concentration of Canada warbler seen overall was for broadleaf dense habitat areas in the Mid-Boreal Lowland ecoregion where 0.15 birds/ha was calculated.

Sampling of Canada warbler and modeling of species occurrence based on habitat variables occurred in two ecoregions: Interlake Plain and Mid-Boreal Lowland. In the Interlake Plain ecoregion the best variable used in explaining Canada warbler presence was broadleaf dense which accounted for 7.9% of variation in Canada warbler presence where the best-fit model, also including mixedwood dense, wetland treed and coniferous dense accounted for 16.6% of variation. The global model, accounting for 17 variable habitat types in this ecoregion, indicated 21.8% of variation in Canada warbler presence as explained.

Table E-29. Density of Canada warbler (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics**

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
81-wetland treed'	-	0.02	-	-	-	-	0.01
82-wetland shrub'	-	0.02	-	-	-	-	<0.01
110-grassland'	<0.01	-	-	-	-	-	<0.01
211-softwood dense'	-	-	0.02	-	<0.01	-	<0.01
221-hardwood dense'	-	0.04	0.15	-	-	-	0.05
222-hardwood open'	0.01	0.02	-	-	-	-	0.01
231-mixedwood dense'	-	0.06	0.15	-	-	-	0.04
All Habitats	<0.01	0.02	0.03	-	<0.01	-	0.01

From breeding bird survey conducted May to July 2010

Habitat types selected for by Canada warbler in the Mid-Boreal Lowland sampling areas included broadleaf-dense, mixedwood dense, water, grassland and coniferous dense (Table E-30). Together these accounted for 42.7% of variation in the presence of Canada warbler in sampling sites while broadleaf dense habitat alone accounted for 28.3%. The global model, consisting of all available habitat information for this ecoregion, alternately accounted for 46.8% of variation.

Table E-30. Variation explained (r^2) in Canada warbler presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables	r^2
Canada Warbler	Interlake Plain	Best variable	Broadleaf dense	7.9%
		Best-fit model	Broadleaf dense+ mixedwood dense + wetland treed + coniferous dense	16.6%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + annual crops + perennial crops & pasture + coniferous dense + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	21.8%
	Mid-Boreal Lowland	Best variable	Broadleaf dense	28.3%
		Best-fit model	Broadleaf dense + mixedwood dense + water + grassland + coniferous dense	42.7%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	46.8%

* ***Negative signs (-) indicate species avoidance of particular habitat type (best-fit model only)***

A range of habitat types were identified as being potentially meaningful indicators of Canada warbler presence; including broadleaf dense and open habitat areas as well as mixedwood dense and open habitat areas. This assessment of habitat variables used by Canada warbler was also indicated through logistic regression analysis where broadleaf dense habitat in the Interlake Plain and Mid-Boreal Lowland Ecoregions was actively selected for. In considering the best-fit model for these ecoregions, mixedwood dense was also present as a habitat variable selected for by Canada warbler where coniferous dense forest areas were also present; although not ranked as highly as mixedwood dense.

Rusty Blackbird

Rusty blackbird density was highest in sampling areas sampled in the Mid-Boreal Lowland and Hudson Bay Lowland ecoregions at 0.04 birds/ha (Table E-31). This is higher than the average total over all sampling sites considered for density calculations where on average 0.02 birds/ha was calculated. The highest rusty blackbird density was recorded for wetland treed habitat in Hudson Bay Lowland where an estimate of 0.37 birds/ha was calculated.

Sampling of rusty blackbird occurred in four ecoregions where habitat information influencing the extent of rusty blackbird presence could be validated (Table E-32). In the Mid-Boreal Lowland ecoregion, wetland herb was indicated as the best fit habitat variable and accounted for 14.7% of the variation in presence of this species in sampled areas. The best-fit model alternately also incorporated wetland treed and wetland shrub habitat areas; and together explained 24.5% of the variation in rusty blackbird presence. The global model, where all available habitat information for this ecoregion was modeled, explained 27.8% of variation in the presence of rusty blackbird in sampling areas within the ecoregion.

In the Churchill River Upland ecoregion, sampling of rusty blackbird indicated a preference for wetland herb habitat areas which accounted for 14.1% of the variation for the presence of this species within sampling areas for this ecoregion. When combined, with the wetland shrub habitat variable, wetland herb explained 17.5% of the variation in rusty blackbird presence. The global model alternately explained 38.9% of variation. Other habitat variables likely contributing to the high amount of variation explained by the global model, but not fitted as part of the best-fit model, included water and wetland herb habitat variables.

Table E-31. Density of rusty blackbirds (number per hectare) **in sampled ecoregions based on sampled LLCEB habitat characteristics**

LCCEB Class	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Ecoregion
51-shrub tall'	-	-	0.01	-	0.02	0.01	0.01
81-wetland treed'	-	0.01	0.03	-	0.07	0.37	0.07
82-wetland shrub'	-	-	0.10	0.01	0.04	0.07	0.03
83-wetland herb'	-	-	0.07	0.15	-	0.05	0.04
211-coniferous dense'	-	-	-	-	<0.01	-	<0.01
212-coniferous open'	-	-	-	0.04	<0.01	0.04	0.02
213-coniferous sparse'	-	-	-	-	0.11	0.04	0.04
231-mixedwood dense'	-	-	-	0.02	-	-	0.01
all habitats	-	<0.01	0.04	0.03	0.02	0.04	0.02

From breeding bird survey conducted May to July 2010

In the Hayes River Upland ecoregion, sampling of rusty blackbird indicated a preference for wetland treed habitat areas where the best-fit model also incorporated wetland shrub, shrub tall, wetland herb and coniferous open habitat areas. The best habitat variable alone, wetland herb, accounted for 7.0% of variation in rusty blackbird presence where the best-fit model explained 15.7% of variation. These amounts varied from the 18.4% of variation explained by the global model.

Sampling of rusty blackbird in the Hudson Bay Lowland ecoregion indicated habitat selection for wetland shrub habitat areas which accounted for 6.1% of the variation in the presence of this species in sampled areas. The best-fit model for rusty blackbird in this ecoregion, incorporating wetland treed and wetland shrub habitats, alternately accounted for 10.3% of variation where the global model accounted for 12.9% of variation.

Selection of habitat by rusty blackbird based on expert models indicated the use of varied forest habitat areas including coniferous, broadleaf and mixedwood areas as well as a range of wetland habitats including wetland treed, wetland shrub and wetland herb. Wetland habitat use was validated through logistic regression analysis where wetland herb was the primary habitat type selected for in the Mid-Boreal Lowland and Churchill River Upland Ecoregions while wetland treed was selected for in the Hayes River Upland and wetland shrub in the Hudson Bay Lowland. Some selection for forested areas was represented in rusty blackbird selection for coniferous open habitat areas as part of the best-fit model for the Hayes River Upland Ecoregion. Alternately, all other variables included in the best-fit models consisted of wetland habitat variables only.

Table E-32. Variation explained (r^2) in rusty blackbird presence based on logistic regression of mapped habitat features

Species	Ecoregion	Model type	Model variables	r^2
Rusty blackbird	Mid-Boreal Lowland	Best variable	Wetland-herb	14.7%
		Best-fit model	Wetland-herb + wetland treed + wetland shrub	24.5%
		Global model	Water+ exposed + developed +shrub tall + wetland treed + wetland shrub + wetland herb + herb + grassland + perennial crops & pasture + coniferous dense + coniferous sparse + coniferous open + broadleaf dense + broadleaf open + mixedwood dense + mixedwood open	27.8%
	Churchill River Upland	Best variable	Wetland herb	14.1%
		Best-fit model	Wetland herb + wetland shrub	17.5%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse coniferous open + broadleaf dense + mixedwood dense	38.9%
	Hayes River Upland	Best variable	Wetland-treed	7.0%
		Best-fit model	Wetland-treed + wetland shrub + shrub tall + wetland herb + coniferous open	15.7%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse coniferous open + broadleaf dense + mixedwood dense	18.4%
	Hudson Bay Lowland	Best variable	Wetland shrub	6.1%
		Best-fit model	Wetland shrub + wetland treed + wetland herb	10.3%
		Global model	Water+ exposed +shrub tall + wetland treed + wetland shrub + wetland herb + coniferous dense + coniferous sparse + coniferous open + mixedwood dense	12.9%

Habitat Selection by Songbirds and Other Birds

Riparian

Yellow warblers prefer breeding habitat in wet riparian woodlands (Ficken and Ficken 1968). Their selection of nesting habitat is strongly influenced by the surrounding habitat, not just on the individual bush or tree selected for nesting (Knopf and Sedgwick 1992). In Manitoba yellow warblers are found in woodlands in the close vicinity of lake shorelines, waterways, and wetlands (Edie *et al.* 2003b). The alder flycatcher favours wet shrubby habitat associated with riparian areas when selecting nesting sites (Taylor 2003f).

Wetlands

Common yellowthroats breed and nest Manitoba's wetlands, and are typically found in marshy areas (Neily 2000; Taylor 2003g). They are most numerous in the Boreal Plains Ecoregion, where wetlands are abundant (Taylor 2003g). Foraging behaviour is strongly tied to wetland habitats such as wet willow patches and cattails (Kelly and Wood 1996). Yellow-headed blackbirds utilize marshes and wetlands with an abundance of emergent vegetation intermixed with open areas of water (Willson 1966). They can be found throughout the large wetland areas of Manitoba in the southwest and north to The Pas, as well as smaller wetlands throughout the south (Holland *et al.* 2003e).

Coniferous

Blackpoll warblers typically prefer breeding and foraging habitat consisting of predominately coniferous forests (Morse 1979). In Manitoba they are commonly found breeding in northern coniferous forests (Edie *et al.* 2003c). Within forest stands dominated by conifers where many birds utilize different niches for foraging, blackpoll warblers forage close to the trunk at mid height of individual trees (Morse 1979). Bay-breasted warblers are common summer inhabitants of Manitoba's mature conifer forests from the Whiteshell and Nopiming Provincial Parks, west to Riding Mountain National Park, and north to the central boreal forests (Edie *et al.* 2003d). They typically favour dense stands of conifer trees (Mendall 1937). The foraging niche of these warblers is mainly the middle to upper levels of conifer branches (Mendall 1937).

Deciduous

Veeries are common breeders and nesters in the moist deciduous woodlands of southern Manitoba, where they favour dense stands of aspen with a thick understory (Taylor 2003h). They require large stands of deciduous woodlands for breeding, as small stands are not associated with veery breeding territories (Grant and Berkey 1999). The dense deciduous understory they require is vulnerable to degradation due to over-browsing by deer (Kearns *et al.* 2006).

Shrublands

Clay-coloured sparrows require shrubby habitat throughout their breeding range (Knapton 2003). They are commonly found in the prairies of southwestern Manitoba and more uncommonly in open shrubby areas of the boreal forests to the north (Knapton 2003). Clay-coloured sparrows build their nests in small shrubs and trees, and use the surrounding shrubs and trees for territorial display (Walkinshaw 1939).

Grasslands

Passerines utilize differing niches within grassland habitat; vesper sparrows are found in large, dry clearings in the boreal forest (Krueger and Taylor 2003), whereas bobolinks are frequently associated with tall dense grasses with higher forb densities (Madden *et al.* 2000). Bobolinks are found in the prairie and agricultural areas of southern Manitoba, usually associated with tall dense vegetation (Holland *et al.* 2003f). Vesper sparrows are common in grassland and open farmland in southern and central Manitoba (Krueger and Taylor 2003).

Disturbance

Many passerine species' habitat requirements are fulfilled by ecosystems that are subject to routine disturbance regimes that create or maintain suitable habitat (Hunter *et al.* 2001). Golden-winged warblers are dependent upon frequent fire and flooding to restore their habitat requirement of early succession shrub and young forests (Hunter *et al.* 2001). Similarly, Canada warblers depend on natural disturbances to provide for sufficient forage opportunities, as population growth has been tied to spruce budworm outbreaks (Sleep *et al.* 2009). Red-headed woodpeckers, found in areas of southern Manitoba with open deciduous woodlands with many standing dead or dying trees (Taylor 2003i), have increased in population following selective logging and prescribed burning (King *et al.* 2007).

SPECIES AREA CURVES

Species area curves were used to assess the rate of 'new' species observations at point count locations during the breeding bird survey. Assessment of new species seen was based on Ecoregion to adjust for the possibility of seeing species only within certain geographic ranges and to account for rare or unseen species more appropriately. In calculation of species area curves calculations of a likely number of species within each ecoregion was calculated using a jackknife estimator (Table E-33).

In determining the number of sampling areas required in potentially observing all species present it is recommended surveys other than the breeding birds survey be applied. This is evident through the relatively large number of surveys required in sampling the last 5% of species for each ecoregion and where the rate of seeing new species rapidly declines. Alternate survey designs can include such surveys as nocturnal owl and colonial waterbirds surveys; which were also done in this study.

Table E-33. Species richness estimates calculated for sampling sites surveyed from six ecoregions in the development of the final preferred route

	Ecoregion						
	Lake Manitoba Plain	Interlake Plain	Mid-Boreal Lowland	Churchill River Upland	Hayes River Upland	Hudson Bay Lowland	All Eco-regions combined
Number of sampling locations	493	626	677	246	807	500	3,349
Number of species observed	140	150	132	78	106	91	192
Number of species observed once	19	17	17	13	21	19	13
Number of species observed twice	15	9	13	7	7	8	14
Jackknife estimate of species	163	175	153	97	141	121	201

Lake Manitoba Plain

Sampling of the Lake Manitoba Plain Ecoregion during the 2010 breeding bird survey indicated the presence of 140 bird species recorded through a combination of point count and handheld recorder information. Few additional species were added to the total number of species as a result of increased effort based on the sample size (n=493 plots). 95% of species identified in the Lake Manitoba Plains was achieved at 133 plots (Figure E-14). This indicates the potentially slow increase in identified species through the adding of sampling locations past a certain point; particularly in reaching the calculated jackknife estimate of 163 species (Table E-33).

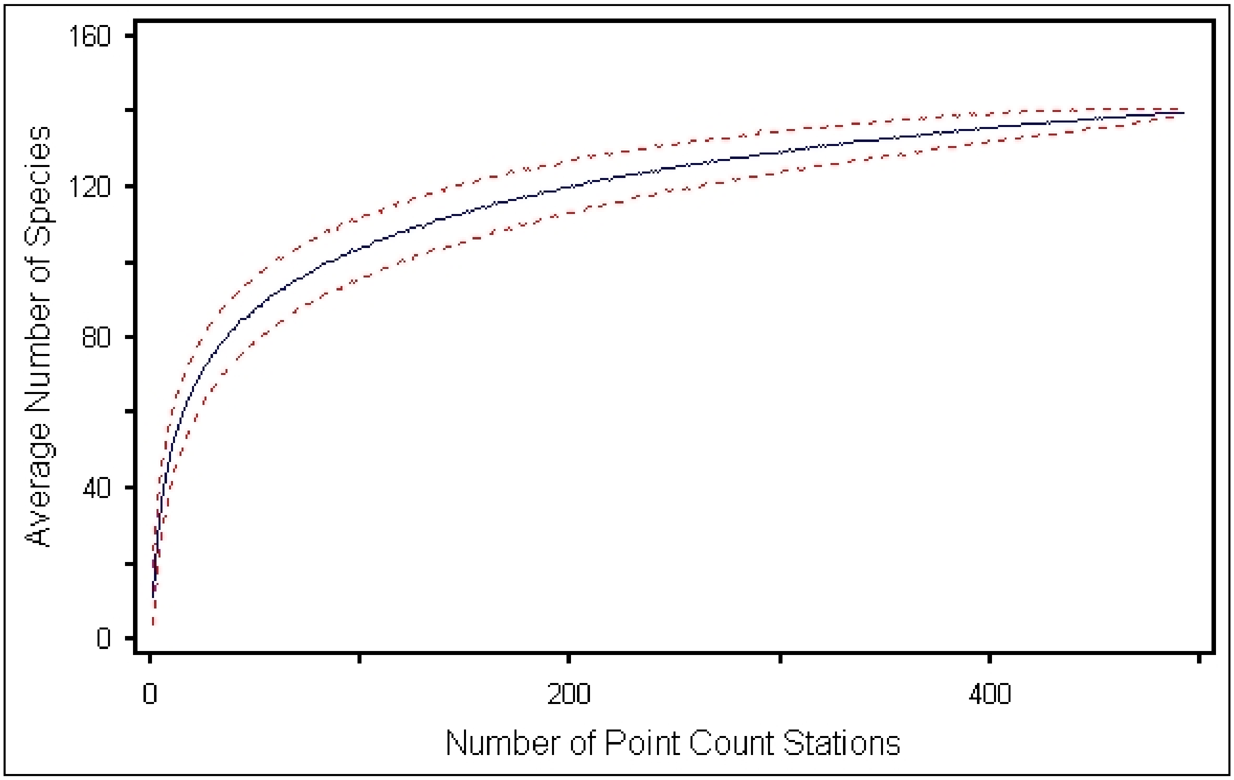


Figure E-14. Species area curve for total number of bird species sampled in 2010 from sampling locations in the Lake Manitoba Plain Ecoregion. *Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).*

Interlake Plain

The Interlake Plain Ecoregion, 150 bird species were identified during the 2010 breeding bird survey. A total of 626 plots were sampled (Figure E-15). In reaching a goal of sampling 95% of identifiable species in the Interlake Plains Ecoregion, 401 plots would have needed surveying. This indicates that the sampling of the last 5% of species in this ecoregion (n = 7) took an additional 225 sampling locations to verify. The estimated number of species in this area using the jackknife estimator is 175 (Table E-33).

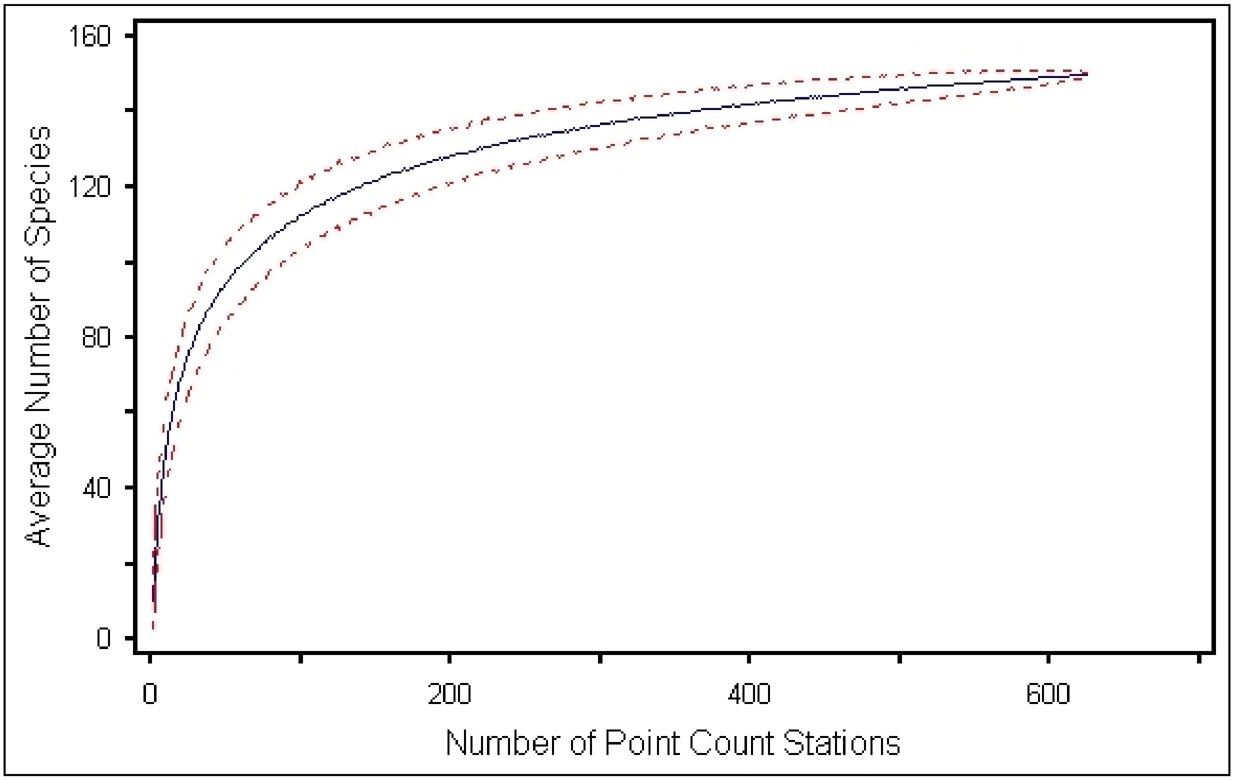


Figure E-15. Species area curve for total number of bird species sampled in 2010 from sampling locations in the Interlake Plain Ecoregion. Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).

Mid-Boreal Lowland

The Mid-Boreal Lowland Ecoregion had 132 unique bird species identified during the 2010 breeding bird survey where 677 plots were sampled. One hundred and twenty-six species (95%) were observed following the surveying of 437 of the 677 sampling sites, which was then supplemented through the sampling of the remaining sites and species. The estimated number of species in this area using the jackknife estimator is 153 (see Table E-33). Sampling this many species would likely take an extensive number of additional sampling periods based on calculated rates of change observed for bird species after sampling 600+ sites using the breeding bird survey (Figure E-16).

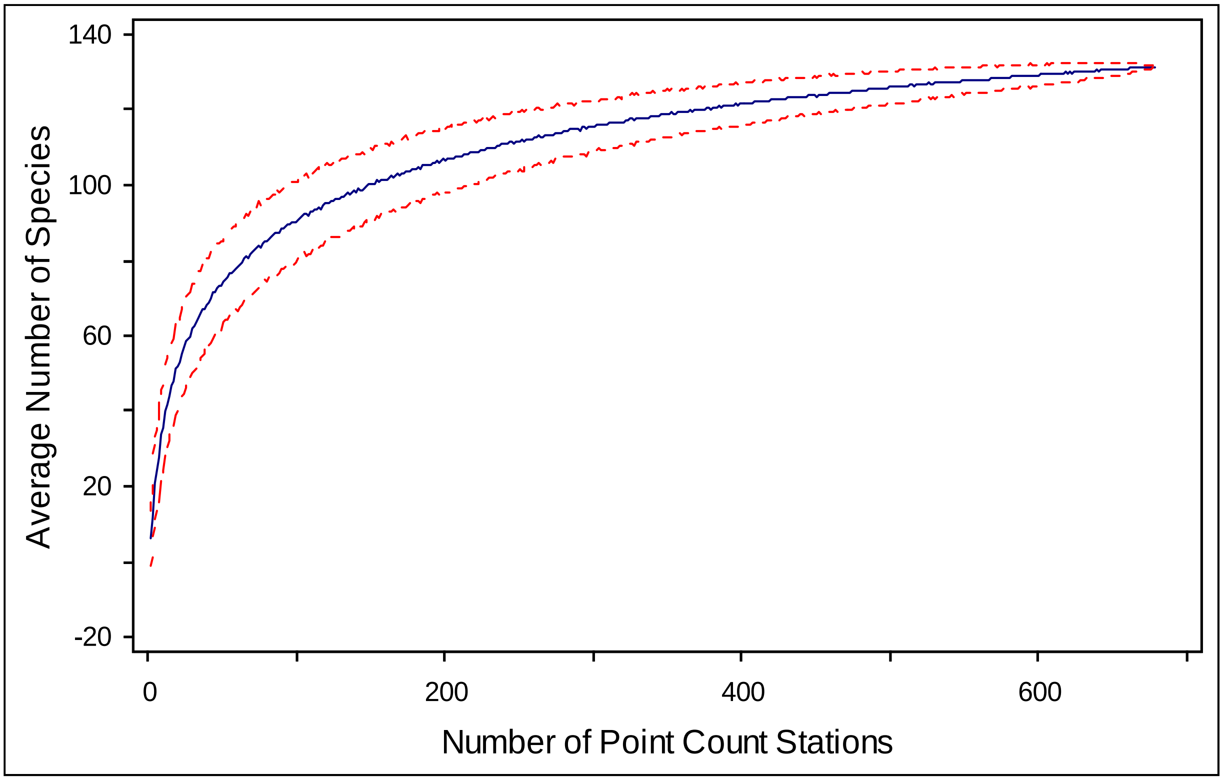


Figure E-16. **Species area curve for total number of bird species sampled in 2010 from plots in the Mid-Boreal Lowland Ecoregion. Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).**

Churchill River Upland

The Churchill River Upland Ecoregion had 78 unique bird species identified across 246 plots investigated during the 2010 breeding bird survey. On reaching a hypothetical goal of sampling 95% percent of species in the sampling area, 183 sampling locations would have been required (Figure E-17). This indicates the sampling of the last 5% of remaining species (n = 4) effectively required an additional 63 sampling locations and where reaching the hypothetical estimate of species richness of 97 (see Table E-33) would likely require modification of survey techniques over the addition of new sampling sites to the existing breeding bird survey. Because this ecoregion was sampled the fewest number of times, however, it could be expected that any increase in the number of sampling sites to an ecoregion would have the net greatest positive effect here proportional to other study populations/ecoregions.

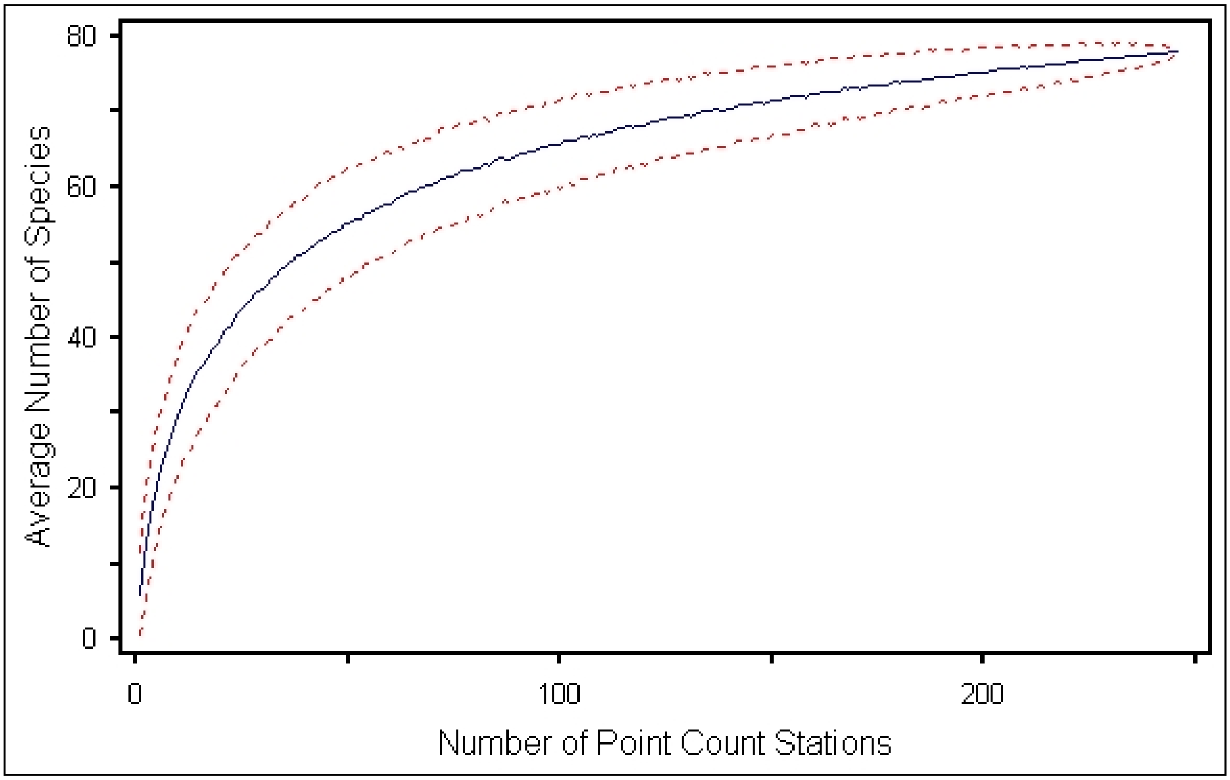


Figure E-17. Species area curve for total number of bird species sampled in 2010 from plots in the Churchill River Upland ecoregion. Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).

Hayes River Upland

One hundred and six bird species were identified on 807 plots through breeding bird surveys conducted in the Hayes River Upland Ecoregion during the 2010 breeding bird surveys. To have effectively estimated 95% of the birds identified in this ecoregion (n = 101), only 601 survey sites would have been required (provided 2010 survey conditions remained constant; Figure E-18). This number of species was supplemented by the investigation of bird species at 206 more sites where the last 5% of species (n = 5) could be successfully identified. Despite considerable sampling effort, jackknife estimates for species richness indicate the possibility of an additional 35 species present in the area (see Table E-33).

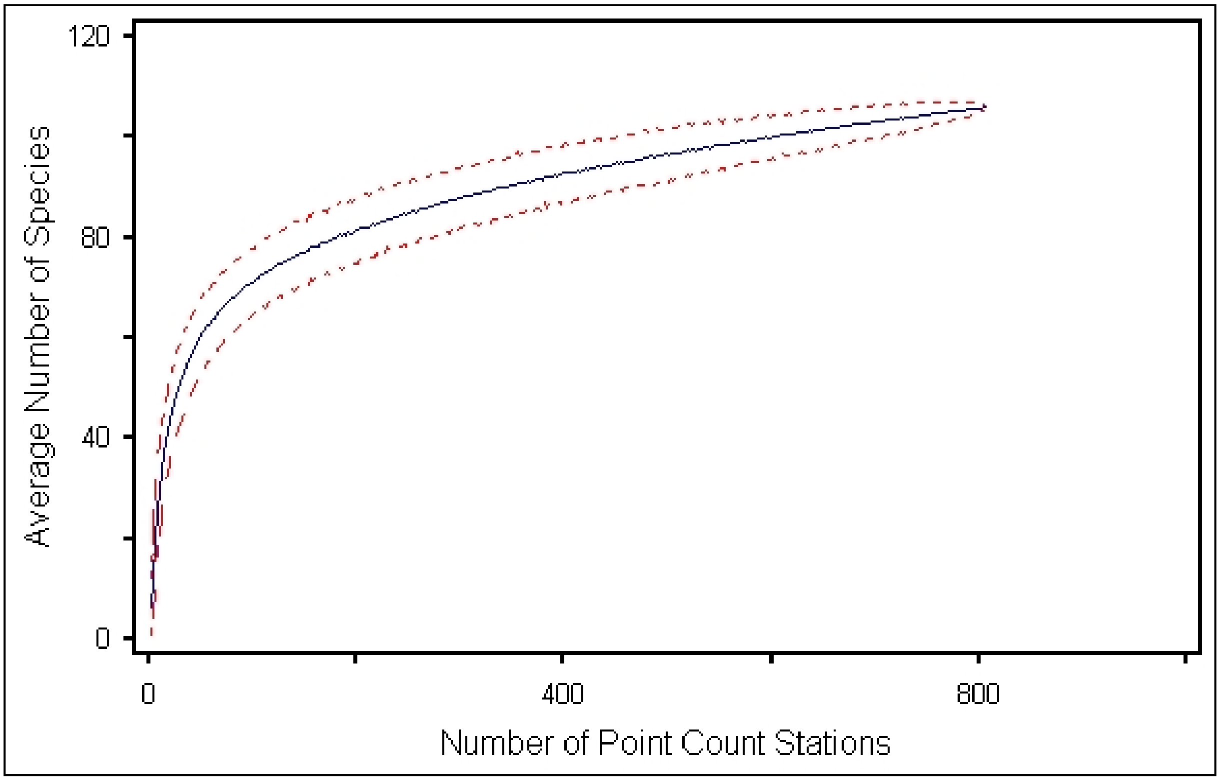


Figure E-18. **Species area curve for total number of bird species sampled in 2010 from plots in the Hayes River Upland ecoregion. Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).**

Hudson Bay Lowland

Sampling of the Hudson Bay Lowland Ecoregion occurred at 500 plots during the 2010 breeding bird survey. Over this time 91 species were observed. To reach a threshold where 95% of identified species for this region had been seen (n = 87), it was determined that a random selection of 392 sampling sites would have been sufficient (Figure E-19). This indicates that the relative sampling of four species, the last 5% of species identified, took place over the last 108 sampling locations surveyed. This would also indicate that sampling of all 107 species, as indicated through calculated jackknife estimates (see Table E-33), would require an additional number of sampling periods or other modifications to survey design for increased species identification to take place.

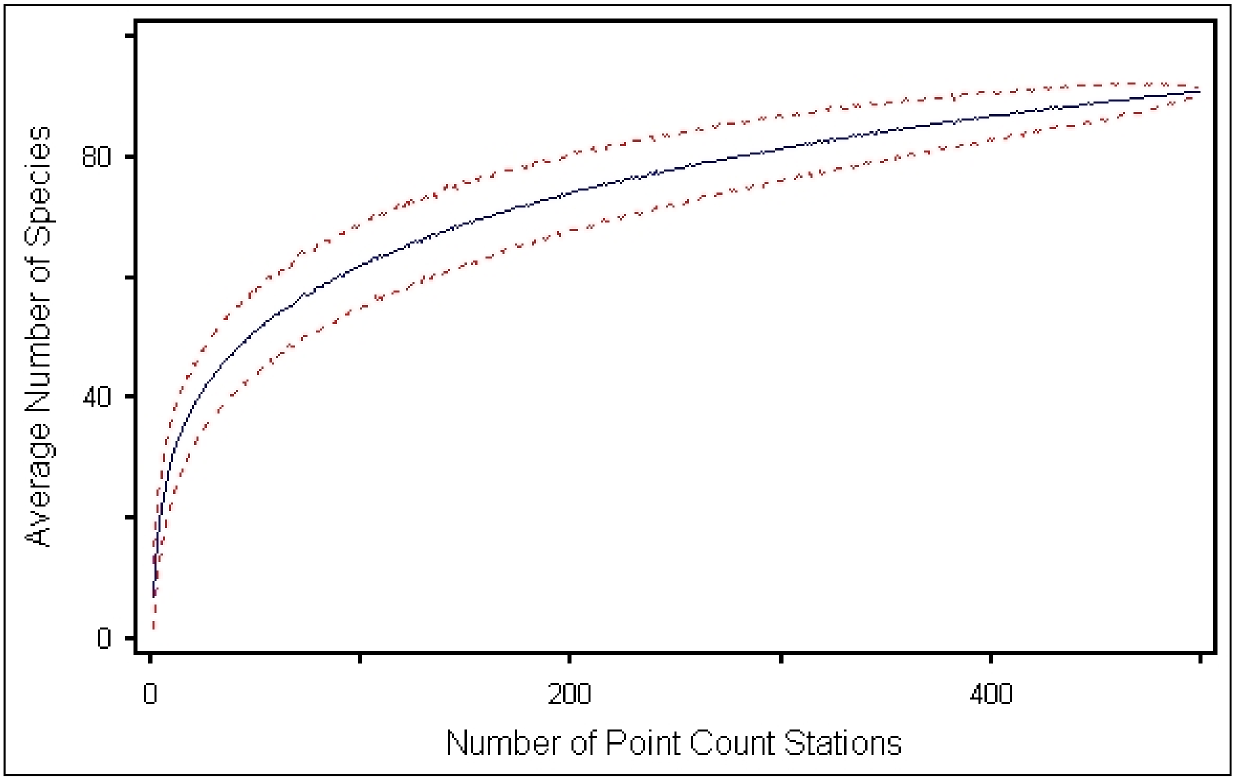
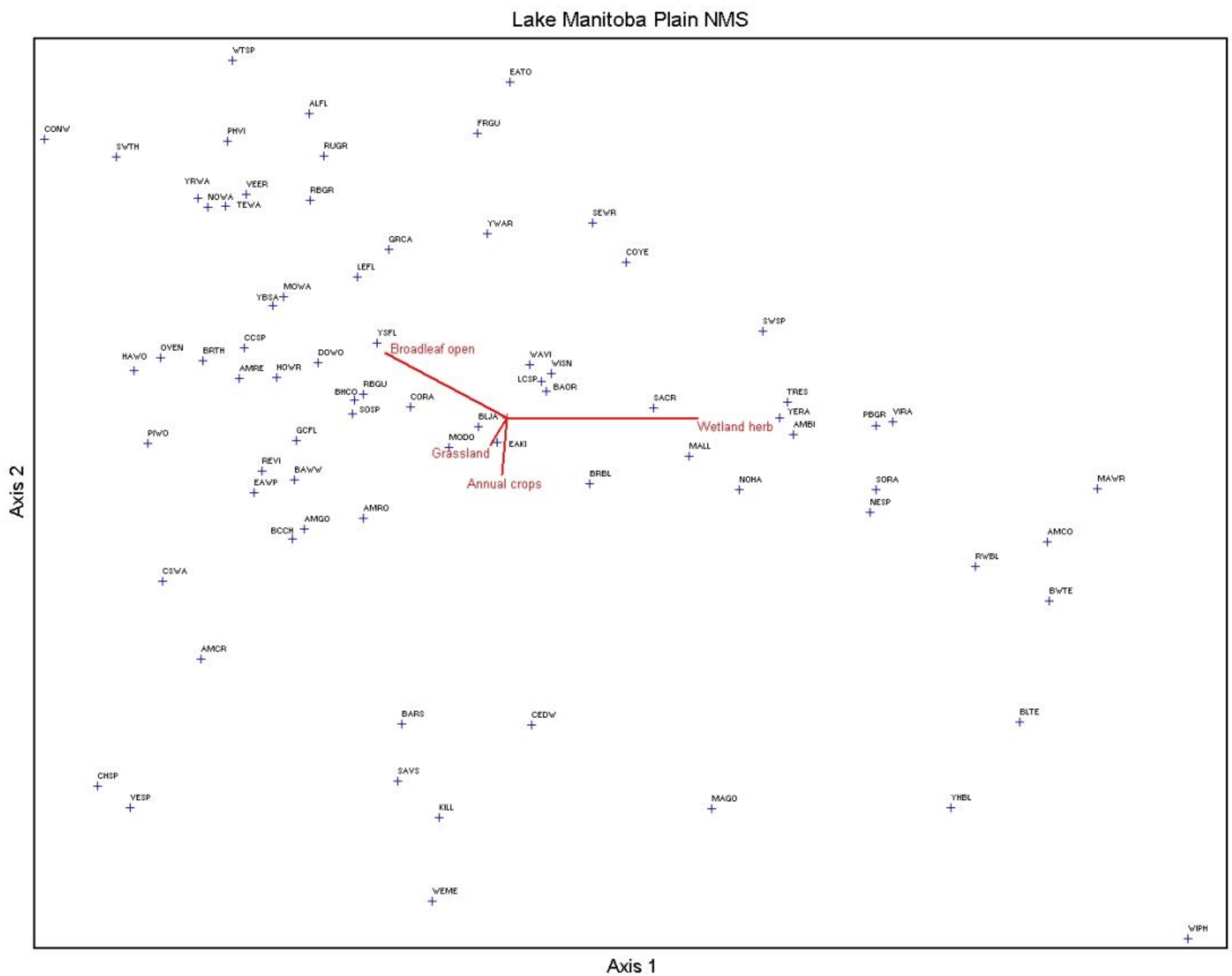


Figure E-19. **Species area curve for total number of bird species sampled in 2010 from plots in the Hudson Bay Lowland Ecoregion. Dashed line indicates 95% confidence interval associated with calculated species richness (solid line).**

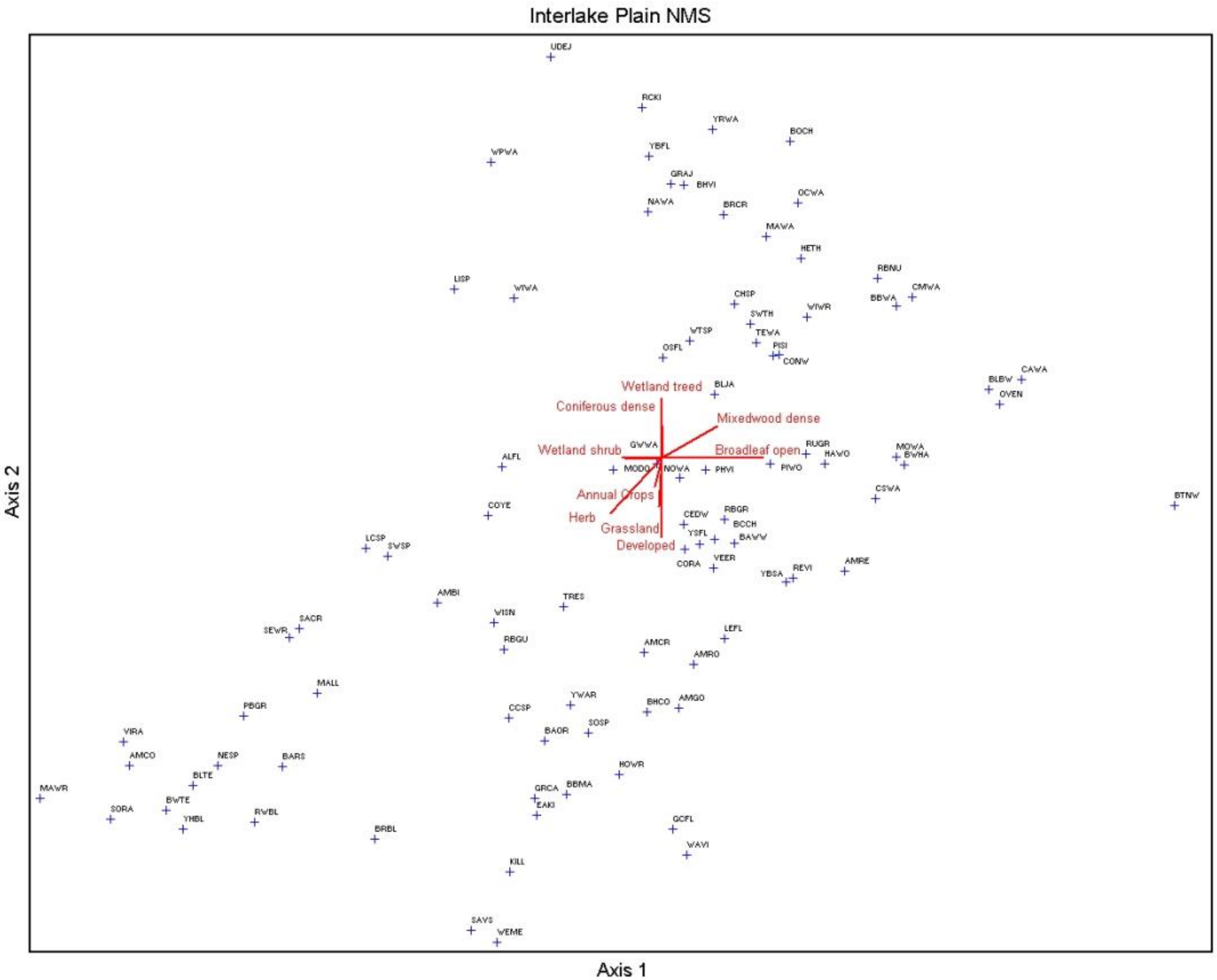
SUMMARY

The general agreement between logistic regression and NMS analysis to determine habitat areas selected by birds in each ecoregion is important. These statistical techniques are largely independent where having the results from one analysis validate results from the other shows that the assessment of certain habitat classes on bird species are correct. However, while important habitat types can be delineated, there is still some consideration to be given for only a small amount of variation in bird species presence as explained by habitat classes.

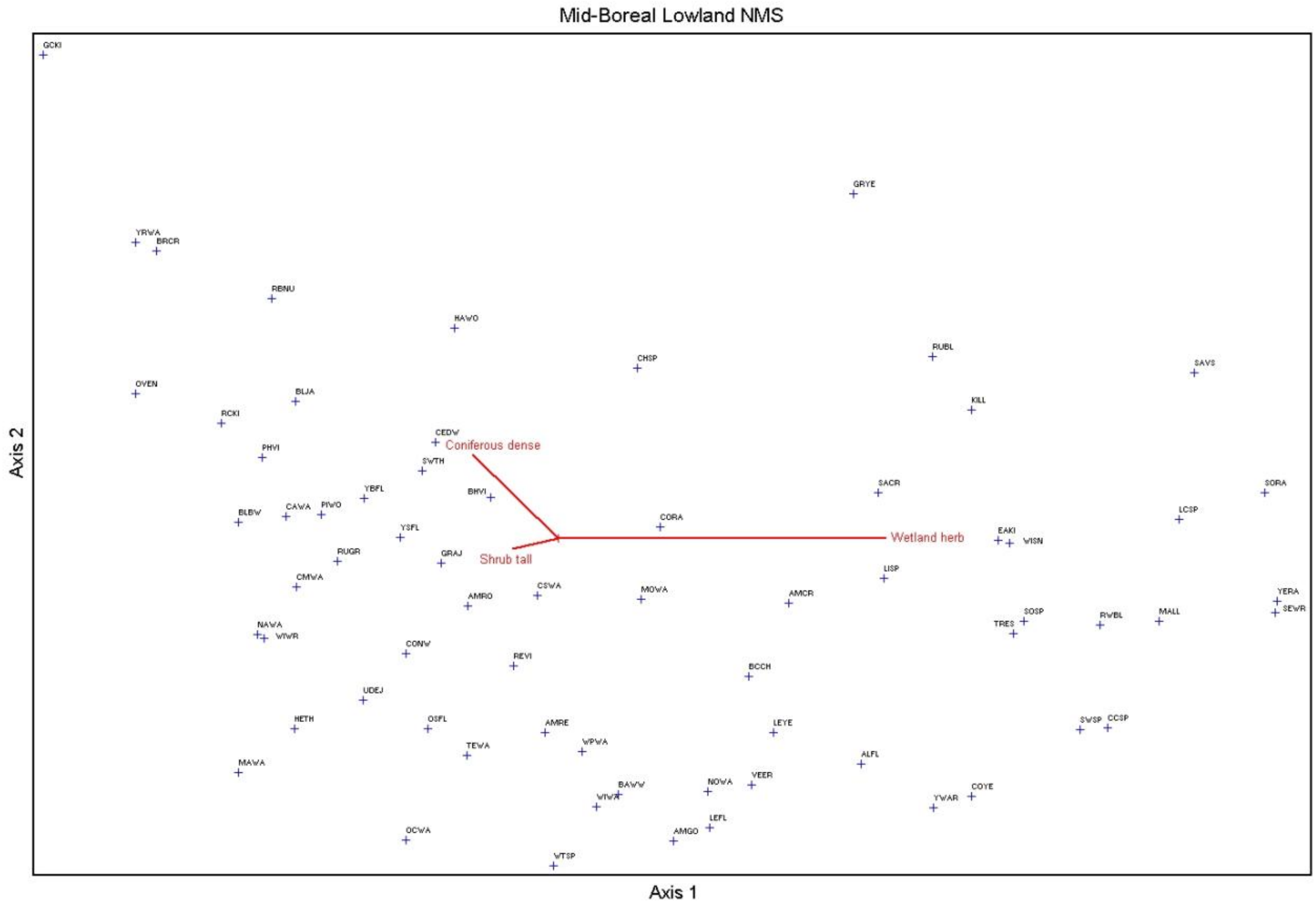
Results of cluster analysis for this ecoregion (Figures E7 - E-12) indicate some association between bird groups based on habitat classes. These groups did not form singular blocks, however, and are distributed amongst other groups where the selection for other habitat classes is occurring. This would indicate that factors other than the selection of a primary habitat class is taking place and could include the selection for multiple habitat classes by species or spatial variation in the selection of habitat by species. A more complete interpretation of habitat selection by VEC species in this ecoregion can be found in section 5.4-4 of the technical report for birds.



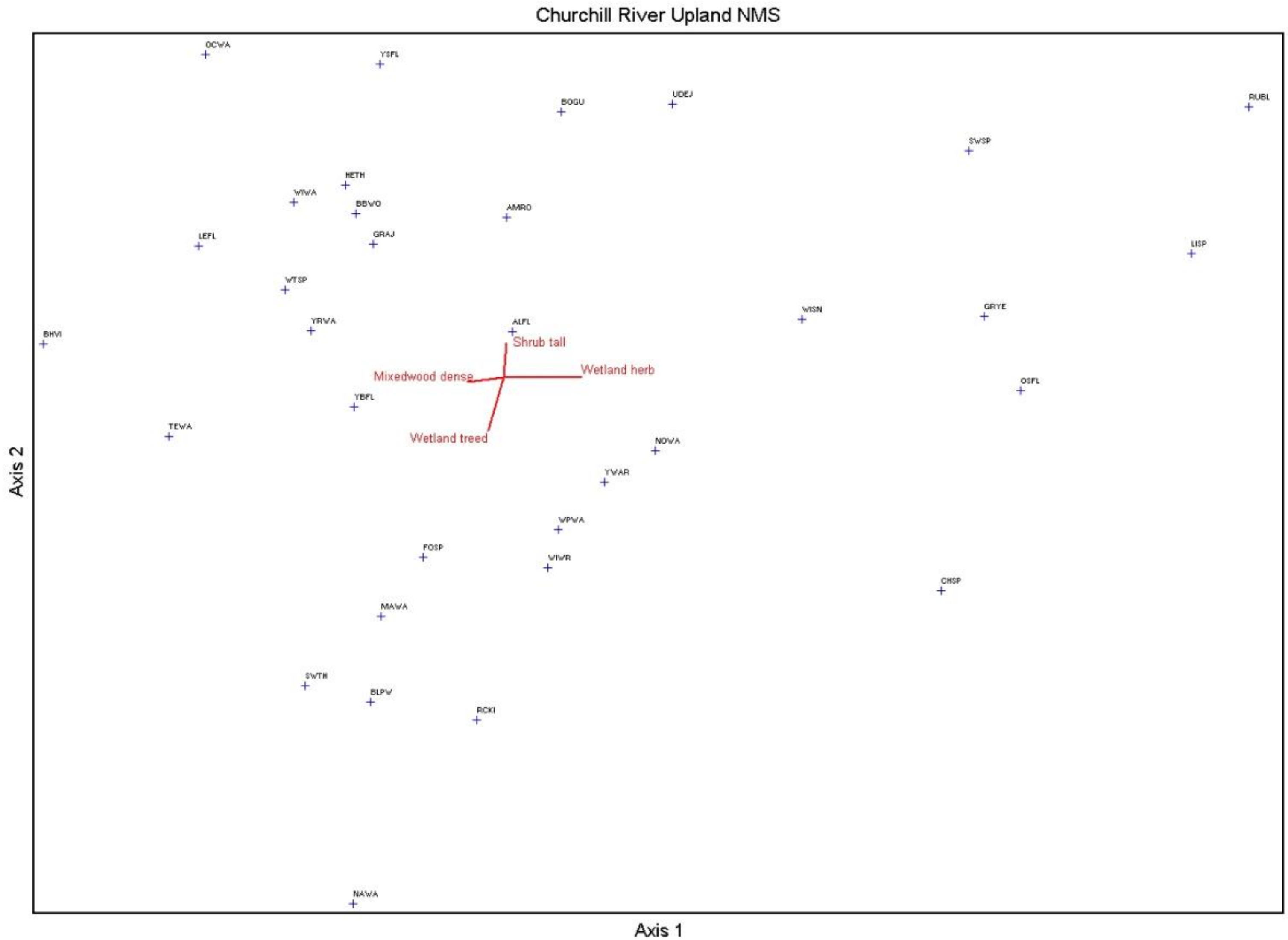
E-1: **Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Lake Manitoba Plain Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.05 level.**



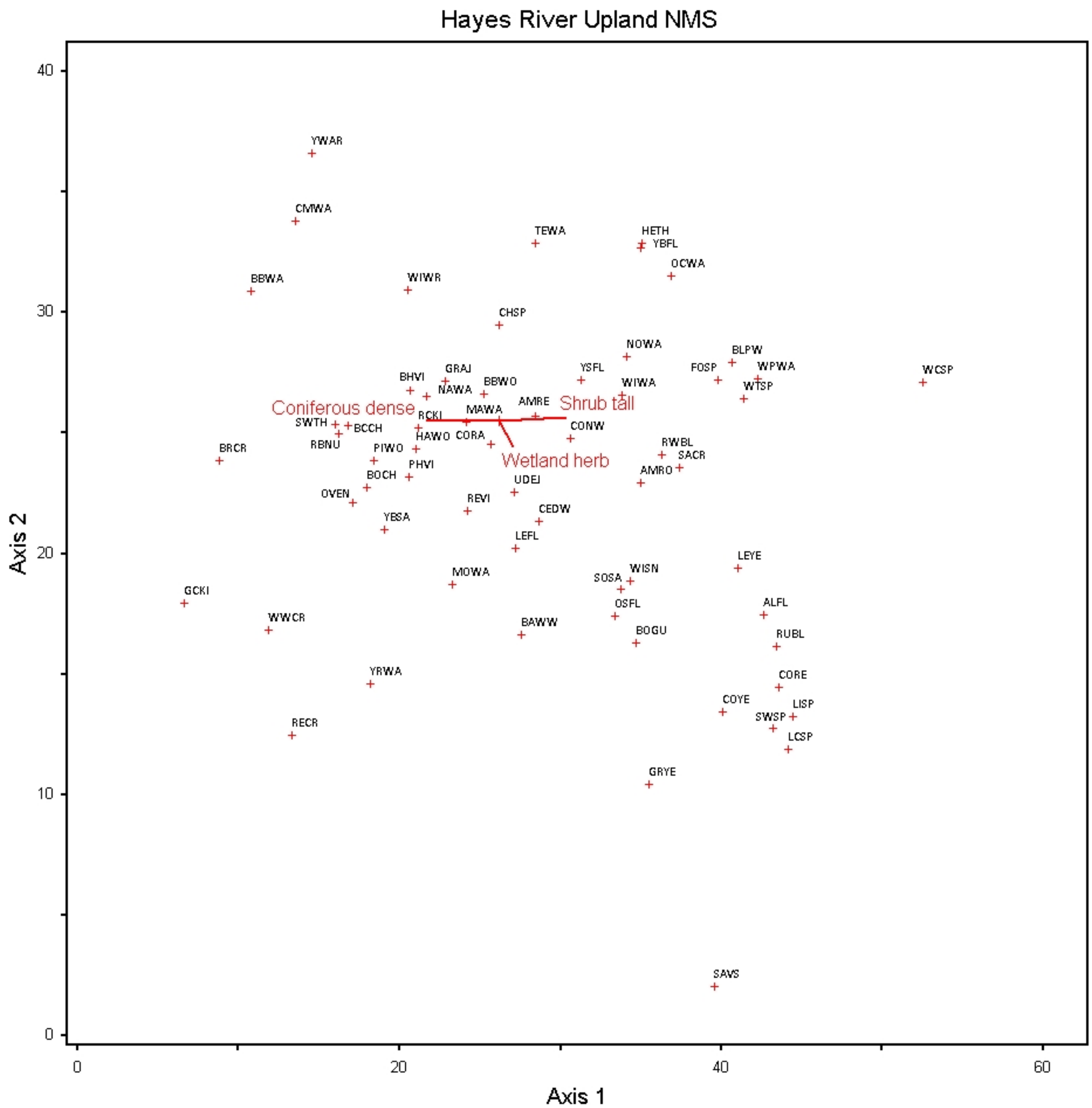
E-2: Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Interlake Plain Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.10 level.



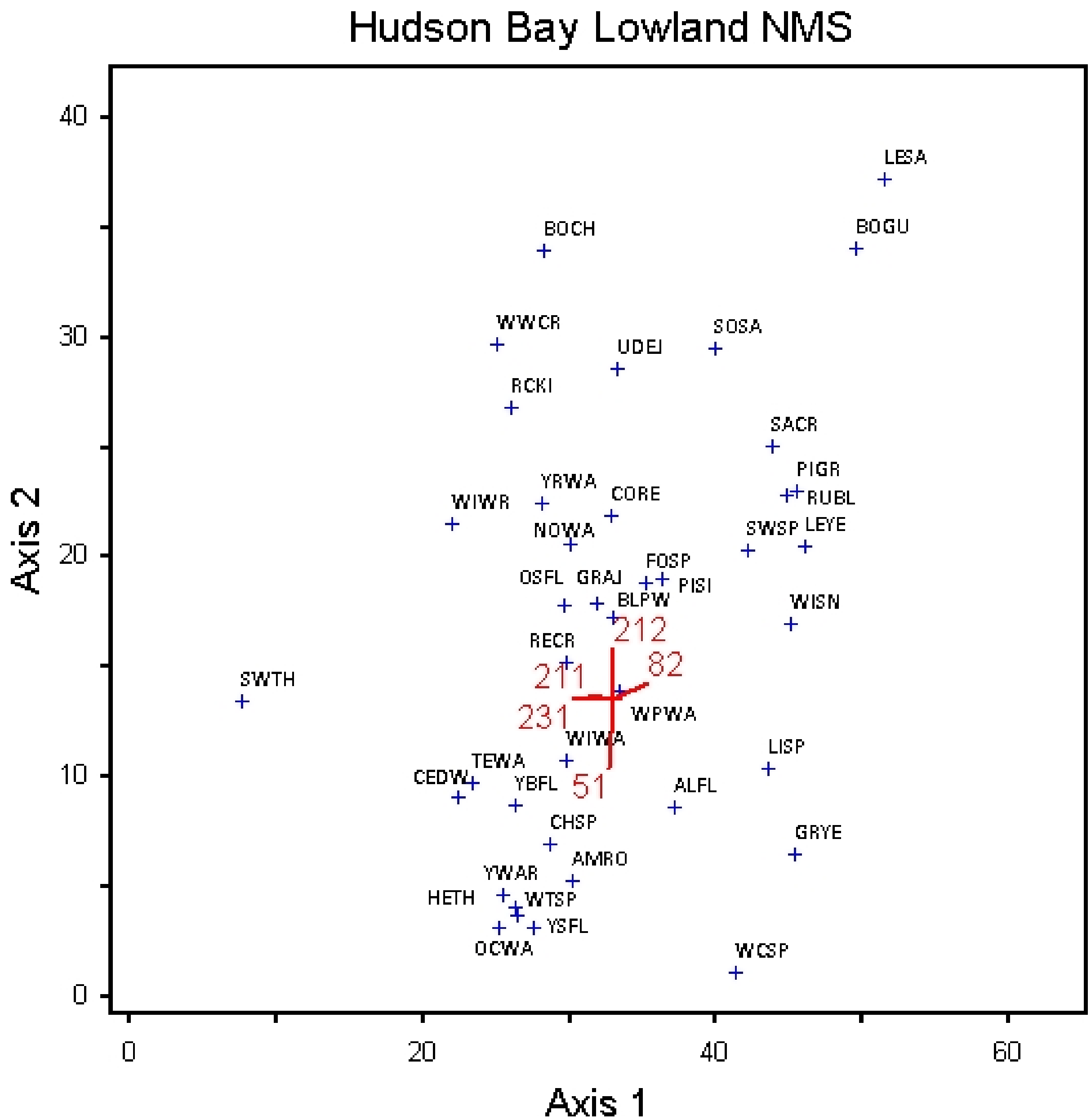
E-3: **Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Mid-Boreal Lowland Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.20 level.**



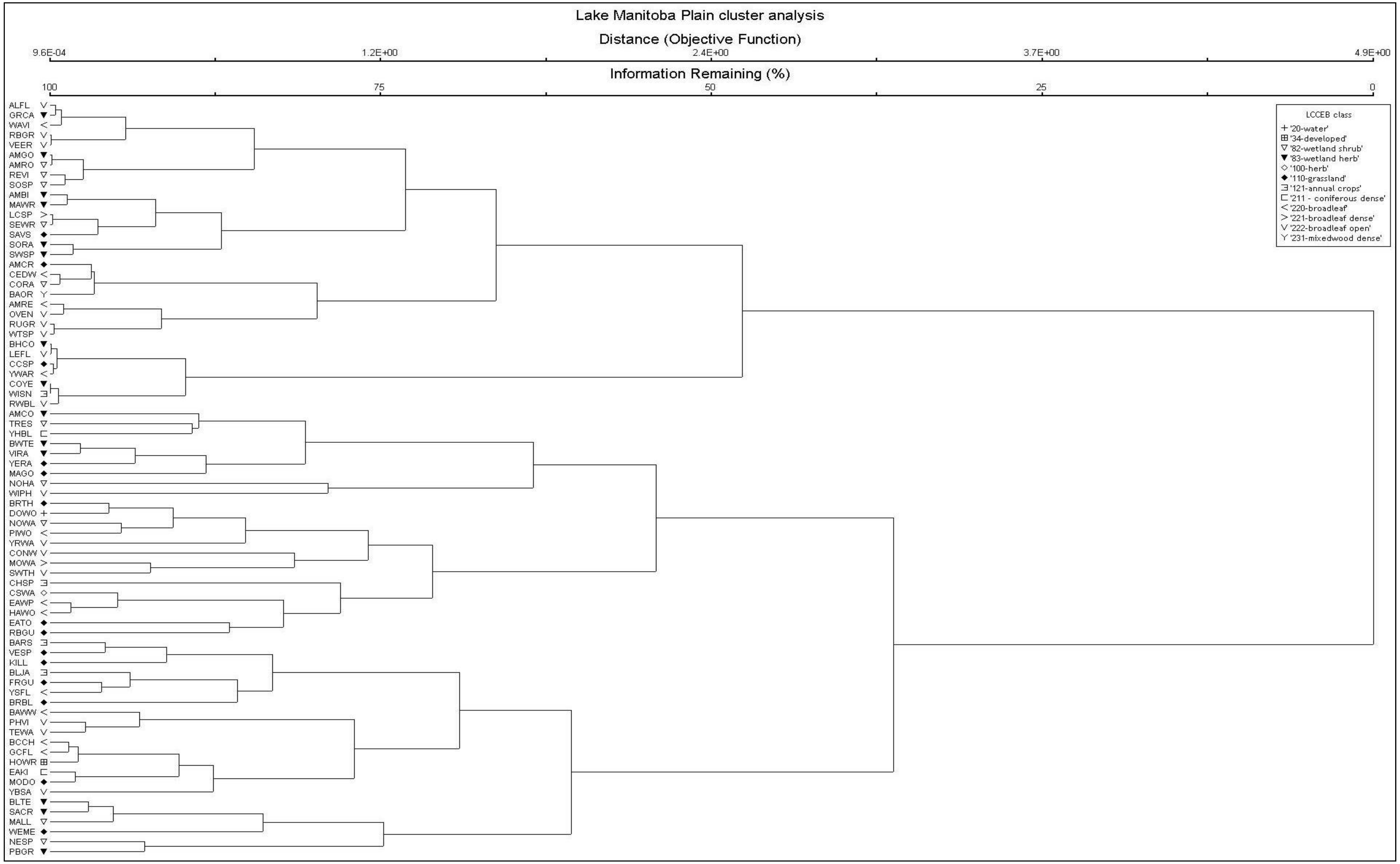
E-4: Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Churchill River Upland Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.05 level.



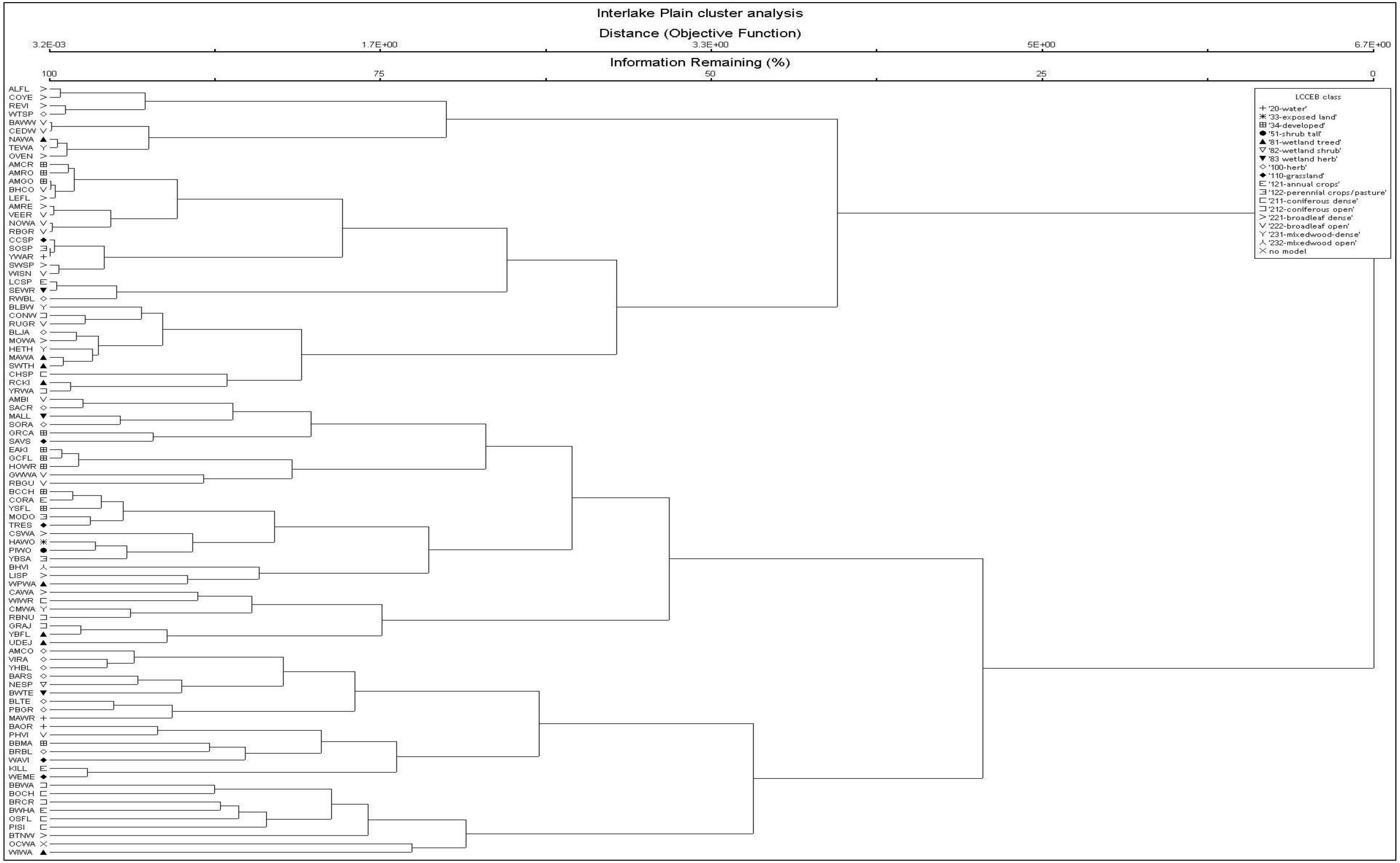
E-5: Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Hayes River Upland Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.10 level.



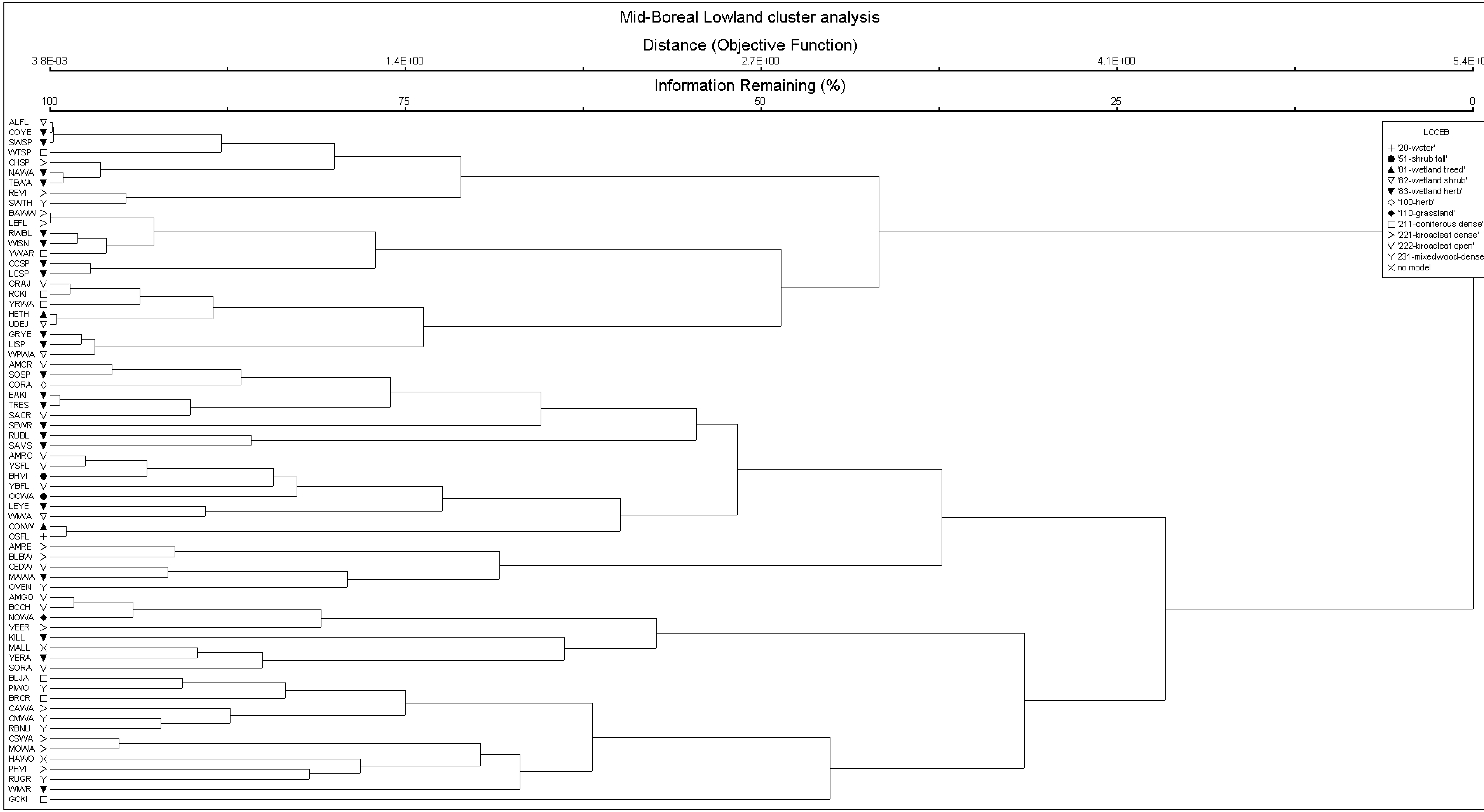
E-6: Results of Nonmetric Multidimensional Scaling (NMS) for sampled bird species in the Hudson Bay Lowland Ecoregion. Joint plot within axes accounts for correlations of bird species with LCCEB habitat types at r2 ≥ 0.10 level.



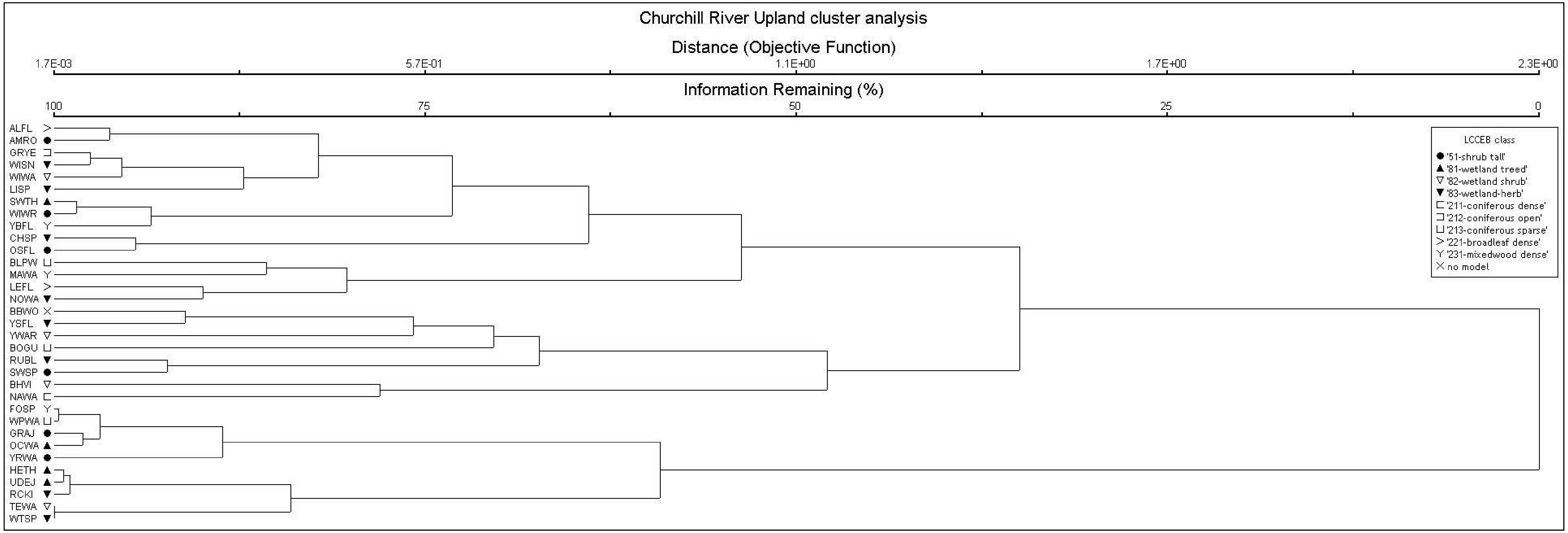
E-7: **Results of cluster analysis for sampled bird species in the Lake Manitoba Plain Ecoregion**



E-8: **Results of cluster analysis for sampled bird species in the Interlake Plain Ecoregion**



E-9: Results of cluster analysis for sampled bird species in the Mid-Boreal Lowland Ecoregion



E-10: Results of cluster analysis for sampled bird species in the Churchill River Upland Ecoregion

APPENDIX F

Tables

F-1: Bird species potentially found in the Project Study Area

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Yellow-billed Loon	*Gavia*	*adamsii*	YBLO	Loons	N/A	N/A	Occasional visitor
Common Loon	*Bavia*	*immer*	COLO	Loons	N/A	N/A	Short distance migrant, breeding populations
Pacific Loon	*Gavia*	*pacifica*	PALO	Loons	N/A	N/A	Occasional visitor
Red-throated Loon	*Gavia*	*stellata*	RTLO	Loons	N/A	N/A	Migrant
Clark's Grebe	*Aechmophorus*	*clarkii*	CLGR	Grebes	N/A	N/A	Occasional visitor
Western Grebe	*Aechmophorus*	*occidentalis*	WEGR	Grebes	N/A	N/A	Short distance migrant, breeding populations
Red-necked Grebe	*Podiceps*	*grisegena*	RNGR	Grebes	N/A	N/A	Short distance migrant, breeding populations
Horned Grebe	*Podiceps*	*auritus*	HOGR	Grebes	N/A	N/A	Short distance migrant, breeding populations
Eared Grebe	*Podiceps*	*nigricollis*	EAGR	Grebes	N/A	N/A	Long distance migrant, breeding populations
Pied-billed Grebe	*Podilymbus*	*podiceps*	PBGR	Grebes	N/A	N/A	Long distance migrant, breeding populations
American White Pelican	*Pelecanus*	*erythrorhynchos*	AWPE	Pelicans	N/A	N/A	Long distance migrant, breeding populations
Double-crested Cormorant	*Phalacrocorax*	*auritus*	DCCO	Cormorants	N/A	N/A	Long distance migrant, breeding populations
Mute Swan	*Cygnus*	*olor*	MUSW	Swans	N/A	N/A	Occasional visitor
Tundra Swan	*Cygnus*	*columbianus*	TUSW	Swans	N/A	N/A	Regular migrant
Trumpeter Swan	*Cygnus*	*buccinator*	TRUS	Swans	Extirpated	N/A	Rare migrant or visitor
Canada Goose	*Branta*	*canadensis*	CAGO	Geese	N/A	N/A	Short distance migrant, breeding populations
Greater White-fronted Goose	*Anser*	*albifrons*	GWFG	Geese	N/A	N/A	Regular migrant
Snow Goose	*Chen*	*caerulescens*	SNGO	Geese	N/A	N/A	Regular migrant
Ross's Goose	*Chen*	*rossii*	ROGO	Geese	N/A	N/A	Regular migrant
Mallard	*Anas*	*platyrhynchos*	MALL	Ducks	N/A	N/A	Short distance migrant, breeding populations

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
American Black Duck	*Anas*	*rubripes*	ABDU	Ducks	N/A	N/A	Short distance migrant, breeding populations
Northern Pintail	*Anas*	*acuta*	NOPI	Ducks	N/A	N/A	Long distance migrant, breeding populations
Gadwall	*Anas*	*strepera*	GADW	Ducks	N/A	N/A	Long distance migrant, breeding populations
American Wigeon	*Anas*	*americana*	AMWI	Ducks	N/A	N/A	Long distance migrant, breeding populations
Eurasian Wigeon	*Anas*	*penelope*	EUWI	Ducks	N/A	N/A	Occasional visitor
Northern Shoveler	*Anas*	*clypeata*	NSHO	Ducks	N/A	N/A	Long distance migrant, breeding populations
Blue-winged Teal	*Anas*	*discors*	BWTE	Ducks	N/A	N/A	Long distance migrant, breeding populations
Cinnamon Teal	*Anas*	*cyanoptera*	CITE	Ducks	N/A	N/A	Rare migrant or visitor
American Green-winged Teal	*Anas*	*crecca*	AGWT	Ducks	N/A	N/A	Long distance migrant, breeding populations
Wood Duck	*Aix*	*sponsa*	WODU	Ducks	N/A	N/A	Short distance migrant, breeding populations
Redhead	*Aythya*	*americana*	REDH	Ducks	N/A	N/A	Long distance migrant, breeding populations
Canvasback	*Aythya*	*valisineria*	CANV	Ducks	N/A	N/A	Long distance migrant, breeding populations
Ring-necked Duck	*Aythya*	*collaris*	RNDU	Ducks	N/A	N/A	Long distance migrant, breeding populations
Greater Scaup	*Aythya*	*marila*	GRSC	Ducks	N/A	N/A	Regular migrant
Lesser Scaup	*Aythya*	*affinis*	LESC	Ducks	N/A	N/A	Long distance migrant, breeding populations
Common Goldeneye	*Bucephala*	*clangula*	COGO	Ducks	N/A	N/A	Short distance migrant, breeding populations
Barrow's Goldeneye	*Bucephala*	*islandica*	BAGO	Ducks	N/A	N/A	Occasional visitor
Bufflehead	*Bucephala*	*albeola*	BUFF	Ducks	N/A	N/A	Short distance migrant, breeding populations
Harlequin Duck	*Histionicus*	*histrionicus*	HARD	Ducks	N/A	N/A	Rare migrant or visitor
Long-tailed Duck	*Clangula*	*hyemalis*	LTDU	Ducks	N/A	N/A	Rare migrant or visitor

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Black Scoter	*Melanitta*	*nigra*	BLSC	Ducks	N/A	N/A	Rare migrant or visitor
White-winged Scoter	*Melanitta*	*fusca*	WWSC	Ducks	N/A	N/A	Short distance migrant, breeding populations
Surf Scoter	*Melanitta*	*perspicillata*	SUSC	Ducks	N/A	N/A	Rare migrant or visitor
Hooded Merganser	*Lophodytes*	*cucullatus*	HOME	Mergansers	N/A	N/A	Short distance migrant, breeding populations
Red-breasted Merganser	*Mergus*	*serrator*	RBME	Mergansers	N/A	N/A	Short distance migrant, breeding populations
Common Merganser	*Mergus*	*merganser*	COME	Mergansers	N/A	N/A	Short distance migrant, breeding populations
Ruddy Duck	*Oxyura*	*jamaicensis*	RUDU	Stiff-tailed Ducks	N/A	N/A	Long distance migrant, breeding populations
Turkey Vulture	*Cathartes*	*aura*	TUVU	Vultures	N/A	N/A	Long distance migrant, breeding populations
Northern Goshawk	*Accipiter*	*gentilis*	NOGO	Accipiters	N/A	N/A	Year-round inhabitant
Cooper's Hawk	*Accipiter*	*cooperii*	COHA	Accipiters	N/A	N/A	Long distance migrant, breeding populations
Sharp-shinned Hawk	*Accipiter*	*striatus*	SSHA	Accipiters	N/A	N/A	Long distance migrant, breeding populations
Northern Harrier	*Circus*	*cyaneus*	NOHA	Harriers	N/A	N/A	Long distance migrant, breeding populations
Rough-legged Hawk	*Buteo*	*lagopus*	RLHA	Buteos	N/A	N/A	Regular migrant
Ferruginous Hawk	*Buteo*	*regalis*	FEHA	Buteos	Threatened	N/A	Rare migrant or visitor
Red-tailed Hawk	*Buteo*	*jamaicensis*	RTHA	Buteos	N/A	N/A	Long distance migrant, breeding populations
Swainson's Hawk	*Buteo*	*swainsoni*	SWHA	Buteos	N/A	N/A	Long distance migrant, breeding populations
Broad-winged Hawk	*Buteo*	*platypterus*	BWHA	Buteos	N/A	N/A	Long distance migrant, breeding populations
Red-shouldered Hawk	*Buteo*	*lineatus*	RSHA	Buteos	N/A	N/A	Rare migrant or visitor
Golden Eagle	*Aquila*	*chrysaetos*	GOEA	Eagles	N/A	N/A	Rare migrant or visitor
Bald Eagle	*Haliaeetus*	*leucocephalus*	BAEA	Eagles	N/A	N/A	Short distance migrant, breeding populations

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Osprey	*Pandion*	*haliaetus*	OSPR	Osprey	N/A	N/A	Long distance migrant, breeding populations
Gyrfalcon	*Falco*	*rusticolus*	GYRF	Falcons	N/A	N/A	Rare migrant or visitor
Prairie Falcon	*Falco*	*mexicanus*	PRFA	Falcons	N/A	N/A	Rare migrant or visitor
Peregrine Falcon	*Falco*	*peregrinus*	PEFA	Falcons	Endangered	Threatened	Regular migrant
Merlin	*Falco*	*columbarius*	MERL	Falcons	N/A	N/A	Year-round inhabitant
American Kestrel	*Falco*	*sparverius*	MAKE	Falcons	N/A	N/A	Regular migrant
Wild Turkey	*Meleagris*	*gallopavo*	WITU	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Year-round inhabitant
Spruce Grouse	*Palcipennis*	*canadensis*	SPGR	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Year-round inhabitant
Ruffed Grouse	*Bonasa*	*umbellus*	RUGR	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Year-round inhabitant
Sharp-tailed Grouse	*Tympanuchus*	*phasianellus*	STGR	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Year-round inhabitant
Willow Ptarmigan	*Lagopus*	*lagopus*	WIPT	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Regular in winter
Rock Ptarmigan	*Lagopus*	*mutus*	ROPT	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Regular in winter
Ring-necked Pheasant	*Phasianus*	*colchicus*	RNEP	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Rare migrant or visitor
Gray Partridge	*Perdix*	*perdix*	GRAP	Partridges, Pheasants, Grouse and Turkeys	N/A	N/A	Year-round inhabitant
Great Egret	*Ardea*	*alba*	GREG	Herons	N/A	N/A	Rare migrant or visitor
Snowy Egret	*Egretta*	*thula*	SNEG	Herons	N/A	N/A	Occasional visitor
Cattle Egret	*Bubulcus*	*ibis*	CAEG	Herons	N/A	N/A	Rare migrant or visitor
Great Blue Heron	*Ardea*	*herodias*	GBHE	Herons	N/A	N/A	Long distance migrant, breeding populations
Tricolored Heron	*Egretta*	*tricolor*	TRHE	Herons	N/A	N/A	Rare migrant or visitor
Little Blue Heron	*Egretta*	*caerulea*	LBHE	Herons	N/A	N/A	Rare migrant or visitor
Green Heron	*Butorides*	*virescens*	GRHE	Herons	N/A	N/A	Rare migrant or visitor

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Black-crowned Night-Heron	*Nycticorax*	*nycticorax*	BCNH	Herons	N/A	N/A	Long distance migrant, breeding populations
Yellow-Crowned Night-Heron	*Nyctanassa*	*violacea*	YCNH	Herons	N/A	N/A	Occasional visitor
American Bittern	*Botaurus*	*lentiginosus*	AMBI	Herons	N/A	N/A	Long distance migrant, breeding populations
Least Bittern	*Ixobrychus*	*exilis*	LEBI	Herons	N/A	Threatened	Rare migrant or visitor
White-faced Ibis	*Plegadis*	*chihi*	WFIB	Ibises	N/A	N/A	Occasional visitor
Whooping Crane	*Grus*	*americana*	WHCR	Cranes	Endangered	Endangered	Rare migrant or visitor
Sandhill Crane	*Grus*	*canadensis*	SACR	Cranes	N/A	N/A	Short distance migrant, breeding populations
Virginia Rail	*Rallus*	*limicola*	VIRA	Rails and Coots	N/A	N/A	Short distance migrant, breeding populations
Sora Rail	*Porzana*	*carolina*	SORA	Rails and Coots	N/A	N/A	Long distance migrant, breeding populations
Yellow Rail	*Coturnicops*	*noveboracensis*	YEAR	Rails and Coots	N/A	Special Concern	Short distance migrant, breeding populations
King Rail	*Rallus*	*elegans*	KIRA	Rails and Coots	N/A	Endangered	Occasional visitor
Common Moorhen	*Gallinula*	*chloropus*	COMO	Rails and Coots	N/A	N/A	Occasional visitor
American Coot	*Pulica*	*americana*	AMCO	Rails and Coots	N/A	N/A	Long distance migrant, breeding populations
American Avocet	*Recurvirostra*	*americana*	AMAV	Stilts and Avocets	N/A	N/A	Long distance migrant, breeding populations
Black-necked Stilt	*Himantopus*	*mexicanus*	BNST	Stilts and Avocets	N/A	N/A	Occasional visitor
American Golden-Plover	*Pluvialis*	*dominica*	AMGP	Plovers	N/A	N/A	Regular migrant
Black-bellied Plover	*Pluvialis*	*squatarola*	BBPL	Plovers	N/A	N/A	Regular migrant
Piping Plover	*Charadrius*	*melodus*	PIPL	Plovers	Endangered	Endangered	Long distance migrant, breeding populations
Semipalmated Plover	*Charadrius*	*semipalmatus*	SEPL	Plovers	N/A	N/A	Long distance migrant, breeding populations
Killdeer	*Charadrius*	*vociferus*	KILL	Plovers	N/A	N/A	Long distance migrant, breeding populations

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Marbled Godwit	*Limosa*	*fedoa*	MAGO	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Hudsonian Godwit	*Limosa*	*haemastica*	HUGO	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Long-billed Curlew	*Numenius*	*americanus*	LBCU	Sandpipers, Phalaropes and Allies	Endangered	Endangered	Extirpated Breeder
Whimbrel	*Numenius*	*phaeopus*	WHIM	Sandpipers, Phalaropes and Allies	N/A	N/A	Rare migrant or visitor
Eskimo Curlew	*Numenius*	*borealis*	ESCU	Sandpipers, Phalaropes and Allies	Endangered	Endangered	Extirpated Breeder
Greater Yellowlegs	*Tringa*	*melanoleuca*	GRYE	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Lesser Yellowlegs	*Tringa*	*flavipes*	LEYE	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Solitary Sandpiper	*Tringa*	*solitaria*	SOSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Upland Sandpiper	*Bartramia*	*longicauda*	UPSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Buff-breasted Sandpiper	*Tryngites*	*subruficollis*	BBSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Ruff	*Philomachus*	*pugnax*	RUFF	Sandpipers, Phalaropes and Allies	N/A	N/A	Occasional visitor
Stilt Sandpiper	*Calidris*	*himantopus*	STSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Willet	*Cataptrophorus*	*semipalmatus*	WILL	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Spotted Sandpiper	*Actitis*	*macularia*	SPSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Short-billed Dowitcher	*Limnodromus*	*griseus*	SBDO	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Long-billed Dowitcher	*Limnodromus*	*scolopaceus*	LBDO	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Wilson's Phalarope	*Phalaropus*	*tricolor*	WIPH	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Red Phalarope	*Phalaropus*	*fulicarius*	REPH	Sandpipers, Phalaropes and Allies	N/A	N/A	Occasional visitor
Red-necked Phalarope	*Phalaropus*	*lobatus*	RNPH	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
American Woodcock	*Scolopax*	*minor*	AMWO	Sandpipers, Phalaropes and Allies	N/A	N/A	Short distance migrant, breeding populations
Wilson's Snipe	*Gallinago*	*delicata*	WISN	Sandpipers, Phalaropes and Allies	N/A	N/A	Long distance migrant, breeding populations
Ruddy Turnstone	*Arenaria*	*interpres*	RUTU	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant

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Purple Sandpiper	*Calidris*	*maritima*	PUSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Occasional visitor
Pectoral Sandpiper	*Calidris*	*melanotos*	PESA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Red Knot	*Calidris*	*canutus*	REKN	Sandpipers, Phalaropes and Allies	N/A	Endangered	Regular migrant
Dunlin	*Calidris*	*alpina*	DUNL	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Sanderling	*Calidris*	*alba*	SAND	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
White-rumped Sandpiper	*Calidris*	*fuscicollis*	WRSA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Baird's Sandpiper	*Calidris*	*bairdii*	BASA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Least Sandpiper	*Calidris*	*minutilla*	LESA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Semipalmated Sandpiper	*Calidris*	*pusilla*	SESA	Sandpipers, Phalaropes and Allies	N/A	N/A	Regular migrant
Western Sandpiper	*Calidris*	*mauri*	WESA	Sandpipers, Phalaropes and Allies	N/A	N/A	Occasional visitor
Parasitic Jaeger	*Stercorarius*	*parasiticus*	PAJA	Jaegers	N/A	N/A	Rare migrant or visitor
Glaucous Gull	*Larus*	*hyperboreus*	GLGU	Gulls	N/A	N/A	Rare migrant or visitor
Great Black-backed Gull	*Larus*	*marinus*	GBBG	Gulls	N/A	N/A	Rare migrant or visitor
Lesser Black-backed Gull	*Larus*	*fuscus*	LBBG	Gulls	N/A	N/A	Occasional visitor
Herring Gull	*Larus*	*argentatus*	HERG	Gulls	N/A	N/A	Long distance migrant, breeding populations
Thayer's Gull	*Larus*	*thayeri*	THGU	Gulls	N/A	N/A	Rare migrant or visitor
California Gull	*Larus*	*californicus*	CAGU	Gulls	N/A	N/A	Short distance migrant, breeding populations
Ring-billed Gull	*Larus*	*delawarensis*	RBGU	Gulls	N/A	N/A	Short distance migrant, breeding populations
Mew Gull	*Larus*	*canus*	MEGU	Gulls	N/A	N/A	Occasional visitor
Ross's Gull	*Rhodostethia*	*rosea*	ROGU	Gulls	Endangered	Threatened	Occasional visitor
Franklin's Gull	*Larus*	*pipixcan*	FRGU	Gulls	N/A	N/A	Long distance migrant, breeding populations
Bonaparte's Gull	*Larus*	*philadelphia*	BOGU	Gulls	N/A	N/A	Short distance migrant, breeding populations
Little Gull	*Larus*	*minutus*	LIGU	Gulls	N/A	N/A	Rare migrant or visitor
Arctic Tern	*Sterna*	*paradisaea*	ARTE	Terns	N/A	N/A	Rare migrant or visitor
Common Tern	*Sterna*	*hirundo*	COTE	Terns	N/A	N/A	Long distance migrant, breeding populations

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Forester's Tern	*Sterna*	*forsteri*	FOTE	Terns	N/A	N/A	Long distance migrant, breeding populations
Caspian Tern	*Sterna*	*caspia*	CATE	Terns	N/A	N/A	Long distance migrant, breeding populations
Black Tern	*Sterna*	*niger*	BLTE	Terns	N/A	N/A	Long distance migrant, breeding populations
Rock Pigeon	*Columba*	*livia*	ROPI	Pigeons and Doves	N/A	N/A	Year-round inhabitant
Mourning Dove	*Zenaida*	*macroura*	MODO	Pigeons and Doves	N/A	N/A	Long distance migrant, breeding populations
Yellow-billed Cuckoo	*Coccyzus*	*americanus*	YBCU	Cuckoos, Roadrunners and Anis	N/A	N/A	Occasional visitor
Black-billed Cuckoo	*Coccyzus*	*erythropthalmus*	BBCU	Cuckoos, Roadrunners and Anis	N/A	N/A	Long distance migrant, breeding populations
Eastern Screech-Owl	*Otus*	*asio*	EASO	Owls	N/A	N/A	Year-round inhabitant
Great Horned Owl	*Bubo*	*virginianus*	GHOW	Owls	N/A	N/A	Year-round inhabitant
Long-eared Owl	*Asio*	*otus*	LEOW	Owls	N/A	N/A	Year-round inhabitant
Short-eared Owl	*Asio*	*flammeus*	SEOW	Owls	N/A	Special Concern	Short distance migrant, breeding populations
Barn Owl	*Tyto*	*alba*	BNOW	Owls	N/A	Special Concern	Occasional visitor
Snowy Owl	*Nyctea*	*scandiaca*	SNOW	Owls	N/A	N/A	Regular in winter
Barred Owl	*Strix*	*varia*	BDOW	Owls	N/A	N/A	Year-round inhabitant
Great Gray Owl	*Strix*	*nebulosa*	GGOW	Owls	N/A	N/A	Year-round inhabitant
Northern Hawk Owl	*Surnia*	*ulula*	NHOW	Owls	N/A	N/A	Year-round inhabitant
Burrowing Owl	*Athene*	*cunicularia*	BUOW	Owls	Endangered	Endangered	Long distance migrant, breeding populations
Boreal Owl	*Aegolius*	*funereus*	BOOW	Owls	N/A	N/A	Year-round inhabitant
Northern Saw-whet Owl	*Aegolius*	*acadicus*	NSWO	Owls	N/A	N/A	Year-round inhabitant
Whip-poor-will	*Caprimulgus*	*vociferus*	WPWI	Goatsuckers	N/A	N/A	Long distance migrant, breeding populations
Common Nighthawk	*Chordeiles*	*minor*	CONI	Goatsuckers	N/A	Threatened	Long distance migrant, breeding populations

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Chimney Swift	*Chaetura*	*pelagica*	CHSW	Swifts	N/A	Threatened	Long distance migrant, breeding populations
Ruby-throated Hummingbird	*Archilochus*	*colubris*	RTHU	Hummingbirds	N/A	N/A	Long distance migrant, breeding populations
Belted Kingfisher	*Ceryle*	*alcyon*	BEKI	Kingfishers	N/A	N/A	Long distance migrant, breeding populations
Northern Flicker	*Colaptes*	*auratus*	YSFL	Woodpeckers	N/A	N/A	Short distance migrant, breeding populations
Pileated Woodpecker	*Dryocopus*	*pileatus*	PIWO	Woodpeckers	N/A	N/A	Year-round inhabitant
Red-bellied Woodpecker	*Melanerpes*	*carolinus*	RBWO	Woodpeckers	N/A	N/A	Rare migrant or visitor
Red-headed Woodpecker	*Melanerpes*	*erythrocephalus*	RHWO	Woodpeckers	N/A	Threatened	Short distance migrant, breeding populations
Lewis's Woodpecker	*Melanerpes*	*lewis*	LEWO	Woodpeckers	N/A	N/A	Occasional visitor
Yellow-bellied Sapsucker	*Sphyrapicus*	*varius*	YBSA	Woodpeckers	N/A	N/A	Long distance migrant, breeding populations
Hairy Woodpecker	*Picoides*	*villosus*	HAWO	Woodpeckers	N/A	N/A	Year-round inhabitant
Downy Woodpecker	*Picoides*	*pubescens*	DOWO	Woodpeckers	N/A	N/A	Year-round inhabitant
Black-backed Woodpecker	*Picoides*	*arcticus*	BBWO	Woodpeckers	N/A	N/A	Year-round inhabitant
Three-toed Woodpecker	*Picoides*	*tridactylus*	TTWO	Woodpeckers	N/A	N/A	Year-round inhabitant
Scissor-tailed Flycatcher	*Tyrannus*	*forficatus*	STFL	Tyrant Flycatchers	N/A	N/A	Rare migrant or visitor
Eastern Kingbird	*Tyrannus*	*tyrannus*	EAKI	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Western Kingbird	*Tyrannus*	*verticalis*	WEKI	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Great Crested Flycatcher	*Myiarchus*	*crinitus*	GCFL	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Eastern Phoebe	*Sayornis*	*phoebe*	EAPH	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Say's Phoebe	*Sayornis*	*saya*	SAPH	Tyrant Flycatchers	N/A	N/A	Rare migrant or visitor
Yellow-bellied Flycatcher	*Empidonax*	*flaviventris*	YBFL	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Willow Flycatcher	*Empidonax*	*traillii*	WIFL	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations

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Alder Flycatcher	*Empidonax*	*alnorum*	ALFL	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Least Flycatcher	*Empidonax*	*minimus*	LEFL	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Eastern Wood-Peewee	*Contopus*	*virens*	EAWP	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Western Wood-Peewee	*Contopus*	*sordidulus*	WEWP	Tyrant Flycatchers	N/A	N/A	Long distance migrant, breeding populations
Olive-sided Flycatcher	*Contopus*	*cooperi*	OSFL	Tyrant Flycatchers	N/A	Threatened	Long distance migrant, breeding populations
Horned Lark	*Eremophila*	*alpestris*	HOLA	Larks	N/A	N/A	Short distance migrant, breeding populations
Barn Swallow	*Hirundo*	*rustica*	BARS	Swallows	N/A	N/A	Long distance migrant, breeding populations
Cliff Swallow	*Petrochelidon*	*pyrrhonota*	CLSW	Swallows	N/A	N/A	Long distance migrant, breeding populations
Tree Swallow	*Tachycineta*	*bicolor*	TRES	Swallows	N/A	N/A	Long distance migrant, breeding populations
Bank Swallow	*Riparia*	*riparia*	BANS	Swallows	N/A	N/A	Long distance migrant, breeding populations
Northern Rough-winged Swallow	*Stelgidopteryx*	*serripennis*	NRWS	Swallows	N/A	N/A	Long distance migrant, breeding populations
Purple Martin	*Progne*	*subis*	PUMA	Swallows	N/A	N/A	Long distance migrant, breeding populations
Blue Jay	*Cyanocitta*	*cristata*	BLJA	Crows, Magpies and Jays	N/A	N/A	Year-round inhabitant
Gray Jay	*Perisoreus*	*canadensis*	GRAJ	Crows, Magpies and Jays	N/A	N/A	Year-round inhabitant
Black-billed Magpie	*Pica*	*hudsonia*	BBMA	Crows, Magpies and Jays	N/A	N/A	Year-round inhabitant
Clark's Nutcracker	*Nucifraga*	*columbiana*	CLNU	Crows, Magpies and Jays	N/A	N/A	Occasional visitor
Common Raven	*Corvus*	*corax*	CORA	Crows, Magpies and Jays	N/A	N/A	Year-round inhabitant
American Crow	*Corvus*	*brachyrhynchos*	AMCR	Crows, Magpies and Jays	N/A	N/A	Year-round inhabitant
Black-capped Chickadee	*Poecile*	*atricapillus*	BCCH	Chickadees and Titmice	N/A	N/A	Year-round inhabitant
Boreal Chickadee	*Poecile*	*hudsonicus*	BOCH	Chickadees and Titmice	N/A	N/A	Year-round inhabitant
White-breasted Nuthatch	*Sitta*	*carolinensis*	WBNU	Nuthatches	N/A	N/A	Year-round inhabitant

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Red-breasted Nuthatch	*Sitta*	*canadensis*	RBNU	Nuthatches	N/A	N/A	Year-round inhabitant
Brown Creeper	*Certhia*	*americana*	BRCR	Creepers	N/A	N/A	Long distance migrant, breeding populations
House Wren	*Troglodytes*	*aedon*	HOWR	Wrens	N/A	N/A	Long distance migrant, breeding populations
Winter Wren	*Troglodytes*	*troglodytes*	WIWR	Wrens	N/A	N/A	Extralimital breeding record
Carolina Wren	*Thryothorus*	*ludovicianus*	CARW	Wrens	N/A	N/A	Occasional visitor
Rock Wren	*Salpinctes*	*obsoletus*	ROWR	Wrens	N/A	N/A	Occasional visitor
Marsh Wren	*Cistothorus*	*palustris*	MAWR	Wrens	N/A	N/A	Long distance migrant, breeding populations
Sedge Wren	*Cistothorus*	*platensis*	SEWR	Wrens	N/A	N/A	Long distance migrant, breeding populations
Northern Mockingbird	*Mimus*	*polyglottos*	NOMO	Mockingbirds and Thrashers	N/A	N/A	Extralimital breeding record
Gray Catbird	*Dumetella*	*carolinensis*	CRCA	Mockingbirds and Thrashers	N/A	N/A	Long distance migrant, breeding populations
Brown Thrasher	*Toxostoma*	*rufum*	BRTH	Mockingbirds and Thrashers	N/A	N/A	Short distance migrant, breeding populations
Sage Thrasher	*Oreoscoptes*	*montanus*	SATH	Mockingbirds and Thrashers	N/A	Endangered	Occasional visitor
Curve-billed Thrasher	*Toxostoma*	*curvirostre*	CBTH	Mockingbirds and Thrashers	N/A	N/A	Occasional visitor
American Robin	*Turdus*	*migratorius*	AMRO	Thrushes	N/A	N/A	Year-round inhabitant
Varied Thrush	*Ixoreus*	*naevius*	VATH	Thrushes	N/A	N/A	Rare migrant or visitor
Townsend's Solitaire	*Myadestes*	*townsendi*	TOSO	Thrushes	N/A	N/A	Rare migrant or visitor
Northern Wheatear	*Oenanthe*	*oenanthe*	NOWH	Thrushes	N/A	N/A	Occasional visitor
Wood Thrush	*Hylocichla*	*mustelina*	WOTH	Thrushes	N/A	N/A	Rare migrant or visitor
Hermit Thrush	*Catharus*	*guttatus*	HETH	Thrushes	N/A	N/A	Long distance migrant, breeding populations
Swainson's Thrush	*Catharus*	*ustulatus*	SWTH	Thrushes	N/A	N/A	Long distance migrant, breeding populations
Gray-cheeked Thrush	*Catharus*	*minimus*	GCTH	Thrushes	N/A	N/A	Long distance migrant, breeding populations
Veery	*Catharus*	*fuscescens*	VEER	Thrushes	N/A	N/A	Long distance migrant, breeding populations

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Eastern Bluebird	*Sialia*	*sialis*	EABL	Thrushes	N/A	N/A	Short distance migrant, breeding populations
Mountain Bluebird	*Sialia*	*currucoides*	MOBL	Thrushes	N/A	N/A	Short distance migrant, breeding populations
Blue-gray Gnatcatcher	*Polioptila*	*caerulea*	BGGN	Gnatcatchers and Kinglets	N/A	N/A	Occasional visitor
Golden-crowned Kinglet	*Regulus*	*satrapa*	GCKI	Gnatcatchers and Kinglets	N/A	N/A	Short distance migrant, breeding populations
Ruby-crowned Kinglet	*Regulus*	*calendula*	RCKI	Gnatcatchers and Kinglets	N/A	N/A	Long distance migrant, breeding populations
American Pipit	*Anthus*	*rubescens*	AMPI	Wagtails and Pipits	N/A	N/A	Regular migrant
Sprague's Pipit	*Anthus*	*spragueii*	SPPI	Wagtails and Pipits	Threatened	Threatened	Short distance migrant, breeding populations
Bohemian Waxwing	*Bombycilla*	*garrulus*	BOWA	Waxwings	N/A	N/A	Year-round inhabitant
Cedar Waxwing	*Bombycilla*	*cedrorum*	CEDW	Waxwings	N/A	N/A	Year-round inhabitant
Northern Shrike	*Lanius*	*excubitor*	NSHR	Shrikes	N/A	N/A	Regular in winter
Loggerhead Shrike	*Lanius*	*ludovicianus*	LOSH	Shrikes	Endangered	Threatened	Long distance migrant, breeding populations
European Starling	*Sturnus*	*vulgaris*	EUST	Starlings	N/A	N/A	Year-round inhabitant
Blue-headed Vireo	*Vireo*	*solitarius*	BHVI	Vireos	N/A	N/A	Long distance migrant, breeding populations
Yellow-throated Vireo	*Vireo*	*flavifrons*	YTVI	Vireos	N/A	N/A	Long distance migrant, breeding populations
Red-eyed Vireo	*Vireo*	*olivaceus*	REVI	Vireos	N/A	N/A	Long distance migrant, breeding populations
Philadelphia Vireo	*Vireo*	*philadelphicus*	PHVI	Vireos	N/A	N/A	Long distance migrant, breeding populations
Warbling Vireo	*Vireo*	*gilvus*	WAVI	Vireos	N/A	N/A	Long distance migrant, breeding populations
Black-and-white Warbler	*Mniotilta*	*varia*	BAWW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Prothonotary Warbler	*Protonotaria*	*citrea*	PROW	Wood-Warblers	N/A	Endangered	Occasional visitor
Worm-eating Warbler	*Helmitheros*	*vermivorus*	WEWA	Wood-Warblers	N/A	N/A	Occasional visitor

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Golden-winged Warbler	*Vermivora*	*chrysoptera*	GWWA	Wood-Warblers	N/A	Threatened	Long distance migrant, breeding populations
Blue-winged Warbler	*Vermivora*	*pinus*	BWWA	Wood-Warblers	N/A	N/A	Occasional visitor
Tennessee Warbler	*Vermivora*	*peregrina*	TEWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Orange-crowned Warbler	*Vermivora*	*celata*	OCWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Nashville Warbler	*Vermivora*	*ruficapilla*	NAWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Northern Parula	*Parula*	*americana*	NOPA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Yellow Warbler	*Dendroica*	*petechia*	YWAR	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Magnolia Warbler	*Dendroica*	*magnolia*	MAWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Cape May Warbler	*Dendroica*	*tigrina*	CMWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Yellow-rumped Warbler	*Dendroica*	*coronata*	YRWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Black-throated Green Warbler	*Dendroica*	*virens*	BTNW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Black-throated Blue Warbler	*Dendroica*	*caerulescens*	BTBW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Yellow-throated Warbler	*Dendroica*	*dominica*	YTWA	Wood-Warblers	N/A	N/A	Occasional visitor
Blackburnian Warbler	*Dendroica*	*fusca*	BLBW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Chestnut-sided Warbler	*Dendroica*	*pensylvanica*	CSWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Bay-breasted Warbler	*Dendroica*	*castanea*	BBWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Blackpoll Warbler	*Dendroica*	*striata*	BLPW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Pine Warbler	*Dendroica*	*pinus*	PIWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Prairie Warbler	*Dendroica*	*discolor*	PRAW	Wood-Warblers	N/A	N/A	Occasional visitor
Western Palm Warbler	*Dendroica*	*palmarum*	WPWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Ovenbird	*Seiurus*	*aurocapillus*	OVEN	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Northern Waterthrush	*Seiurus*	*noveboracensis*	NOWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Common Yellowthroat	*Geothlypis*	*trichas*	COYE	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Yellow-breasted Chat	*Icteria*	*virens*	YBCH	Wood-Warblers	N/A	Special Concern	Occasional visitor
Kentucky Warbler	*Oporornis*	*formosus*	KEWA	Wood-Warblers	N/A	N/A	Occasional visitor
Mourning Warbler	*Oporornis*	*philadelphia*	MOWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Connecticut Warbler	*Oporornis*	*agilis*	CONW	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Hooded Warbler	*Wilsonia*	*citrina*	HOWA	Wood-Warblers	N/A	N/A	Occasional visitor
Wilson's Warbler	*Wilsonia*	*pusilla*	WIWA	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
Canada Warbler	*Wilsonia*	*canadensis*	CAWA	Wood-Warblers	N/A	Threatened	Long distance migrant, breeding populations
American Redstart	*Setophaga*	*ruticilla*	AMRE	Wood-Warblers	N/A	N/A	Long distance migrant, breeding populations
House Sparrow	*Passer*	*domesticus*	HOSP	Old World Sparrows	N/A	N/A	Year-round inhabitant
Eurasian Tree Sparrow	*Passer*	*montanus*	ETSP	Old World Sparrows	N/A	N/A	Extralimital breeding record
Bobolink	*Dolichonyx*	*oryzivorus*	BOBO	Blackbirds and Allies	N/A	N/A	Long distance migrant, breeding populations
Eastern Meadowlark	*Sturnella*	*magna*	EAME	Blackbirds and Allies	N/A	N/A	Occasional visitor
Western Meadowlark	*Sturnella*	*neglecta*	WEME	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations
Yellow-headed blackbird	*Xanthocephalus*	*xanthocephalus*	YHBL	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations
Red-winged Blackbird	*Agelaius*	*phoeniceus*	RWBL	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Rusty Blackbird	*Euphagus*	*carolinus*	RUBL	Blackbirds and Allies	N/A	Special Concern	Short distance migrant, breeding populations
Brewer's Blackbird	*Euphagus*	*cyanocephalus*	BRBL	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations
Common Grackle	*Quiscalus*	*quiscula*	COGR	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations
Brown-headed Cowbird	*Molothrus*	*ater*	BHCO	Blackbirds and Allies	N/A	N/A	Short distance migrant, breeding populations
Orchard Oriole	*Icterus*	*spurius*	OROR	Orioles	N/A	N/A	Long distance migrant, breeding populations
Baltimore Oriole	*Icterus*	*galbula*	BAOR	Orioles	N/A	N/A	Long distance migrant, breeding populations
Western Tanager	*Piranga*	*ludoviciana*	WETA	Tanagers	N/A	N/A	Occasional visitor
Scarlet Tanager	*Piranga*	*olivacea*	SCTA	Tanagers	N/A	N/A	Long distance migrant, breeding populations
Summer Tanager	*Piranga*	*rubra*	SUTA	Tanagers	N/A	N/A	Occasional visitor
Northern Cardinal	*Cardinalis*	*cardinalis*	NOCA	Grosbeaks, Finches and Buntings	N/A	N/A	Extralimital breeding record
Rose-breasted Grosbeak	*Pheucticus*	*ludovicianus*	RBGR	Grosbeaks, Finches and Buntings	N/A	N/A	Long distance migrant, breeding populations
Black-headed Grosbeak	*Pheucticus*	*melanocephalus*	BHGR	Grosbeaks, Finches and Buntings	N/A	N/A	Rare migrant or visitor
Evening Grosbeak	*Coccothraustes*	*vespertinus*	EVGR	Grosbeaks, Finches and Buntings	N/A	N/A	Year-round inhabitant
Indigo Bunting	*Passerina*	*cyanea*	INBU	Grosbeaks, Finches and Buntings	N/A	N/A	Long distance migrant, breeding populations
Lazuli Bunting	*Passerina*	*amoena*	LAZB	Grosbeaks, Finches and Buntings	N/A	N/A	Occasional visitor
Brambling	*Fringilla*	*montifringilla*	BRAM	Grosbeaks, Finches and Buntings	N/A	N/A	Occasional visitor
Purple Finch	*Carpodacus*	*purpureus*	PUFI	Grosbeaks, Finches and Buntings	N/A	N/A	Short distance migrant, breeding populations
House Finch	*Carpodacus*	*mexicanus*	HOFI	Grosbeaks, Finches and Buntings	N/A	N/A	Year-round inhabitant
Pine Grosbeak	*Pinicola*	*enucleator*	PIGR	Grosbeaks, Finches and Buntings	N/A	N/A	Year-round inhabitant
Hoary Redpoll	*Carduelis*	*hornemanni*	HORE	Redpolls	N/A	N/A	Regular in winter
Common Redpoll	*Carduelis*	*flammea*	CORE	Redpolls	N/A	N/A	Year-round inhabitant
Pine Siskin	*Carduelis*	*pinus*	PISI	Redpolls	N/A	N/A	Year-round inhabitant

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
American Goldfinch	*Carduelis*	*tristis*	AMGO	Redpolls	N/A	N/A	Short distance migrant, breeding populations
Gray-crowned Rosy-Finch	*Leucosticte*	*tephrocotis*	GCRF	Redpolls	N/A	N/A	Occasional visitor
Red Crossbill	*Loxia*	*curvirostra*	RECR	Crossbills	N/A	N/A	Year-round inhabitant
White-winged Crossbill	*Loxia*	*leucoptera*	WWCR	Crossbills	N/A	N/A	Year-round inhabitant
Dickcissel	*Spiza*	*americana*	DICK	Crossbills	N/A	N/A	Rare migrant or visitor
Spotted Towhee	*Pipilo*	*maculatus*	SPTO	Towhees, New-World Sparrows, Allies	N/A	N/A	Occasional visitor
Eastern Towhee	*Pipilo*	*erythrophthalmus*	EATO	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Savannah Sparrow	*Passerculus*	*sandwichensis*	SAVS	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Grasshopper Sparrow	*Ammodramus*	*savannarum*	GRSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Baird's Sparrow	*Ammodramus*	*bairdii*	BAIS	Towhees, New-World Sparrows, Allies	Endangered	N/A	Rare migrant or visitor
Le Conte's Sparrow	*Ammodramus*	*leconteii*	LCSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
Nelson's Sharp-tailed Sparrow	*Ammodramus*	*nelsoni*	NSTS	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Lark Bunting	*Calamospiza*	*melanocorys*	LARB	Towhees, New-World Sparrows, Allies	N/A	N/A	Rare migrant or visitor
Vesper Sparrow	*Pooecetes*	*gramineus*	VESP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Lark Sparrow	*Chondestes*	*grammacus*	LASP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Dark-eyed Junco	*Junco*	*hyemalis*	UDEJ	Towhees, New-World Sparrows, Allies	N/A	N/A	Year-round inhabitant
American Tree Sparrow	*Spizella*	*arborea*	ATSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
Chipping Sparrow	*Spizella*	*passerina*	CHSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Clay-colored Sparrow	*Spizella*	*pallida*	CCSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations

Common Name	Genus	Species	AOU Code	Family	Provincial Listing	Federal Listing	Occurrence Type
Field Sparrow	*Spizella*	*pusilla*	FISP	Towhees, New-World Sparrows, Allies	N/A	N/A	Extralimital breeding record
Harris's Sparrow	*Zonotrichia*	*querula*	HASP	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
White-crowned Sparrow	*Zonotrichia*	*leucophrys*	WCSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Golden-crowned Sparrow	*Zonotrichia*	*atricapilla*	GCSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Occasional visitor
White-throated Sparrow	*Zonotrichia*	*albicollis*	WTSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
Fox Sparrow	*Passerella*	*iliaca*	FOSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
Lincoln's Sparrow	*Melospiza*	*lincolnii*	LISP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Swamp Sparrow	*Melospiza*	*georgiana*	SWSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
Song Sparrow	*Melospiza*	*melodia*	SOSP	Towhees, New-World Sparrows, Allies	N/A	N/A	Long distance migrant, breeding populations
McCown's Longspur	*Calcarius*	*mccownii*	MCLO	Towhees, New-World Sparrows, Allies	N/A	N/A	Occasional visitor
Chestnut-collared Longspur	*Calcarius*	*ornatus*	CCLO	Towhees, New-World Sparrows, Allies	N/A	N/A	Occasional visitor
Lapland Longspur	*Calcarius*	*lapponicus*	LALO	Towhees, New-World Sparrows, Allies	N/A	N/A	Short distance migrant, breeding populations
Smith's Longspur	*Calcarius*	*pictus*	SMLO	Towhees, New-World Sparrows, Allies	N/A	N/A	Regular migrant
Snow Bunting	*Plectrophenax*	*nivalis*	SNBU	Towhees, New-World Sparrows, Allies	N/A	N/A	Regular migrant

F-2: Waterfowl observed during the 2010 waterfowl survey

Species	**Number Observed**
Mallard	6,350
Snow goose	5,719
Canada goose	4,773
Canvasback	3,013
Scaup spp.	2,696
Blue-winged teal	732
Common merganser	243
Green-winged teal	158
Tundra swan	156
Northern shoveler	127
Bufflehead	110
American coot	72
Gadwall	67
Common goldeneye	38
Pied-billed grebe	24
Redhead	15
Red-breasted merganser	15
Red-necked grebe	11
Ring-necked duck	10
Great scaup	10
Hooded merganser	9
Western grebe	9
Lesser scaup	8
American widgeon	7
Common loon	4
Ruddy duck	3
American black duck	2
Total	**24,381**

F-3: Waterfowl observed incidentally during the colonial waterbird surveys and the raptor surveys

Species	Colonial Waterbird Survey	Raptor Survey
Canada goose	23	161
Canvasback	1	0
Common goldeneye	0	2
Common merganser	0	1
Common moorhen	9	0
Green-winged teal	0	1
Greater scaup	1	0
Greater white-fronted goose	0	10
Northern pintail	0	1
Red-breasted merganser	0	1
Ring-necked duck	4	0
Scaup ssp.	7	0
Snow goose	0	18
Swan ssp.	1	0
Tundra swan	0	19
White-winged scoter	2	0
Total	**48**	**214**

F-4: Colonial waterbirds observed during the 2010 colonial waterbird surveys

Species	Number Observed
Ring-billed gull	784
Franklin's gull	349
Bonaparte's gull	170
American white pelican	85
Great blue heron	78
Black tern	36
Gull species	16
Common tern	15
Total	**1,533**

F-5: Colonial waterbirds observed incidentally during the 2010 waterfowl and raptor surveys

Species	Waterfowl Survey	Raptor Survey
American bittern	1	0
American white pelican	7	2
Bonaparte's gull	6	0
Cattle egret	1	0
Common tern	4	0
Double-crested cormorant	0	1
Franklin's gull	1	0
Great blue heron	12	2
Herring gull	3	3
Ring-billed gull	76	14
Lesser yellowlegs	0	1
Western grebe	5	0
Wilson’s snipe	1	0
Total	**117**	**23**

F-6: Raptor species identified during the 2010 raptor surveys

Species	**Number Observed**
Red-tailed hawk	311
Bald eagle	79
Northern harrier	41
Sharp-shinned hawk	23
Cooper's hawk	15
American kestrel	11
Unknown raptor	10
Turkey vulture	8
Rough-legged hawk	8
Unidentified buteo	7
Unidentified raptor	6
Unidentified accipiter	4
Merlin	4
Golden eagle	4
Northern goshawk	3
Unidentified eagle	1
Total	**535**

F-7: Bird of prey species observed incidentally during the 2010 bird surveys

Species	Colonial Waterbird Survey	Nocturnal Owl Survey	Waterfowl Survey
American kestrel	2	1	0
Broad-winged hawk	0	1	2
Great gray owl	1	0	1
Great horned owl	1	0	0
Northern goshawk	0	0	1
Northern harrier	25	4	30
Northern hawk owl	0	0	1
Osprey	4	0	0
Rough-legged hawk	3	0	2
Red-tailed hawk	14	18	19
Snowy owl	0	6	0
Turkey vulture	2	0	0
Total	**52**	**30**	**56**

F-8: Owl species recorded during the 2010 nocturnal owl surveys

Common Name	Number Observed
Boreal owl	228
Great horned owl	64
Northern saw-whet owl	20
Long-eared owl	12
Barred owl	10
Great gray owl	7
Northern hawk owl	2
Short-eared owl	2
Eastern screech-owl	1
Total	**346**

F-9: Sampled bird species in the Lake Manitoba Plain Ecoregion based on sampled forestry resource inventory habitats

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Alder Flycatcher	29	American Green-winged Teal	1	Alder Flycatcher	1	Alder Flycatcher	48	Alder Flycatcher	29	American Green-winged Teal	1
American Bittern	12	Alder Flycatcher	37	American Crow	16	American Bittern	12	American Avocet	1	Alder Flycatcher	18
American Crow	7	American Bittern	25	American Goldfinch	11	American Crow	5	American Bittern	33	American Avocet	1
American Goldfinch	24	American Crow	85	American Redstart	16	American Goldfinch	17	American Coot	1	American Bittern	41
American Redstart	75	American Goldfinch	75	American Robin	21	American Redstart	14	American Crow	12	American Coot	16
American Robin	31	American Redstart	9	Bank Swallow	16	American Robin	20	American Goldfinch	28	American Crow	4
Bank Swallow	1	American Robin	49	Baltimore Oriole	5	Baltimore Oriole	11	American Redstart	4	American Goldfinch	8
Baltimore Oriole	21	American White Pelican	1	Barn Swallow	6	Black-and-White Warbler	5	American Robin	30	American Redstart	3
Black-and-White Warbler	12	Bank Swallow	2	Black-and-White Warbler	1	Black-billed Cuckoo	1	American Wigeon	1	American Robin	8
Bay-breasted Warbler	2	Baltimore Oriole	11	Bay-breasted Warbler	3	Bay-breasted Warbler	1	American Woodcock	5	Bald Eagle	1
Black-capped Chickadee	14	Barn Swallow	29	Black-capped Chickadee	5	Black-capped Chickadee	3	American White Pelican	11	Baltimore Oriole	13
Brown-headed Cowbird	67	Black-and-White Warbler	1	Brown-headed Cowbird	16	Brown-headed Cowbird	41	Baltimore Oriole	24	Barn Swallow	8
Blue-headed Vireo	1	Black-billed Cuckoo	2	Blue Jay	3	Blue-headed Vireo	2	Barn Swallow	5	Black-and-White Warbler	4
Blackburnian Warbler	1	Black-billed Magpie	4	Black-billed Cuckoo	1	Blue Jay	6	Black-and-White Warbler	4	Black-billed Magpie	1

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Blue Jay	5	Black-capped Chickadee	8	Brown Thrasher	1	Blackpoll Warbler	1	Black-billed Cuckoo	5	Black-capped Chickadee	2
Blackpoll Warbler	2	Brown-headed Cowbird	85	Clay-colored Sparrow	12	Black Tern	3	Black-capped Chickadee	3	Brown-headed Cowbird	18
Brewer's Blackbird	3	Blue-headed Vireo	1	Cedar Waxwing	18	Brewer's Blackbird	5	Brown-headed Cowbird	48	Blue Jay	3
Brown Creeper	1	Blue Jay	10	Chipping Sparrow	13	Black-throated Green Warbler	1	Blue-headed Vireo	1	Black Tern	109
Broad-winged Hawk	2	Black Tern	15	Common Goldeneye	1	Blue-winged Teal	1	Blue Jay	7	Brewer's Blackbird	13
Canada Goose	3	Black-billed Cuckoo	11	Common Grackle	8	Canada Goose	3	Black Tern	33	Brown Thrasher	1
Canada Warbler	4	Brewer's Blackbird	14	Common Raven	2	Clay-colored Sparrow	43	Black-billed Cuckoo	2	Blue-winged Teal	15
Clay-colored Sparrow	64	Brown Thrasher	10	Chestnut-sided Warbler	5	Cedar Waxwing	8	Brewer's Blackbird	9	Canada Goose	124
Cedar Waxwing	12	Blue-winged Teal	1	Downy Woodpecker	1	Chipping Sparrow	1	Blue-winged Teal	14	Canvasback	2
Cape May Warbler	2	Canada Goose	24	Eastern Kingbird	4	Common Nighthawk	2	Canada Goose	34	Clay-colored Sparrow	35
Common Loon	1	Canada Warbler	1	Eastern Phoebe	1	Connecticut Warbler	1	Canvasback	1	Cedar Waxwing	25
Connecticut Warbler	10	Clay-colored Sparrow	172	European Starling	5	Common Raven	9	Clay-colored Sparrow	59	Cape May Warbler	1
Common Raven	13	Cedar Waxwing	29	Great Crested Flycatcher	2	Common Yellowthroat	67	Cedar Waxwing	13	Common Goldeneye	1
Common Yellowthroat	29	Chipping Sparrow	10	Gray Catbird	3	Chestnut-sided Warbler	1	Chipping Sparrow	1	Common Grackle	9
Chestnut-sided Warbler	10	Common Grackle	1	Hermit Thrush	2	Eastern Kingbird	1	Cape May Warbler	1	Common Loon	2

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Downy Woodpecker	3	Connecticut Warbler	2	House Sparrow	1	Eastern Towhee	1	Connecticut Warbler	1	Common Merganser	1
Eastern Kingbird	4	Common Raven	22	House Wren	4	Eastern Wood-Pewee	1	Common Raven	22	Common Raven	8
Eastern Towhee	4	Common Yellowthroat	71	Killdeer	2	Franklin's Gull	22	Common Tern	2	Common Tern	4
Eastern Wood-Pewee	6	Chestnut-sided Warbler	1	Least Flycatcher	16	Great Crested Flycatcher	4	Common Yellowthroat	98	Common Yellowthroat	90
Great Crested Flycatcher	16	Downy Woodpecker	5	Mallard	2	Gray Catbird	17	Chestnut-sided Warbler	2	Chestnut-sided Warbler	2
Great-horned Owl	1	Eastern Bluebird	1	Mourning Dove	5	Hairy Woodpecker	3	Downy Woodpecker	3	Eastern Kingbird	5
Gray Catbird	11	Eastern Kingbird	16	Mourning Warbler	4	Hermit Thrush	1	Eastern Bluebird	1	Forster's Tern	1
Hairy Woodpecker	4	Eastern Towhee	6	Northern Harrier	2	House Wren	4	Eastern Kingbird	13	Franklin's Gull	4
Hermit Thrush	5	Eastern Wood-Pewee	1	Northern Waterthrush	1	Killdeer	1	Eastern Towhee	7	Great Crested Flycatcher	2
House Wren	15	European Starling	6	Orange-crowned Warbler	1	Le Conte's Sparrow	14	Eastern Wood-Pewee	1	Gray-cheeked Thrush	1
Killdeer	2	Forster's Tern	1	Ovenbird	2	Least Flycatcher	44	Franklin's Gull	24	Gray Catbird	7
Le Conte's Sparrow	11	Franklin's Gull	24	Pileated Woodpecker	3	Lincoln's Sparrow	1	Great Crested Flycatcher	2	Hairy Woodpecker	2
Least Flycatcher	174	Great Crested Flycatcher	6	Purple Martin	5	Mallard	5	Gray Catbird	29	House Wren	1
Lincoln's Sparrow	1	Great-horned Owl	1	Rose-breasted Grosbeak	1	Magnolia Warbler	1	House Wren	5	Killdeer	5
Magnolia Warbler	3	Gray Catbird	27	Ring-billed Gull	21	Marsh Wren	3	Killdeer	8	Le Conte's Sparrow	26
Mourning Dove	7	Greater Yellowlegs	2	Red-eyed Vireo	21	Mourning Dove	4	Le Conte's Sparrow	67	Least Bittern	1

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Mourning Warbler	7	Hairy Woodpecker	2	Mourning Dove	7	Nashville Warbler	10	Least Flycatcher	56	Least Flycatcher	17
Northern Hawk owl	1	Hermit Thrush	1	Ruby-throated Hummingbird	1	Nelson's Sharp-tailed Sparrow	2	Lincoln's Sparrow	1	Marbled Godwit	4
Northern Waterthrush	3	House Sparrow	4	Ruffed Grouse	3	Northern Goshawk	1	Marbled Godwit	28	Mallard	46
Ovenbird	57	House Wren	10	Red-winged Blackbird	20	Northern Harrier	1	Mallard	34	Marsh Wren	115
Pied-billed Grebe	3	Killdeer	19	Savannah Sparrow	6	Northern Waterthrush	3	Magnolia Warbler	2	Merlin	1
Philadelphia Vireo	25	Le Conte's Sparrow	57	Song Sparrow	14	Olive-sided Flycatcher	3	Marsh Wren	56	Mourning Dove	2
Pileated Woodpecker	1	Least Bittern	1	Spotted Sandpiper	1	Ovenbird	12	Mourning Dove	7	Nelson's Sharp-tailed Sparrow	16
Rose-breasted Grosbeak	66	Least Flycatcher	69	Tennessee Warbler	1	Pied-billed Grebe	2	Mourning Warbler	2	Northern Harrier	3
Ring-billed Gull	5	Lincoln's Sparrow	1	Veery	1	Philadelphia Vireo	2	Nashville Warbler	1	Northern Shoveler	7
Red-eyed Vireo	63	Marbled Godwit	16	Vesper Sparrow	3	Pileated Woodpecker	3	Nelson's Sharp-tailed Sparrow	19	Pied-billed Grebe	20
Ruby-throated Hummingbird	4	Mallard	36	Warbling Vireo	1	Rose-breasted Grosbeak	22	Northern Goshawk	1	Philadelphia Vireo	1
Ruffed Grouse	58	Marsh Wren	11	Western Meadowlark	1	Ring-billed Gull	12	Northern Harrier	3	Rose-breasted Grosbeak	6
Red-winged Blackbird	14	Merlin	4	Wilson's Snipe	1	Red-breasted Nuthatch	1	Northern Waterthrush	1	Ring-billed Gull	2
Sandhill Crane	6	Mourning Dove	14	White-throated Sparrow	1	Red-eyed Vireo	27	Northern Shoveler	4	Red-eyed Vireo	13
Savannah Sparrow	5	Mourning Warbler	2	Yellow-bellied Sapsucker	5	Ruffed Grouse	19	Ovenbird	10	Ruffed Grouse	4

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Sedge Wren	8	Nelson's Sharp-tailed Sparrow	10	Yellow-rumped Warbler	4	Red-winged Blackbird	35	Pied-billed Grebe	9	Red-winged Blackbird	284
Sora Rail	5	Northern Harrier	2	Yellow Warbler	14	Sandhill Crane	6	Philadelphia Vireo	2	Sandhill Crane	14
Song Sparrow	33	Northern Waterthrush	3			Savannah Sparrow	3	Pileated Woodpecker	2	Savannah Sparrow	8
Swamp Sparrow	3	Ovenbird	7			Sedge Wren	33	Rose-breasted Grosbeak	31	Sedge Wren	29
Swainson's Thrush	12	Pied-billed Grebe	6			Sora Rail	11	Ring-billed Gull	17	Sora Rail	72
Tennessee Warbler	16	Philadelphia Vireo	8			Song Sparrow	26	Red-eyed Vireo	27	Song Sparrow	23
Tree Swallow	1	Pileated Woodpecker	1			Swamp Sparrow	31	Ring-necked Duck	1	Swamp Sparrow	39
Veery	90	Purple Martin	5			Swainson's Thrush	4	Ruffed Grouse	16	Tree Swallow	8
Warbling Vireo	29	Rose-breasted Grosbeak	30			Tennessee Warbler	10	Red-winged Blackbird	280	Unidentified Dark-eyed Junco	1
White-breasted Nuthatch	4	Ring-billed Gull	9			Tree Swallow	4	Sandhill Crane	18	Veery	3
Western Meadowlark	1	Red-eyed Vireo	42			Unidentified Dark-eyed Junco	1	Savannah Sparrow	55	Virginia Rail	8
Wilson's Snipe	52	Red-tailed Hawk	1			Veery	31	Sedge Wren	72	Warbling Vireo	11
Wood Duck	1	Ruby-throated Hummingbird	1			Warbling Vireo	13	Sora Rail	88	Western Meadowlark	4
White-throated Sparrow	64	Ruffed Grouse	9			White-crowned Sparrow	4	Song Sparrow	42	Willet	1
Yellow-bellied Flycatcher	1	Red-winged Blackbird	113			Wilson's Snipe	37	Spotted Sandpiper	2	Wilson's Phalarope	9
Yellow-bellied Sapsucker	23	Sandhill Crane	12			Wilson's Warbler	2	Swamp Sparrow	73	Wilson's Snipe	61

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
Yellow-rumped Warbler	3	Savannah Sparrow	124			White-throated Sparrow	30	Tennessee Warbler	3	Wilson's Warbler	1
Yellow-shafted Flicker	5	Sedge Wren	36			Yellow-bellied Sapsucker	9	Tree Swallow	7	Western Palm Warbler	1
Yellow-throated Vireo	1	Sora Rail	43			Yellow Rail	2	UNKWOOD	1	White-throated Sparrow	5
Yellow Warbler	114	Song Sparrow	69			Yellow-rumped Warbler	6	Upland Sandpiper	1	Yellow-bellied Sapsucker	2
		Swamp Sparrow	13			Yellow-shafted Flicker	5	Veery	25	Yellow Rail	8
		Tennessee Warbler	9			Yellow Warbler	66	Virginia Rail	11	Yellow-headed Blackbird	11
		Tree Swallow	4					Warbling Vireo	37	Yellow-shafted Flicker	7
		Upland Sandpiper	1					Western Meadowlark	20	Yellow Warbler	30
		Veery	30					Wilson's Phalarope	31		
		Vesper Sparrow	26					Wilson's Snipe	69		
		Virginia Rail	3					Wilson's Warbler	1		
		Warbling Vireo	21					White-throated Sparrow	15		
		White-breasted Nuthatch	5					Yellow-bellied Sapsucker	2		
		Western Meadowlark	53					Yellow Rail	7		
		Western Wood-Pewee	1					Yellow-headed Blackbird	17		
		Willow Flycatcher	1					Yellow-shafted Flicker	5		

Broadleaf Pure		Grassland		Other Broadleaf		Shrub		Wet Prairie		Wetland Herb	
		Willet	1					Yellow Warbler	92		
		Wilson's Phalarope	4								
		Wilson's Snipe	80								
		Wood Duck	6								
		White-throated Sparrow	7								
		Yellow-bellied Sapsucker	9								
		Yellow Rail	15								
		Yellow-headed Blackbird	3								
		Yellow-rumped Warbler	1								
		Yellow-shafted Flicker	7								
		Yellow Warbler	108								
Number of Birds	**1509**	**Number of Birds**	**2101**	**Number of Birds**	**374**	**Number of Birds**	**948**	**Number of Birds**	**2008**	**Number of Birds**	**1544**
Number of Plots	**98**	**Number of Plots**	**115**	**Number of Plots**	**17**	**Number of Plots**	**52**	**Number of Plots**	**111**	**Number of Plots**	**82**
Birds Per Point	**15.4**	**Birds Per Point**	**18.3**	**Birds Per Point**	**22.0**	**Birds Per Point**	**18.2**	**Birds Per Point**	**18.1**	**Birds Per Point**	**18.8**
Species Richness	**80**	**Species Richness**	**103**	**Species Richness**	**62**	**Species Richness**	**82**	**Species Richness**	**93**	**Species Richness**	**84**
Species Diversity	**3.6**	**Species Diversity**	**3.9**	**Species Diversity**	**3.7**	**Species Diversity**	**3.8**	**Species Diversity**	**3.7**	**Species Diversity**	**3.4**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question.

F-10: Sampled bird species in the Interlake Plain Ecoregion based on sampled forestry resource inventory habitats

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Alder Flycatcher	27	Alder Flycatcher	19	Alder Flycatcher	9	Alder Flycatcher	77	Alder Flycatcher	13	Alder Flycatcher	19
American Bittern	1	American Bittern	6	American Crow	2	American Bittern	2	American Bittern	1	American Bittern	2
American Crow	8	American Crow	33	American Goldfinch	2	American Crow	7	American Crow	4	American Coot	1
American Goldfinch	12	American Goldfinch	36	American Redstart	2	American Goldfinch	10	American Goldfinch	2	American Crow	24
American Kestrel	1	American Redstart	73	American Robin	9	American Redstart	8	American Redstart	4	American Goldfinch	22
American Redstart	21	American Robin	43	Black-and-White Warbler	1	American Robin	17	American Robin	5	American Kestrel	1
American Robin	14	American Woodcock	1	Black-backed Woodpecker	1	Bank Swallow	1	Black-and-White Warbler	8	American Redstart	13
Baltimore Oriole	1	Bank Swallow	8	Blue-headed Vireo	2	Baltimore Oriole	2	Black-billed Magpie	1	American Robin	23
Black-and-White Warbler	30	Baltimore Oriole	4	Blackburnian Warbler	5	Barn Swallow	2	Bay-breasted Warbler	1	American Wigeon	1
Bay-breasted Warbler	4	Black-and-White Warbler	44	Blue Jay	3	Black-and-White Warbler	11	Black-backed Woodpecker	4	Bank Swallow	4
Black-backed Woodpecker	2	Black-billed Cuckoo	2	Brown Creeper	1	Bay-breasted Warbler	3	Black-capped Chickadee	1	Baltimore Oriole	1
Black-capped Chickadee	4	Black-billed Magpie	2	Canada Warbler	1	Black-backed Woodpecker	5	Blue-headed Vireo	9	Barn Swallow	3
Barred Owl	1	Bay-breasted Warbler	1	Clay-colored Sparrow	2	Black-capped Chickadee	5	Blackburnian Warbler	8	Black-and-White Warbler	12
Brown-headed Cowbird	6	Black-capped Chickadee	21	Cedar Waxwing	3	Brown-headed Cowbird	3	Blue Jay	5	Black-billed Magpie	5
Blue-headed Vireo	13	Belted Kingfisher	1	Chipping Sparrow	7	Blue-headed Vireo	23	Boreal Chickadee	7	Black-capped Chickadee	3

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Blackburnian Warbler	31	Brown-headed Cowbird	41	Cape May Warbler	1	Blackburnian Warbler	6	Brown Creeper	5	Brown-headed Cowbird	19
Blue Jay	14	Blue-headed Vireo	1	Connecticut Warbler	2	Blue Jay	22	Broad-winged Hawk	1	Blackburnian Warbler	1
Brewer's Blackbird	1	Blackburnian Warbler	19	Common Raven	1	Black Tern	2	Canada Goose	1	Blue Jay	3
Brown Creeper	1	Blue Jay	17	Common Yellowthroat	8	Black-billed Cuckoo	1	Canada Warbler	7	Black Tern	1
Black-throated Green Warbler	10	Black-billed Cuckoo	1	Hairy Woodpecker	2	Boreal Chickadee	4	Cedar Waxwing	18	Black-billed Cuckoo	2
Broad-winged Hawk	4	Brewer's Blackbird	1	Hermit Thrush	4	Brewer's Blackbird	4	Chipping Sparrow	7	Brewer's Blackbird	2
Blue-winged Teal	1	Brown Creeper	1	Least Flycatcher	4	Brown Creeper	3	Cape May Warbler	4	Broad-winged Hawk	1
Canada Goose	1	Brown Thrasher	1	Magnolia Warbler	4	Black-throated Green Warbler	1	Connecticut Warbler	3	Canada Goose	2
Canada Warbler	13	Black-throated Green Warbler	5	Mourning Warbler	2	Broad-winged Hawk	3	Common Raven	1	Clay-colored Sparrow	37
Clay-colored Sparrow	2	Broad-winged Hawk	5	Nashville Warbler	10	Canada Goose	8	Common Yellowthroat	12	Cedar Waxwing	19
Cedar Waxwing	27	Blue-winged Teal	2	Northern Waterthrush	3	Canada Warbler	5	Chestnut-sided Warbler	4	Chipping Sparrow	7
Chipping Sparrow	25	Canada Goose	14	Orange-crowned Warbler	1	Clay-colored Sparrow	17	Gray Jay	6	Cliff Swallow	1
Cape May Warbler	8	Canada Warbler	7	Olive-sided Flycatcher	3	Cedar Waxwing	31	Hairy Woodpecker	1	Common Grackle	2
Common Goldeneye	1	Clay-colored Sparrow	44	Ovenbird	10	Chipping Sparrow	41	Hermit Thrush	8	Connecticut Warbler	2
Connecticut Warbler	16	Cedar Waxwing	41	Pied-billed Grebe	1	Cape May Warbler	6	House Wren	2	Common Raven	6

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Common Raven	8	Chipping Sparrow	14	Pileated Woodpecker	2	Common Loon	1	Mallard	1	Common Tern	1
Common Tern	1	Common Goldeneye	1	Rose-breasted Grosbeak	2	Connecticut Warbler	13	Magnolia Warbler	6	Common Yellowthroat	35
Common Yellowthroat	27	Common Grackle	1	Red-breasted Nuthatch	3	Common Raven	6	Mourning Dove	2	Chestnut-sided Warbler	2
Chestnut-sided Warbler	10	Connecticut Warbler	21	Ruby-crowned Kinglet	6	Common Yellowthroat	70	Mourning Warbler	3	Downy Woodpecker	1
Eastern Kingbird	1	Common Raven	9	Red Crossbill	2	Chestnut-sided Warbler	1	Nashville Warbler	14	Eastern Bluebird	1
Eastern Wood-Pewee	2	Common Yellowthroat	42	Red-eyed Vireo	9	Eastern Kingbird	1	Northern Waterthrush	19	Eastern Kingbird	5
Evening Grosbeak	4	Chestnut-sided Warbler	19	Ruffed Grouse	3	Evening Grosbeak	6	Ovenbird	18	Eastern Phoebe	2
Great Crested Flycatcher	1	Downy Woodpecker	3	Song Sparrow	2	Golden-crowned Kinglet	7	Pileated Woodpecker	4	Eastern Towhee	1
Gray Jay	3	Eastern Kingbird	7	Swainson's Thrush	6	Gray Jay	11	Purple Finch	3	Eastern Wood-Pewee	1
Greater Yellowlegs	1	Eastern Phoebe	2	Tennessee Warbler	7	Gray Catbird	3	Rose-breasted Grosbeak	6	European Starling	3
Golden-winged Warbler	10	Eastern Towhee	3	Tree Swallow	1	Greater Yellowlegs	1	Red-breasted Nuthatch	2	Great Crested Flycatcher	6
Hairy Woodpecker	2	Eastern Wood-Pewee	5	Veery	1	Hairy Woodpecker	4	Ruby-crowned Kinglet	8	Gray Jay	1
Hermit Thrush	17	Evening Grosbeak	1	Wilson's Snipe	2	Hermit Thrush	19	Red Crossbill	1	Gray Catbird	7
House Wren	4	Great Crested Flycatcher	13	Winter Wren	3	House Wren	1	Red-eyed Vireo	14	Golden-winged Warbler	1
Killdeer	1	Golden-crowned Kinglet	1	Western Palm Warbler	1	Le Conte's Sparrow	5	Ruffed Grouse	5	Hermit Thrush	1
Least Flycatcher	10	Gray Jay	1	White-throated Sparrow	21	Least Flycatcher	8	Swamp Sparrow	3	House Sparrow	1

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Lincoln's Sparrow	7	Gray Catbird	17	Yellow-bellied Sapsucker	1	Lincoln's Sparrow	20	Swainson's Thrush	16	House Wren	6
Mallard	3	Greater Yellowlegs	1	Yellow-rumped Warbler	8	Marbled Godwit	1	Tennessee Warbler	22	Killdeer	7
Magnolia Warbler	27	Golden-winged Warbler	5	Yellow-shafted Flicker	1	Mallard	2	Tree Swallow	2	Le Conte's Sparrow	13
Mourning Dove	5	Hairy Woodpecker	12	Yellow Warbler	3	Magnolia Warbler	42	Three-toed Woodpecker	1	Least Flycatcher	15
Mourning Warbler	37	Hermit Thrush	18			Mourning Dove	4	Wilson's Snipe	5	Lincoln's Sparrow	1
Nashville Warbler	50	House Wren	14			Mourning Warbler	9	Wilson's Warbler	1	Marbled Godwit	1
Northern Waterthrush	13	Killdeer	1			Nashville Warbler	99	Winter Wren	2	Mallard	8
Orange-crowned Warbler	3	Le Conte's Sparrow	8			Northern Waterthrush	9	Western Palm Warbler	1	Mourning Dove	8
Olive-sided Flycatcher	3	Least Flycatcher	55			Olive-sided Flycatcher	3	White-throated Sparrow	38	Mourning Warbler	6
Ovenbird	145	Lincoln's Sparrow	2			Ovenbird	21	Yellow-bellied Flycatcher	3	Nashville Warbler	2
Pied-billed Grebe	1	Mallard	2			Philadelphia Vireo	3	Yellow-bellied Sapsucker	1	Nelson's Sharp-tailed Sparrow	1
Philadelphia Vireo	4	Magnolia Warbler	8			Pine Siskin	3	Yellow-rumped Warbler	10	Northern Waterthrush	5
Pine Grosbeak	1	Marsh Wren	2			Pileated Woodpecker	2	Yellow Warbler	4	Olive-sided Flycatcher	1
Pine Siskin	1	Mourning Dove	2			Purple Finch	1			Ovenbird	9
Pileated Woodpecker	9	Mourning Warbler	40			Rose-breasted Grosbeak	8			Pied-billed Grebe	2
Purple Finch	2	Nashville Warbler	27			Ring-billed Gull	1			Philadelphia Vireo	1
Rose-breasted Grosbeak	8	Northern Harrier	2			Red-breasted Nuthatch	6			Pine Siskin	2

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Ring-billed Gull	2	Northern Waterthrush	18			Ruby-crowned Kinglet	58			Pileated Woodpecker	1
Red-breasted Nuthatch	5	Northern Shoveler	1			Red-eyed Vireo	23			Rose-breasted Grosbeak	5
Ruby-crowned Kinglet	8	Northern Saw-whet Owl	1			Red-tailed Hawk	2			Ring-billed Gull	4
Red-eyed Vireo	65	Ovenbird	122			Ruby-throated Hummingbird	1			Red-eyed Vireo	30
Red-tailed Hawk	1	Pied-billed Grebe	1			Ruffed Grouse	4			Ruffed Grouse	3
Ruffed Grouse	18	Philadelphia Vireo	2			Red-winged Blackbird	4			Red-winged Blackbird	22
Sedge Wren	1	Pine Siskin	1			Sandhill Crane	9			Sandhill Crane	2
Song Sparrow	7	Pileated Woodpecker	6			Savannah Sparrow	1			Savannah Sparrow	23
Spotted Sandpiper	1	Purple Finch	1			Sedge Wren	10			Scarlet Tanager	1
Swainson's Thrush	17	Rose-breasted Grosbeak	23			Solitary Sandpiper	1			Sedge Wren	12
Tennessee Warbler	37	Ring-billed Gull	3			Song Sparrow	8			Sora Rail	5
Tree Swallow	3	Red-breasted Nuthatch	4			Spotted Sandpiper	1			Song Sparrow	26
Veery	7	Ruby-crowned Kinglet	1			Swamp Sparrow	19			Spotted Sandpiper	1
Wilson's Snipe	11	Red-eyed Vireo	133			Swainson's Thrush	28			Swamp Sparrow	21
Wilson's Warbler	2	Red-tailed Hawk	2			Tennessee Warbler	40			Tennessee Warbler	3
Winter Wren	8	Ruby-throated Hummingbird	1			Thrush	1			Thrush	1
Western Palm Warbler	3	Ruffed Grouse	15			Tree Swallow	3			Tree Swallow	6

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
White-throated Sparrow	93	Red-winged Blackbird	44			Three-toed Woodpecker	1			Veery	14
Yellow-bellied Flycatcher	4	Sandhill Crane	4			Unidentified Dark-eyed Junco	25			Vesper Sparrow	1
Yellow-bellied Sapsucker	5	Savannah Sparrow	18			Veery	9			Virginia Rail	1
Yellow-rumped Warbler	19	Scarlet Tanager	3			Wilson's Phalarope	2			Warbling Vireo	4
Yellow-shafted Flicker	9	Sedge Wren	10			Wilson's Snipe	23			White-breasted Nuthatch	1
Yellow Warbler	8	Sora Rail	1			Wilson's Warbler	6			Western Meadowlark	5
		Solitary Sandpiper	1			Winter Wren	11			Wilson's Snipe	22
		Song Sparrow	34			Western Palm Warbler	19			White-throated Sparrow	13
		Swamp Sparrow	18			White-throated Sparrow	136			Yellow-bellied Sapsucker	7
		Swainson's Thrush	8			White-winged Crossbill	4			Yellow-shafted Flicker	6
		Tennessee Warbler	33			Yellow-bellied Flycatcher	15			Yellow Warbler	33
		Tree Swallow	8			Yellow-rumped Warbler	31				
		Unidentified Dark-eyed Junco	2			Yellow-shafted Flicker	3				
		Veery	48			Yellow Warbler	11				
		Vesper Sparrow	1								
		Warbling Vireo	5								
		White-breasted Nuthatch	4								
		Western Meadowlark	6								

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
		Wilson's Snipe	34								
		Winter Wren	2								
		White-throated Sparrow	97								
		Yellow-bellied Sapsucker	12								
		Yellow-headed Blackbird	2								
		Yellow-rumped Warbler	4								
		Yellow-shafted Flicker	14								
		Yellow-throated Vireo	1								
		Yellow Warbler	26								
Number of Birds	**1055**	**Number of Birds**	**1628**	**Number of Birds**	**190**	**Number of Birds**	**1230**	**Number of Birds**	**368**	**Number of Birds**	**669**
Number of Plots	**87**	**Number of Plots**	**116**	**Number of Plots**	**16**	**Number of Plots**	**88**	**Number of Plots**	**26**	**Number of Plots**	**43**
Birds Per Point	**12.1**	**Birds Per Point**	**14.0**	**Birds Per Point**	**11.9**	**Birds Per Point**	**14.0**	**Birds Per Point**	**14.2**	**Birds Per Point**	**15.6**
Species Richness	**86**	**Species Richness**	**107**	**Species Richness**	**50**	**Species Richness**	**94**	**Species Richness**	**59**	**Species Richness**	**91**
Species Diversity	**3.7**	**Species Diversity**	**3.9**	**Species Diversity**	**3.6**	**Species Diversity**	**3.8**	**Species Diversity**	**3.6**	**Species Diversity**	**3.9**

JP Mixed		JP Pure		Mud/ Salt Flats		Other Broadleaf		Shrub	
Alder Flycatcher	1	Alder Flycatcher	2	American Green-winged Teal	1	American Crow	1	Alder Flycatcher	103
Blue Jay	1	American Crow	1	Alder Flycatcher	4	American Goldfinch	2	American Bittern	4
Canada Warbler	1	American Redstart	1	American Bittern	2	American Redstart	2	American Crow	16
Cedar Waxwing	2	Clay-colored Sparrow	1	American Crow	9	American Robin	4	American Goldfinch	31
Chipping Sparrow	2	Cedar Waxwing	4	American Goldfinch	2	Bank Swallow	59	American Kestrel	1
Connecticut Warbler	1	Chipping Sparrow	4	Black-and-White Warbler	3	Black-and-White Warbler	3	American Redstart	46
Common Raven	1	Cape May Warbler	1	Black-billed Magpie	1	Clay-colored Sparrow	4	American Robin	14
Common Yellowthroat	2	Common Raven	4	Black-capped Chickadee	1	Downy Woodpecker	1	Baltimore Oriole	2
Chestnut-sided Warbler	1	Common Yellowthroat	3	Brown-headed Cowbird	2	Great Crested Flycatcher	1	Black-and-White Warbler	42
Hairy Woodpecker	1	Evening Grosbeak	1	Blackburnian Warbler	1	Gray Catbird	2	Black-billed Cuckoo	3
Hermit Thrush	6	Hermit Thrush	9	Blue Jay	1	Least Flycatcher	2	Black-billed Magpie	2
Magnolia Warbler	3	Least Flycatcher	2	Black Tern	2	Pileated Woodpecker	1	Black-capped Chickadee	7
Mourning Warbler	2	Magnolia Warbler	2	Brewer's Blackbird	1	Rose-breasted Grosbeak	1	Brown-headed Cowbird	29
Nashville Warbler	10	Nashville Warbler	8	Canada Goose	1	Red-eyed Vireo	7	Blue-headed Vireo	1
Orange-crowned Warbler	1	Northern Waterthrush	1	Clay-colored Sparrow	2	Red-winged Blackbird	1	Blackburnian Warbler	7
Ovenbird	5	Orange-crowned Warbler	3	Cedar Waxwing	1	Tennessee Warbler	1	Blue Jay	14
Rose-breasted Grosbeak	1	Ovenbird	6	Chipping Sparrow	1	Wilson's Snipe	1	Black Tern	2
Red-breasted Nuthatch	1	Pine Siskin	2	Connecticut Warbler	2	White-throated Sparrow	4	Brewer's Blackbird	3
Ruby-crowned Kinglet	1	Rose-breasted Grosbeak	1	Common Raven	2	Yellow Warbler	8	Brown Creeper	1
Red-eyed Vireo	1	Ruby-crowned Kinglet	2	Common Tern	2			Black-throated Green Warbler	1

JP Mixed		JP Pure		Mud/ Salt Flats		Other Broadleaf		Shrub	
Tennessee Warbler	7	Red-eyed Vireo	5	Common Yellowthroat	7			Broad-winged Hawk	1
Western Palm Warbler	1	Rusty Blackbird	1	Eastern Kingbird	1			Blue-winged Teal	1
White-throated Sparrow	10	Tennessee Warbler	3	Franklin's Gull	1			Canada Goose	17
Yellow-bellied Sapsucker	2	Wilson's Warbler	1	Gray Jay	1			Canada Warbler	1
Yellow-rumped Warbler	5	White-throated Sparrow	15	Greater Yellowlegs	1			Clay-colored Sparrow	37
Yellow-shafted Flicker	2	Yellow-bellied Flycatcher	1	Hairy Woodpecker	1			Cedar Waxwing	25
		Yellow-shafted Flicker	2	Hermit Thrush	2			Chipping Sparrow	12
		Yellow-rumped Warbler	5	Killdeer	1			Cape May Warbler	2
		Yellow-shafted Flicker	1	Le Conte's Sparrow	7			Common Goldeneye	1
		Yellow Warbler	1	Lincoln's Sparrow	1			Common Grackle	1
				Marsh Wren	2			Connecticut Warbler	5
				Mourning Warbler	1			Common Raven	7
				Nashville Warbler	1			Common Yellowthroat	101
				Nelson's Sharp-tailed Sparrow	1			Chestnut-sided Warbler	3
				Northern Waterthrush	1			Eastern Bluebird	1
				Ovenbird	2			Eastern Kingbird	4
				Pileated Woodpecker	1			Great Crested Flycatcher	1
				Ring-billed Gull	2			Great-horned Owl	1
				Red-eyed Vireo	5			Gray Jay	2
				Red-winged Blackbird	5			Gray Catbird	16
				Savannah Sparrow	5			Golden-winged Warbler	6
				Sedge Wren	8			Hairy Woodpecker	4

JP Mixed		JP Pure		Mud/ Salt Flats		Other Broadleaf		Shrub	
				Sora Rail	2			Hermit Thrush	6
				Solitary Sandpiper	1			House Wren	5
				Song Sparrow	7			Le Conte's Sparrow	3
				Swamp Sparrow	4			Least Flycatcher	19
				Swainson's Thrush	2			Lincoln's Sparrow	3
				Tree Swallow	1			Marbled Godwit	1
				Wilson's Snipe	1			Mallard	1
				White-throated Sparrow	6			Magnolia Warbler	4
				Yellow Rail	2			Mourning Dove	9
				Yellow-headed Blackbird	3			Mourning Warbler	4
				Yellow Warbler	5			Nashville Warbler	43
								Nelson's Sharp-tailed Sparrow	3
								Northern Harrier	2
								Northern Parula	2
								Northern Waterthrush	32
								Northern Shoveler	1
								Orange-crowned Warbler	1
								Ovenbird	16
								Pied-billed Grebe	1
								Philadelphia Vireo	3
								Pileated Woodpecker	1
								Rose-breasted Grosbeak	22
								Ring-billed Gull	4
								Ruby-crowned Kinglet	5
								Red-eyed Vireo	80
								Ruby-throated Hummingbird	1
								Ruffed Grouse	10
								Red-winged Blackbird	9

JP Mixed		JP Pure		Mud/ Salt Flats		Other Broadleaf		Shrub	
								Sandhill Crane	6
								Savannah Sparrow	1
								Sedge Wren	12
								Song Sparrow	20
								Swamp Sparrow	57
								Swainson's Thrush	15
								Tennessee Warbler	46
								Tree Swallow	9
								Veery	50
								Vesper Sparrow	1
								Warbling Vireo	4
								Western Kingbird	1
								Wilson's Snipe	34
								Wilson's Warbler	1
								Winter Wren	7
								Western Palm Warbler	5
								White-throated Sparrow	91
								Yellow-bellied Flycatcher	3
								Yellow-bellied Sapsucker	3
								Yellow-rumped Warbler	5
								Yellow-shafted Flicker	5
								Yellow Warbler	43
Number of Birds	**71**	**Number of Birds**	**93**	**Number of Birds**	**132**	**Number of Birds**	**105**	**Number of Birds**	**1288**
Number of Plots	**12**	**Number of Plots**	**16**	**Number of Plots**	**7**	**Number of Plots**	**3**	**Number of Plots**	**76**
Birds Per Point	**5.9**	**Birds Per Point**	**5.8**	**Birds Per Point**	**18.9**	**Birds Per Point**	**35.0**	**Birds Per Point**	**16.9**
Species Richness	**26**	**Species Richness**	**30**	**Species Richness**	**53**	**Species Richness**	**19**	**Species Richness**	**92**
Species Diversity	**2.9**	**Species Diversity**	**3.0**	**Species Diversity**	**3.7**	**Species Diversity**	**1.8**	**Species Diversity**	**3.7**

TL Pure		Wet Prairie		Wetland Herb		Wetland Treed		WS Pure	
Alder Flycatcher	17	Alder Flycatcher	36	Alder Flycatcher	22	Alder Flycatcher	33	Cedar Waxwing	1
American Goldfinch	3	American Bittern	20	American Bittern	8	American Crow	5	Common Loon	2
American Redstart	4	American Coot	6	American Coot	8	American Goldfinch	4	Common Yellowthroat	1
American Robin	1	American Crow	4	American Crow	8	American Redstart	2	Magnolia Warbler	2
Bank Swallow	1	American Goldfinch	6	American Goldfinch	4	American Robin	2	Nashville Warbler	2
Black-and-White Warbler	4	American Redstart	2	American Redstart	5	Barn Swallow	5	Ovenbird	2
Black-capped Chickadee	2	American Robin	8	American Robin	1	Black-and-White Warbler	7	Ruby-crowned Kinglet	1
Brown-headed Cowbird	1	Baltimore Oriole	3	Baltimore Oriole	1	Brown-headed Cowbird	1	Red-eyed Vireo	2
Blue-headed Vireo	3	Barn Swallow	3	Barn Swallow	1	Blue-headed Vireo	2	Tennessee Warbler	2
Blackburnian Warbler	3	Black-and-White Warbler	10	Black-billed Cuckoo	1	Blackburnian Warbler	1	Wilson's Snipe	1
Blue Jay	1	Black-capped Chickadee	1	Black-capped Chickadee	1	Blue Jay	4	White-throated Sparrow	3
Boreal Chickadee	1	Belted Kingfisher	1	Brown-headed Cowbird	8	Brewer's Blackbird	1	Yellow-rumped Warbler	1
Bonaparte's Gull	3	Brown-headed Cowbird	8	Blackburnian Warbler	2	Clay-colored Sparrow	13		
Brown Creeper	2	Blue Jay	2	Black Tern	17	Cedar Waxwing	5		
Clay-colored Sparrow	4	Black Tern	16	Blue-winged Teal	11	Chipping Sparrow	7		
Cedar Waxwing	6	Brewer's Blackbird	2	Canada Goose	72	Connecticut Warbler	3		
Chipping Sparrow	7	Blue-winged Teal	6	Clay-colored Sparrow	21	Common Yellowthroat	37		
Common Loon	1	Canada Goose	37	Cedar Waxwing	3	Eastern Kingbird	1		
Connecticut Warbler	7	Canvasback	1	Chipping Sparrow	1	Gray Catbird	2		
Common Raven	1	Clay-colored Sparrow	8	Common Goldeneye	1	Greater Yellowlegs	2		
Common Yellowthroat	23	Cedar Waxwing	11	Common Grackle	1	Golden-winged Warbler	1		
Eastern Wood-Pewee	1	Common Goldeneye	3	Common Loon	2	Hermit Thrush	6		
Golden-crowned	1	Common Grackle	2	Common Raven	1	Le Conte's Sparrow	22		

TL Pure		Wet Prairie		Wetland Herb		Wetland Treed		WS Pure	
Kinglet									
Gray Jay	2	Common Nighthawk	1	Common Yellowthroat	50	Least Flycatcher	1		
Greater Yellowlegs	1	Common Raven	3	Eastern Kingbird	3	Lincoln's Sparrow	17		
Hairy Woodpecker	1	Common Yellowthroat	42	Evening Grosbeak	1	Mallard	2		
Hermit Thrush	5	Chestnut-sided Warbler	1	Franklin's Gull	15	Magnolia Warbler	1		
Le Conte's Sparrow	3	Eastern Kingbird	2	Gadwall	2	Mourning Dove	1		
Lincoln's Sparrow	13	Eastern Towhee	1	Great Blue Heron	6	Nashville Warbler	18		
Mallard	1	Great Crested Flycatcher	3	Golden-crowned Kinglet	1	Northern Waterthrush	3		
Magnolia Warbler	1	Gray Catbird	9	Gray Catbird	3	Ovenbird	2		
Mourning Dove	6	Hermit Thrush	1	Killdeer	3	Philadelphia Vireo	1		
Mourning Warbler	3	Killdeer	1	Le Conte's Sparrow	15	Rose-breasted Grosbeak	7		
Nashville Warbler	22	Le Conte's Sparrow	13	Least Flycatcher	2	Red-breasted Nuthatch	1		
Northern Waterthrush	7	Least Flycatcher	7	Lesser Scaup	1	Ruby-crowned Kinglet	7		
Orange-crowned Warbler	1	Mallard	10	Marbled Godwit	1	Red-eyed Vireo	8		
Ovenbird	8	Marsh Wren	1	Mallard	18	Rusty Blackbird	1		
Pine Siskin	1	Mourning Dove	8	Magnolia Warbler	1	Red-winged Blackbird	7		
Pileated Woodpecker	1	Nashville Warbler	5	Marsh Wren	39	Sandhill Crane	16		
Purple Finch	2	Nelson's Sharp-tailed Sparrow	3	Mourning Warbler	1	Sedge Wren	6		
Rose-breasted Grosbeak	3	Northern Harrier	1	Nelson's Sharp-tailed Sparrow	7	Song Sparrow	3		
Ring-billed Gull	3	Northern Waterthrush	8	Northern Harrier	1	Swamp Sparrow	27		
Ruby-crowned Kinglet	11	Orange-crowned Warbler	1	Northern Waterthrush	3	Swainson's Thrush	3		
Red-eyed Vireo	8	Olive-sided Flycatcher	1	Northern Shoveler	6	Tennessee Warbler	12		
Red-winged Blackbird	3	Ovenbird	2	Ovenbird	3	Tree Swallow	3		
Sandhill Crane	1	Pied-billed Grebe	6	Pied-billed Grebe	7	Unidentified Dark-eyed Junco	2		

TL Pure		Wet Prairie		Wetland Herb		Wetland Treed		WS Pure	
Swamp Sparrow	9	Pileated Woodpecker	3	Pileated Woodpecker	1	Veery	6		
Swainson's Thrush	9	Purple Martin	3	Ring-billed Gull	12	Wilson's Snipe	8		
Tennessee Warbler	11	Rose-breasted Grosbeak	5	Ruby-crowned Kinglet	1	Wilson's Warbler	3		
Tree Swallow	2	Red-breasted Nuthatch	1	Red-eyed Vireo	5	Winter Wren	1		
Unidentified Dark-eyed Junco	8	Red-eyed Vireo	14	RNGR	1	Western Palm Warbler	5		
Veery	4	Red-tailed Hawk	1	Red-winged Blackbird	85	White-throated Sparrow	29		
Wilson's Snipe	2	Ruffed Grouse	7	Sandhill Crane	29	Yellow-bellied Flycatcher	2		
Winter Wren	2	Red-winged Blackbird	45	Savannah Sparrow	8	Yellow-rumped Warbler	2		
Western Palm Warbler	9	Sandhill Crane	2	Sedge Wren	67	Yellow-shafted Flicker	1		
White-throated Sparrow	22	Savannah Sparrow	3	Sora Rail	44	Yellow Warbler	2		
Yellow-bellied Flycatcher	1	Sedge Wren	35	Song Sparrow	9				
Yellow-bellied Sapsucker	1	Sora Rail	25	Swamp Sparrow	49				
Yellow-rumped Warbler	6	Song Sparrow	6	Swainson's Thrush	2				
Yellow-shafted Flicker	1	Swamp Sparrow	38	Tree Swallow	1				
Yellow Warbler	2	Swainson's Thrush	2	Veery	2				
		Tennessee Warbler	1	Virginia Rail	9				
		Tree Swallow	3	Western Meadowlark	1				
		Veery	11	Wilson's Phalarope	2				
		Virginia Rail	2	Wilson's Snipe	25				
		Western Meadowlark	1	Yellow Rail	10				
		Wilson's Snipe	19	Yellow-headed Blackbird	13				

TL Pure		Wet Prairie		Wetland Herb		Wetland Treed		WS Pure	
		Wilson's Warbler	1	Yellow Warbler	19				
		White-throated Sparrow	14						
		Yellow-bellied Sapsucker	2						
		Yellow-shafted Flicker	1						
		Yellow Warbler	21						
Number of Birds	**293**	**Number of Birds**	**592**	**Number of Birds**	**784**	**Number of Birds**	**374**	**Number of Birds**	**20**
Number of Plots	**31**	**Number of Plots**	**32**	**Number of Plots**	**40**	**Number of Plots**	**32**	**Number of Plots**	**3**
Birds Per Point	**9.5**	**Birds Per Point**	**18.5**	**Birds Per Point**	**19.6**	**Birds Per Point**	**11.7**	**Birds Per Point**	**6.7**
Species Richness	**61**	**Species Richness**	**72**	**Species Richness**	**68**	**Species Richness**	**56**	**Species Richness**	**12**
Species Diversity	**3.6**	**Species Diversity**	**3.7**	**Species Diversity**	**3.4**	**Species Diversity**	**3.5**	**Species Diversity**	**2.4**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question.

F-11: Sampled bird species in the Mid-Boreal Lowland Ecoregion based on sampled forestry resource inventory habitats

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed	
Alder Flycatcher	1	American Redstart	20	Alder Flycatcher	7	American Green-winged Teal	1	Alder Flycatcher	5
American Bittern	2	American Robin	3	American Crow	2	Alder Flycatcher	45	American Crow	4
American Goldfinch	2	Black-and-White Warbler	4	American Robin	1	American Crow	3	American Goldfinch	1
American Redstart	14	Bay-breasted Warbler	1	Black-and-White Warbler	5	American Robin	8	Black-and-White Warbler	3
American Robin	6	Black-capped Chickadee	3	Black-capped Chickadee	2	Barn Swallow	1	Bay-breasted Warbler	1
Black-and-White Warbler	7	Blue-headed Vireo	1	Blue-headed Vireo	15	Black-and-White Warbler	4	Black-capped Chickadee	2
Bay-breasted Warbler	1	Blackburnian Warbler	11	Blackburnian Warbler	2	Black-backed Woodpecker	3	Blue-headed Vireo	1
Blue-headed Vireo	2	Blue Jay	1	Blue Jay	4	Black-capped Chickadee	1	Blackburnian Warbler	4
Blackburnian Warbler	6	Brown Creeper	3	Boreal Chickadee	2	Blue-headed Vireo	5	Cedar Waxwing	2
Blue Jay	2	Black-throated Green Warbler	4	Bonaparte's Gull	3	Blackburnian Warbler	5	Chipping Sparrow	8
Brown Creeper	1	Broad-winged Hawk	1	Brown Creeper	7	Blue Jay	3	Cape May Warbler	2
Canada Warbler	5	Canada Warbler	15	Canada Goose	6	Boreal Chickadee	4	Common Loon	2
Cedar Waxwing	5	Cedar Waxwing	3	Clay-colored Sparrow	4	Bonaparte's Gull	3	Common Raven	6
Chipping Sparrow	8	Chipping Sparrow	12	Cedar Waxwing	9	Brown Creeper	1	Common Yellowthroat	8
Cape May Warbler	5	Cape May Warbler	5	Chipping Sparrow	14	Canada Goose	5	Eastern Kingbird	5
Common Loon	3	Common Raven	2	Connecticut Warbler	11	Canada Warbler	1	Hermit Thrush	1
Connecticut Warbler	1	Downy Woodpecker	1	Common Raven	1	Clay-colored Sparrow	7	Least Flycatcher	5
Common Raven	6	Hairy Woodpecker	1	Common Yellowthroat	5	Cedar Waxwing	6	Magnolia Warbler	9
Chestnut-sided Warbler	7	Least Flycatcher	5	Downy Woodpecker	1	Chipping Sparrow	76	Nashville Warbler	4

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed	
Golden-crowned Kinglet	1	Magnolia Warbler	4	Golden-crowned Kinglet	9	Cape May Warbler	3	Northern Waterthrush	2
Gray Jay	6	Mourning Warbler	2	Gray Jay	15	Common Loon	3	Ovenbird	3
Hairy Woodpecker	1	Nashville Warbler	2	Greater Yellowlegs	8	Connecticut Warbler	25	Pileated Woodpecker	2
Hermit Thrush	4	Ovenbird	33	Hairy Woodpecker	2	Common Raven	8	Ruby-crowned Kinglet	4
Killdeer	1	Philadelphia Vireo	1	Hermit Thrush	12	Common Yellowthroat	17	Red-eyed Vireo	10
Least Flycatcher	3	Pileated Woodpecker	2	Le Conte's Sparrow	1	Double-crested Cormorant	1	Red-winged Blackbird	7
Magnolia Warbler	15	Rose-breasted Grosbeak	1	Least Flycatcher	8	Eastern Kingbird	3	Sandhill Crane	1
Mourning Warbler	2	Red-breasted Nuthatch	7	Lincoln's Sparrow	1	Great Crested Flycatcher	1	Song Sparrow	2
Nashville Warbler	8	Ruby-crowned Kinglet	8	Magnolia Warbler	12	Gray Jay	40	Swamp Sparrow	8
Orange-crowned Warbler	2	Red-eyed Vireo	23	Mourning Warbler	1	Greater Yellowlegs	27	Swainson's Thrush	9
Ovenbird	39	Ruffed Grouse	2	Nashville Warbler	19	Hairy Woodpecker	2	Tennessee Warbler	5
Philadelphia Vireo	4	Swainson's Thrush	6	Orange-crowned Warbler	3	Hermit Thrush	66	Tree Swallow	4
Pileated Woodpecker	3	Tennessee Warbler	13	Olive-sided Flycatcher	5	Le Conte's Sparrow	18	Wilson's Snipe	3
Red-breasted Nuthatch	5	UNKWOOD	1	Ovenbird	6	Least Flycatcher	5	Winter Wren	3
Ruby-crowned Kinglet	2	Veery	7	Philadelphia Vireo	2	Lesser Yellowlegs	4	White-throated Sparrow	6
Red-eyed Vireo	35	Winter Wren	1	Pileated Woodpecker	1	Lincoln's Sparrow	39	Yellow-rumped Warbler	4
Ruffed Grouse	5	White-throated Sparrow	13	Red-breasted Nuthatch	2	Magnolia Warbler	14	Yellow Warbler	2
Sandhill Crane	4	Yellow-bellied Sapsucker	2	Ruby-crowned Kinglet	30	Mourning Warbler	1		

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed	
Solitary Sandpiper	1	Yellow-rumped Warbler	2	Red Crossbill	1	Nashville Warbler	101		
Swainson's Thrush	12	Yellow-shafted Flicker	2	Red-eyed Vireo	10	Northern Waterthrush	8		
Tennessee Warbler	25			Red-winged Blackbird	1	Orange-crowned Warbler	14		
Unidentified Dark-eyed Junco	3			Swamp Sparrow	1	Olive-sided Flycatcher	24		
Winter Wren	1			Swainson's Thrush	14	Ovenbird	5		
White-throated Sparrow	11			Tennessee Warbler	12	Pied-billed Grebe	2		
White-winged Crossbill	2			Unidentified Dark-eyed Junco	9	Philadelphia Vireo	1		
Yellow-rumped Warbler	10			Wilson's Snipe	1	Pine Siskin	2		
Yellow-shafted Flicker	6			Wilson's Warbler	1	Pileated Woodpecker	2		
Yellow Warbler	2			Winter Wren	1	Purple Martin	2		
				Western Palm Warbler	3	Ring-billed Gull	1		
				White-throated Sparrow	16	Red-breasted Nuthatch	2		
				White-winged Crossbill	1	Ruby-crowned Kinglet	50		
				Yellow-bellied Flycatcher	3	Red Crossbill	3		
				Yellow-rumped Warbler	33	Red-eyed Vireo	5		
				Yellow-shafted Flicker	1	Rusty Blackbird	15		
						Ruffed Grouse	1		
						Red-winged Blackbird	1		
						Sandhill Crane	10		
						Savannah Sparrow	18		
						Song Sparrow	1		
						Swamp Sparrow	10		

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed	
						Swainson's Thrush	21		
						Tennessee Warbler	38		
						Tree Swallow	4		
						Unidentified Dark-eyed Junco	79		
						Veery	2		
						Wilson's Snipe	5		
						Wilson's Warbler	8		
						Winter Wren	6		
						Western Palm Warbler	78		
						White-throated Sparrow	76		
						White-winged Crossbill	11		
						Yellow-bellied Flycatcher	21		
						Yellow-rumped Warbler	45		
						Yellow-shafted Flicker	6		
						Yellow Warbler	7		
Number of Birds	**297**	**Number of Birds**	**228**	**Number of Birds**	**346**	**Number of Birds**	**1144**	**Number of Birds**	**148**
Number of Plots	**28**	**Number of Plots**	**15**	**Number of Plots**	**66**	**Number of Plots**	**141**	**Number of Plots**	**22**
Birds Per Point	**10.6**	**Birds Per Point**	**15.2**	**Birds Per Point**	**5.2**	**Birds Per Point**	**8.1**	**Birds Per Point**	**6.7**
Species Richness	**80**	**Species Richness**	**81**	**Species Richness**	**82**	**Species Richness**	**83**	**Species Richness**	**84**
Species Diversity	**3.3**	**Species Diversity**	**3.1**	**Species Diversity**	**3.5**	**Species Diversity**	**3.5**	**Species Diversity**	**3.4**

JP Mixed		JP Pure		Mud/ Salt Flats		Shrub		TL Pure	
Alder Flycatcher	6	Alder Flycatcher	14	Alder Flycatcher	2	Alder Flycatcher	72	Alder Flycatcher	12
American Goldfinch	4	American Crow	3	American Redstart	1	American Crow	4	American Crow	2
American Kestrel	1	American Goldfinch	1	Bald Eagle	1	American Goldfinch	1	American Goldfinch	2
American Robin	2	American Redstart	2	Black-and-White Warbler	1	American Redstart	32	Black-and-White Warbler	6
Black-and-White Warbler	4	American Robin	3	Black-billed Magpie	2	American Robin	2	Black-capped Chickadee	1
Black-backed Woodpecker	1	Baltimore Oriole	4	Canada Goose	11	American Wigeon	1	Blue-headed Vireo	5
Blue-headed Vireo	3	Barn Swallow	1	Clay-colored Sparrow	2	Black-and-White Warbler	23	Blackburnian Warbler	3
Bonaparte's Gull	1	Black-and-White Warbler	2	Chipping Sparrow	1	Black-capped Chickadee	2	Blue Jay	1
Brown Creeper	3	Black-capped Chickadee	1	Common Tern	2	Blue-headed Vireo	5	Boreal Chickadee	1
Canada Goose	2	Brown-headed Cowbird	5	Common Yellowthroat	2	Blackburnian Warbler	8	Bonaparte's Gull	12
Clay-colored Sparrow	2	Blue-headed Vireo	6	Franklin's Gull	1	Blue Jay	2	Brown Creeper	1
Cedar Waxwing	8	Brown Creeper	4	Greater Yellowlegs	1	Canada Goose	5	Canada Goose	27
Chipping Sparrow	13	Canada Goose	23	Herring Gull	16	Canada Warbler	3	Clay-colored Sparrow	9
Common Loon	2	Clay-colored Sparrow	3	Killdeer	1	Clay-colored Sparrow	38	Cedar Waxwing	4
Common Raven	7	Cedar Waxwing	9	Marsh Wren	1	Cedar Waxwing	7	Chipping Sparrow	34
Common Redpoll	1	Chipping Sparrow	21	Red-winged Blackbird	1	Chipping Sparrow	14	Connecticut Warbler	8
Golden-crowned Kinglet	8	Common Grackle	1	Solitary Sandpiper	1	Cape May Warbler	3	Common Raven	2
Gray Jay	8	Common Loon	4	Song Sparrow	3	Common Loon	6	Common Yellowthroat	30
Greater Yellowlegs	9	Connecticut Warbler	2	Swamp Sparrow	2	Connecticut Warbler	4	Chestnut-sided Warbler	1
Hairy Woodpecker	1	Common Raven	5	White-throated Sparrow	1	Common Raven	7	Eastern Kingbird	8
Hermit Thrush	29	Common Redpoll	3	Yellow-headed	1	Common Yellowthroat	114	Franklin's Gull	3

JP Mixed		JP Pure		Mud/ Salt Flats		Shrub		TL Pure	
				Blackbird					
Killdeer	1	Common Tern	1	Yellow Warbler	1	Chestnut-sided Warbler	2	Great Crested Flycatcher	1
Least Flycatcher	3	Common Yellowthroat	16			Eastern Kingbird	1	Gray Jay	4
Lincoln's Sparrow	1	Downy Woodpecker	1			Fox Sparrow	6	Greater Yellowlegs	26
Magnolia Warbler	9	Eastern Kingbird	2			Gray Jay	3	Hairy Woodpecker	1
Merlin	1	Evening Grosbeak	1			Greater Yellowlegs	7	Hermit Thrush	6
Mourning Warbler	1	Great Crested Flycatcher	3			Herring Gull	2	Le Conte's Sparrow	2
Nashville Warbler	12	Golden-crowned Kinglet	1			Hermit Thrush	4	Least Flycatcher	12
Orange-crowned Warbler	10	Gray Jay	11			Killdeer	1	Lesser Yellowlegs	2
Olive-sided Flycatcher	5	Gray Catbird	2			Le Conte's Sparrow	3	Lincoln's Sparrow	23
Ovenbird	5	Greater Yellowlegs	4			Least Flycatcher	27	Merlin	1
Pine Siskin	1	Hairy Woodpecker	3			Lesser Yellowlegs	1	Nashville Warbler	9
Pileated Woodpecker	2	Hermit Thrush	14			Lincoln's Sparrow	9	Northern Waterthrush	2
Red-breasted Nuthatch	2	House Wren	1			Mallard	1	Orange-crowned Warbler	1
Ruby-crowned Kinglet	7	Least Bittern	2			Magnolia Warbler	11	Olive-sided Flycatcher	4
Red Crossbill	2	Least Flycatcher	8			Mourning Warbler	3	Pine Siskin	1
Red-eyed Vireo	13	Lesser Yellowlegs	1			Nashville Warbler	26	Ruby-crowned Kinglet	8
Swainson's Thrush	4	Mallard	8			Northern Hawk owl	2	Red-eyed Vireo	6
Tennessee Warbler	16	Magnolia Warbler	4			Northern Waterthrush	12	Rusty Blackbird	13
Unidentified Dark-eyed Junco	8	Mourning Dove	4			Orange-crowned Warbler	3	Red-winged Blackbird	7
Wilson's Snipe	2	Nashville Warbler	17			Olive-sided Flycatcher	6	Sandhill Crane	2
Winter Wren	5	Northern Waterthrush	2			Ovenbird	1	Song Sparrow	3
Western Palm Warbler	14	Northern Shoveler	1			Pine Grosbeak	1	Swamp Sparrow	16
White-throated Sparrow	23	Orange-crowned Warbler	3			Pileated Woodpecker	3	Swainson's Thrush	6
Yellow-bellied	3	Olive-sided Flycatcher	2			Rose-breasted	1	Tennessee Warbler	8

JP Mixed		JP Pure		Mud/ Salt Flats		Shrub		TL Pure	
Flycatcher						Grosbeak			
Yellow-rumped Warbler	19	Ovenbird	13			Ring-billed Gull	1	Tree Swallow	6
Yellow-shafted Flicker	4	Pied-billed Grebe	3			Ruby-crowned Kinglet	4	Unidentified Dark-eyed Junco	11
Yellow Warbler	6	Philadelphia Vireo	1			Red-eyed Vireo	38	Wilson's Snipe	5
		Pileated Woodpecker	2			RNGR	3	Wilson's Warbler	7
		Rose-breasted Grosbeak	1			Rusty Blackbird	2	Western Palm Warbler	20
		Red-breasted Nuthatch	1			Red-winged Blackbird	11	White-throated Sparrow	21
		Ruby-crowned Kinglet	9			Sandhill Crane	9	Yellow-bellied Flycatcher	3
		Red-eyed Vireo	7			Sedge Wren	5	Yellow-rumped Warbler	8
		RNGR	1			Solitary Sandpiper	1	Yellow-shafted Flicker	2
		Rusty Blackbird	1			Song Sparrow	6	Yellow Warbler	11
		Ruffed Grouse	2			Swamp Sparrow	60		
		Red-winged Blackbird	16			Swainson's Thrush	28		
		Sandhill Crane	8			Tennessee Warbler	59		
		Sedge Wren	1			Tree Swallow	2		
		Sora Rail	4			Unidentified Dark-eyed Junco	13		
		Swamp Sparrow	12			Veery	9		
		Swainson's Thrush	9			Wilson's Snipe	13		
		Tennessee Warbler	11			Wilson's Warbler	8		
		Tree Swallow	3			White-throated Sparrow	74		
		Unidentified Dark-eyed Junco	6			White-winged Crossbill	1		
		Veery	1			Yellow-bellied Sapsucker	1		

JP Mixed		JP Pure		Mud/ Salt Flats		Shrub		TL Pure	
		Warbling Vireo	2			Yellow-rumped Warbler	7		
		Wilson's Snipe	8			Yellow-shafted Flicker	2		
		Wilson's Warbler	1			Yellow Warbler	54		
		Winter Wren	2						
		Western Palm Warbler	5						
		White-throated Sparrow	21						
		Yellow-bellied Flycatcher	6						
		Yellow-bellied Sapsucker	1						
		Yellow-rumped Warbler	25						
		Yellow-shafted Flicker	13						
		Yellow Warbler	21						
Number of Birds	**294**	**Number of Birds**	**446**	**Number of Birds**	**55**	**Number of Birds**	**900**	**Number of Birds**	**430**
Number of Plots	**57**	**Number of Plots**	**55**	**Number of Plots**	**4**	**Number of Plots**	**85**	**Number of Plots**	**44**
Birds Per Point	**5.2**	**Birds Per Point**	**8.1**	**Birds Per Point**	**13.8**	**Birds Per Point**	**10.6**	**Birds Per Point**	**9.8**
Species Richness	**85**	**Species Richness**	**86**	**Species Richness**	**87**	**Species Richness**	**88**	**Species Richness**	**89**
Species Diversity	**3.5**	**Species Diversity**	**3.9**	**Species Diversity**	**2.5**	**Species Diversity**	**3.4**	**Species Diversity**	**3.6**

Wet Prairie		Wetland Herb		Wetland shrub		Wetland Treed		WS Pure	
American Green-winged Teal	4	Alder Flycatcher	12	Alder Flycatcher	38	Alder Flycatcher	29	Alder Flycatcher	1
Alder Flycatcher	14	American Crow	2	American Goldfinch	1	American Crow	2	American Crow	2
American Bittern	4	American Goldfinch	3	Black-capped Chickadee	1	American Goldfinch	1	American Kestrel	1
American Crow	7	American Redstart	2	Black Tern	4	American Redstart	2	American Robin	1
American Goldfinch	1	American Robin	2	Boreal Chickadee	2	Black-and-White Warbler	6	Black-and-White Warbler	3
American Redstart	1	Barn Swallow	1	Canada Goose	2	Black-capped Chickadee	2	Bay-breasted Warbler	5
American Robin	3	Black-and-White Warbler	6	Clay-colored Sparrow	14	Belted Kingfisher	1	Black-capped Chickadee	2
Baltimore Oriole	1	Black-capped Chickadee	2	Cedar Waxwing	6	Blue-headed Vireo	2	Blue-headed Vireo	3
Black-and-White Warbler	1	Blackburnian Warbler	1	Chipping Sparrow	64	Blackpoll Warbler	1	Blackburnian Warbler	6
Black-billed Cuckoo	2	Blue Jay	1	Connecticut Warbler	2	Brown Creeper	1	Blue Jay	2
Black-billed Magpie	1	Blue-winged Teal	6	Common Raven	4	Canada Goose	236	Black-throated Green Warbler	2
Black-capped Chickadee	1	Clay-colored Sparrow	8	Common Yellowthroat	6	Canada Warbler	1	Canada Warbler	5
Blue-winged Teal	4	Cedar Waxwing	3	Eastern Kingbird	16	Clay-colored Sparrow	31	Cedar Waxwing	1
Canada Goose	1	Chipping Sparrow	2	Eastern Wood-Pewee	2	Cedar Waxwing	4	Cape May Warbler	1
Canada Warbler	3	Common Loon	1	Gray Jay	6	Chipping Sparrow	30	Connecticut Warbler	2
Clay-colored Sparrow	12	Connecticut Warbler	3	Greater Yellowlegs	58	Cape May Warbler	2	Common Yellowthroat	4
Chipping Sparrow	2	Common Raven	3	Hermit Thrush	11	Common Loon	5	Gray Jay	1
Common Loon	1	Common Yellowthroat	31	Le Conte's Sparrow	65	Connecticut Warbler	5	Hairy Woodpecker	2
Common Merganser	1	Eastern Kingbird	1	Lesser Yellowlegs	5	Common Raven	4	Least Flycatcher	4
Common Raven	2	Gadwall	1	Lincoln's Sparrow	44	Common Tern	1	Magnolia Warbler	4
Common Yellowthroat	41	Great Blue Heron	2	Mallard	3	Common Yellowthroat	36	Nashville Warbler	2
Chestnut-sided Warbler	1	Gray Jay	2	Northern Shoveler	1	Eastern Kingbird	6	Ovenbird	24
Franklin's Gull	1	Gray Catbird	2	Olive-sided Flycatcher	2	Eastern Wood-Pewee	1	Pileated Woodpecker	1
Gray Jay	2	Greater Yellowlegs	4	Ruby-crowned Kinglet	4	Evening Grosbeak	1	Red-breasted Nuthatch	3
Gray Catbird	1	Killdeer	4	Rusty Blackbird	27	Franklin's Gull	1	Ruby-crowned Kinglet	1

Wet Prairie		Wetland Herb		Wetland shrub		Wetland Treed		WS Pure	
Greater Yellowlegs	2	Le Conte's Sparrow	17	Sandhill Crane	16	Gray Jay	10	Red-eyed Vireo	13
Killdeer	2	Least Flycatcher	6	Savannah Sparrow	38	Greater Yellowlegs	27	Ruffed Grouse	3
Le Conte's Sparrow	29	Lesser Yellowlegs	5	Spotted Dove	2	Hairy Woodpecker	2	Red-winged Blackbird	2
Lincoln's Sparrow	1	Lincoln's Sparrow	4	Solitary Sandpiper	1	Hermit Thrush	2	Swamp Sparrow	2
Marbled Godwit	2	Mallard	6	Song Sparrow	1	Le Conte's Sparrow	59	Swainson's Thrush	1
Mallard	6	Magnolia Warbler	2	Swamp Sparrow	16	Least Flycatcher	1	Tennessee Warbler	4
Marsh Wren	3	Nashville Warbler	3	Swainson's Thrush	2	Lesser Yellowlegs	2	Tree Swallow	1
Mourning Warbler	3	Nelson's Sharp-tailed Sparrow	2	Tree Swallow	13	Lincoln's Sparrow	19	Wilson's Snipe	2
Nashville Warbler	4	Olive-sided Flycatcher	3	Unidentified Dark-eyed Junco	10	Nashville Warbler	7	White-throated Sparrow	6
Nelson's Sharp-tailed Sparrow	5	Pied-billed Grebe	1	Wilson's Phalarope	4	Nelson's Sharp-tailed Sparrow	6	Yellow Warbler	1
Northern Harrier	1	Ring-billed Gull	2	Wilson's Snipe	28	Orange-crowned Warbler	2		
Philadelphia Vireo	1	Ruby-crowned Kinglet	1	Western Palm Warbler	19	Olive-sided Flycatcher	4		
Rose-breasted Grosbeak	3	Red-eyed Vireo	10	White-throated Sparrow	16	Ovenbird	1		
Ring-billed Gull	2	RNGR	1	Yellow-rumped Warbler	4	Ring-billed Gull	1		
Red-breasted Nuthatch	1	Rusty Blackbird	1	Yellow Warbler	6	Red-breasted Nuthatch	4		
Ruby-crowned Kinglet	1	Red-winged Blackbird	15			Ruby-crowned Kinglet	5		
Red-eyed Vireo	19	Sandhill Crane	6			Red-eyed Vireo	10		
Ring-necked Duck	1	Sedge Wren	2			RNGR	1		
Red-tailed Hawk	2	Sora Rail	3			Rusty Blackbird	3		
Ruffed Grouse	1	Song Sparrow	8			Red-winged Blackbird	6		
Red-winged Blackbird	13	Swamp Sparrow	34			Sandhill Crane	8		
Sandhill Crane	3	Swainson's Thrush	4			Savannah Sparrow	16		
Sedge Wren	70	Tennessee Warbler	2			Sedge Wren	19		
Sora Rail	8	Tree Swallow	4			Song Sparrow	5		
Song Sparrow	7	Unidentified Dark-eyed Junco	4			Swamp Sparrow	37		
Swamp Sparrow	46	Virginia Rail	1			Swainson's Thrush	3		
Swainson's Thrush	3	Wilson's Snipe	15			Tennessee Warbler	12		

Wet Prairie		Wetland Herb		Wetland shrub		Wetland Treed		WS Pure	
Tennessee Warbler	1	Wilson's Warbler	1			Tree Swallow	14		
Tree Swallow	4	Western Palm Warbler	2			Unidentified Dark-eyed Junco	12		
Unidentified Dark-eyed Junco	3	White-throated Sparrow	11			Veery	1		
Veery	7	Yellow Rail	3			Warbling Vireo	1		
Virginia Rail	1	Yellow-headed Blackbird	2			Western Wood-Pewee	1		
Wilson's Snipe	10	Yellow-shafted Flicker	1			Wilson's Snipe	9		
White-throated Sparrow	6	Yellow Warbler	17			Western Palm Warbler	12		
Yellow-bellied Flycatcher	1					White-throated Sparrow	18		
Yellow-bellied Sapsucker	2					Yellow-bellied Flycatcher	1		
Yellow Rail	28					Yellow-rumped Warbler	4		
Yellow-headed Blackbird	2					Yellow Warbler	4		
Yellow Warbler	8								
Number of Birds	**424**	**Number of Birds**	**304**	**Number of Birds**	**564**	**Number of Birds**	**760**	**Number of Birds**	**118**
Number of Plots	**30**	**Number of Plots**	**23**	**Number of Plots**	**46**	**Number of Plots**	**51**	**Number of Plots**	**16**
Birds Per Point	**14.1**	**Birds Per Point**	**13.2**	**Birds Per Point**	**12.3**	**Birds Per Point**	**14.9**	**Birds Per Point**	**7.4**
Species Richness	**90**	**Species Richness**	**91**	**Species Richness**	**92**	**Species Richness**	**93**	**Species Richness**	**94**
Species Diversity	**3.3**	**Species Diversity**	**3.6**	**Species Diversity**	**3.1**	**Species Diversity**	**3.0**	**Species Diversity**	**3.1**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question.

F-12: Sampled bird species in the Churchill River Upland Ecoregion based on sampled forestry resource inventory habitats

Broadleaf Pure		Broadleaf Mixed		BS Mixed		BS Pure		Coniferous Mixed		JP Mixed	
Alder Flycatcher	2	Magnolia Warbler	1	Alder Flycatcher	3	Alder Flycatcher	7	Alder Flycatcher	2	Alder Flycatcher	1
American Crow	4	Nashville Warbler	1	American Redstart	4	American Robin	13	Black-backed Woodpecker	1	American Kestrel	1
American Goldfinch	14	Ruby-crowned Kinglet	1	American Robin	1	Bay-breasted Warbler	1	Blue-headed Vireo	1	American Robin	4
American Redstart	14			Black-and-White Warbler	2	Belted Kingfisher	1	Cedar Waxwing	1	Belted Kingfisher	1
American Robin	8			Black-backed Woodpecker	1	Black-and-White Warbler	2	Chipping Sparrow	3	Black-backed Woodpecker	1
Baltimore Oriole	4			Black-capped Chickadee	1	Black-backed Woodpecker	1	Golden-crowned Kinglet	1	Blackpoll Warbler	6
Bay-breasted Warbler	1			Blackpoll Warbler	2	Blackpoll Warbler	2	Gray Jay	4	Bohemian Waxwing	1
Black-and-White Warbler	6			Blue-headed Vireo	2	Blue-headed Vireo	3	Hermit Thrush	1	Bonaparte's Gull	1
Black-billed Magpie	1			Boreal Chickadee	1	Bonaparte's Gull	6	Least Flycatcher	1	Cape May Warbler	1
Blackburnian Warbler	2			Canada Goose	1	Boreal Chickadee	2	Magnolia Warbler	2	Common Loon	1
Black-capped Chickadee	6			Cape May Warbler	2	Brown Creeper	1	Ovenbird	1	Common Raven	3
Blue Jay	1			Chipping Sparrow	5	Canada Goose	2	Red Crossbill	1	Fox Sparrow	9
Brown-headed Cowbird	9			Common Loon	1	Cape May Warbler	1	Red-eyed Vireo	1	Gray Jay	8
Cedar Waxwing	8			Common Nighthawk	1	Cedar Waxwing	1	Ruby-crowned Kinglet	5	Hermit Thrush	12
Chestnut-sided Warbler	1			Connecticut Warbler	1	Chipping Sparrow	9	Swainson's Thrush	3	Least Flycatcher	8
Chipping Sparrow	2			Fox Sparrow	11	Clay-colored Sparrow	2	Tennessee Warbler	7	Lincoln's Sparrow	1
Clay-colored Sparrow	5			Golden-crowned Kinglet	1	Common Loon	4	Unidentified Dark-eyed Junco	1	Magnolia Warbler	4

Broadleaf Pure		Broadleaf Mixed		BS Mixed		BS Pure		Coniferous Mixed		JP Mixed	
Common Raven	1			Gray Jay	12	Common Redpoll	1	White-throated Sparrow	4	Nashville Warbler	1
Common Yellowthroat	2			Greater Yellowlegs	4	Connecticut Warbler	3	Winter Wren	1	Orange-crowned Warbler	5
Eastern Kingbird	1			Hairy Woodpecker	1	Fox Sparrow	13	Yellow Warbler	1	Philadelphia Vireo	1
Eastern Wood-Pewee	7			Hermit Thrush	21	Golden-crowned Kinglet	2			Pileated Woodpecker	1
Gray Catbird	5			Least Flycatcher	4	Gray Jay	17			Red Crossbill	1
Great Crested Flycatcher	4			Lincoln's Sparrow	1	Greater Yellowlegs	8			Red-tailed Hawk	1
Hairy Woodpecker	3			Magnolia Warbler	12	Hermit Thrush	36			Ruby-crowned Kinglet	8
House Wren	3			Nashville Warbler	4	Least Flycatcher	5			Sandhill Crane	1
Least Flycatcher	15			Northern Waterthrush	2	Lesser Yellowlegs	2			Spruce Grouse	1
Northern Waterthrush	1			Olive-sided Flycatcher	2	Lincoln's Sparrow	8			Swainson's Thrush	3
Ovenbird	10			Orange-crowned Warbler	12	Magnolia Warbler	2			Tennessee Warbler	14
Philadelphia Vireo	1			Pied-billed Grebe	1	Nashville Warbler	9			Unidentified Dark-eyed Junco	10
Pileated Woodpecker	2			Pileated Woodpecker	1	Northern Waterthrush	2			Western Palm Warbler	11
Pine Siskin	1			Pine Grosbeak	1	Olive-sided Flycatcher	11			White-crowned Sparrow	2
Red-breasted Nuthatch	1			Red Crossbill	1	Orange-crowned Warbler	19			White-throated Sparrow	9
Red-eyed Vireo	12			Red-winged Blackbird	1	Philadelphia Vireo	3			Winter Wren	4
Red-winged Blackbird	2			Ruby-crowned Kinglet	20	Pied-billed Grebe	2			Yellow-bellied Flycatcher	2
Rose-breasted Grosbeak	4			Sandhill Crane	3	Pileated Woodpecker	1			Yellow-rumped Warbler	10
Song Sparrow	3			Solitary Sandpiper	1	Red Crossbill	15			Yellow-shafted Flicker	2

Broadleaf Pure		Broadleaf Mixed		BS Mixed		BS Pure		Coniferous Mixed		JP Mixed	
Veery	4			Spruce Grouse	1	Red-winged Blackbird	2				
Warbling Vireo	12			Swainson's Thrush	13	Ruby-crowned Kinglet	38				
White-breasted Nuthatch	1			Tennessee Warbler	33	Solitary Sandpiper	3				
Yellow Warbler	4			Unidentified Dark-eyed Junco	14	Swainson's Thrush	12				
Yellow-bellied Sapsucker	2			Western Palm Warbler	10	Swamp Sparrow	2				
Yellow-shafted Flicker	5			White-throated Sparrow	35	Tennessee Warbler	53				
				White-winged Crossbill	2	Tree Swallow	2				
				Wilson's Snipe	1	Unidentified Dark-eyed Junco	40				
				Wilson's Warbler	3	Western Palm Warbler	19				
				Winter Wren	13	White-crowned Sparrow	2				
				Yellow Warbler	1	White-throated Sparrow	31				
				Yellow-bellied Flycatcher	8	White-winged Crossbill	36				
				Yellow-bellied Sapsucker	1	Wilson's Snipe	5				
				Yellow-rumped Warbler	16	Wilson's Warbler	2				
				Yellow-shafted Flicker	2	Winter Wren	13				
						Yellow Warbler	6				
						Yellow-bellied Flycatcher	12				
						Yellow-rumped Warbler	17				

Broadleaf Pure		Broadleaf Mixed		BS Mixed		BS Pure		Coniferous Mixed		JP Mixed	
						Yellow-shafted Flicker	2				
Number of Birds	**194**	**Number of Birds**	**3**	**Number of Birds**	**297**	**Number of Birds**	**514**	**Number of Birds**	**42**	**Number of Birds**	**150**
Number of Plots	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**
Birds Per Point	**13.9**	**Birds Per Point**	**0.2**	**Birds Per Point**	**21.2**	**Birds Per Point**	**36.7**	**Birds Per Point**	**3.0**	**Birds Per Point**	**10.7**
Species Richness	**42**	**Species Richness**	**3**	**Species Richness**	**51**	**Species Richness**	**55**	**Species Richness**	**20**	**Species Richness**	**36**
Species Diversity	**3.4**	**Species Diversity**	**1.1**	**Species Diversity**	**3.3**	**Species Diversity**	**3.4**	**Species Diversity**	**2.7**	**Species Diversity**	**3.2**

JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Alder Flycatcher	5	Alder Flycatcher	1	Alder Flycatcher	6	American Redstart	1	American Robin	1	Alder Flycatcher	10
American Robin	10	American Robin	2	American Robin	6	Blackpoll Warbler	1	Black-and-White Warbler	4	American Robin	9
Black-backed Woodpecker	7	Fox Sparrow	2	Black-backed Woodpecker	1	Blue-headed Vireo	1	Black-backed Woodpecker	1	Black-backed Woodpecker	1
Bohemian Waxwing	1	Hermit Thrush	2	Bonaparte's Gull	5	Cape May Warbler	1	Blue-headed Vireo	6	Blackpoll Warbler	1
Bonaparte's Gull	1	Northern Waterthrush	1	Boreal Chickadee	1	Cedar Waxwing	1	Boreal Chickadee	2	Bonaparte's Gull	2
Boreal Chickadee	1	Swamp Sparrow	1	Canada Goose	1	Common Redpoll	1	Brown Creeper	1	Boreal Chickadee	1
Canada Goose	8	Tennessee Warbler	2	Chipping Sparrow	11	Fox Sparrow	2	Cape May Warbler	1	Cedar Waxwing	1
Chipping Sparrow	1	Western Palm Warbler	1	Clay-colored Sparrow	2	Gray Jay	3	Chipping Sparrow	1	Chipping Sparrow	5
Clay-colored Sparrow	2	White-throated Sparrow	3	Common Loon	5	Greater Yellowlegs	2	Fox Sparrow	1	Clay-colored Sparrow	1
Common Loon	4	Wilson's Warbler	1	Common Raven	2	Hermit Thrush	4	Gray Jay	10	Common Loon	3
Common Raven	2			Common Yellowthroat	1	Least Flycatcher	3	Hermit Thrush	5	Common Raven	1
Common Redpoll	1			Connecticut Warbler	1	Orange-crowned Warbler	2	Lesser Yellowlegs	1	Gray Jay	5
Fox Sparrow	10			Fox Sparrow	5	Ruby-crowned Kinglet	1	Magnolia Warbler	2	Greater Yellowlegs	15
Gray Jay	6			Gray Jay	7	Solitary Sandpiper	1	Nashville Warbler	1	Hermit Thrush	8
Greater Yellowlegs	4			Greater Yellowlegs	3	Swainson's Thrush	1	Orange-crowned Warbler	7	Le Conte's Sparrow	9
Hairy Woodpecker	1			Hermit Thrush	4	Tennessee Warbler	7	Pine Siskin	1	Least Flycatcher	3
Hermit Thrush	12			Le Conte's Sparrow	1	Unidentified Dark-eyed Junco	1	Swainson's Thrush	3	Lesser Yellowlegs	1
Least Flycatcher	7			Lincoln's Sparrow	27	Western Palm Warbler	1	Tennessee Warbler	22	Lincoln's Sparrow	17

JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Lesser Yellowlegs	3			Mallard	1	White-throated Sparrow	5	Unidentified Dark-eyed Junco	5	Northern Waterthrush	7
Lincoln's Sparrow	3			Northern Waterthrush	3	Wilson's Snipe	1	Western Palm Warbler	1	Olive-sided Flycatcher	6
Magnolia Warbler	2			Olive-sided Flycatcher	8	Wilson's Warbler	2	White-throated Sparrow	12	Orange-crowned Warbler	7
Northern Waterthrush	2			Orange-crowned Warbler	3	Winter Wren	1	Wilson's Warbler	1	Pied-billed Grebe	1
Orange-crowned Warbler	14			Red Crossbill	2	Yellow-bellied Flycatcher	1	Winter Wren	2	Pine Siskin	1
Red-tailed Hawk	2			Red-tailed Hawk	1			Yellow-bellied Flycatcher	2	Red-winged Blackbird	3
Ruby-crowned Kinglet	8			Red-winged Blackbird	1			Yellow-rumped Warbler	7	Ring-billed Gull	1
Rusty Blackbird	2			Ring-billed Gull	12			Yellow-shafted Flicker	1	Ruby-crowned Kinglet	10
Sandhill Crane	1			Ruby-crowned Kinglet	5					Rusty Blackbird	7
Swainson's Thrush	2			Rusty Blackbird	12					Sandhill Crane	1
Tennessee Warbler	20			Sandhill Crane	1					Savannah Sparrow	1
Unidentified Dark-eyed Junco	9			Savannah Sparrow	3					Sharp-shinned Hawk	1
Western Palm Warbler	10			Solitary Sandpiper	2					Solitary Sandpiper	2
White-crowned Sparrow	2			Sora Rail	1					Swainson's Thrush	2
White-throated Sparrow	37			Swainson's Thrush	2					Swamp Sparrow	7
Wilson's Snipe	10			Swamp Sparrow	5					Tennessee Warbler	18
Wilson's Warbler	10			Tennessee Warbler	16					Tree Swallow	4
Yellow Warbler	1			Tree Swallow	1					Unidentified Dark-eyed Junco	13

JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Yellow-bellied Flycatcher	4			Unidentified Dark-eyed Junco	12					Veery	1
Yellow-rumped Warbler	2			Western Palm Warbler	10					Western Palm Warbler	8
Yellow-shafted Flicker	4			White-throated Sparrow	16					White-crowned Sparrow	3
				White-winged Crossbill	1					White-throated Sparrow	27
				Wilson's Snipe	6					Wilson's Snipe	3
				Wilson's Warbler	3					Wilson's Warbler	3
				Winter Wren	9					Yellow Warbler	3
				Yellow-bellied Flycatcher	1					Yellow-rumped Warbler	2
				Yellow-bellied Sapsucker	1					Yellow-shafted Flicker	2
				Yellow-rumped Warbler	5						
				Yellow-shafted Flicker	2						
Number of Birds	**231**	**Number of Birds**	**16**	**Number of Birds**	**234**	**Number of Birds**	**44**	**Number of Birds**	**101**	**Number of Birds**	**237**
Number of Plots	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**	**Number of Plots**	**14**
Birds Per Point	**16.5**	**Birds Per Point**	**1.1**	**Birds Per Point**	**16.7**	**Birds Per Point**	**3.1**	**Birds Per Point**	**7.2**	**Birds Per Point**	**16.9**
Species Richness	**39**	**Species Richness**	**10**	**Species Richness**	**47**	**Species Richness**	**23**	**Species Richness**	**26**	**Species Richness**	**45**
Species Diversity	**3.2**	**Species Diversity**	**2.2**	**Species Diversity**	**3.4**	**Species Diversity**	**2.9**	**Species Diversity**	**2.7**	**Species Diversity**	**3.4**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question.

F-13: Sampled bird species in the Hayes River Upland Ecoregion based on sampled forestry resource inventory habitats

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
Alder Flycatcher	7	American Crow	1	Alder Flycatcher	22	Alder Flycatcher	18	Alder Flycatcher	5	Cedar Waxwing	1
American Green-winged Teal	1	American Kestrel	1	American Kestrel	1	American Robin	21	American Crow	2	Least Flycatcher	1
American Redstart	5	American Redstart	8	American Robin	8	Bay-breasted Warbler	3	American Robin	2	Red-eyed Vireo	2
American Robin	4	Barred Owl	1	Bay-breasted Warbler	13	Black-backed Woodpecker	9	Bay-breasted Warbler	14	Unidentified Dark-eyed Junco	1
Bay-breasted Warbler	15	Bay-breasted Warbler	15	Black-backed Woodpecker	3	Black-capped Chickadee	2	Black-backed Woodpecker	2	White-throated Sparrow	1
Black-backed Woodpecker	2	Black-and-White Warbler	7	Blackpoll Warbler	5	Blackpoll Warbler	5	Black-capped Chickadee	1		
Blackburnian Warbler	1	Blackburnian Warbler	1	Blue-headed Vireo	2	Blue-headed Vireo	2	Blue-headed Vireo	1		
Black-capped Chickadee	7	Brown Creeper	5	Boreal Chickadee	5	Bonaparte's Gull	9	Boreal Chickadee	2		
Blue-headed Vireo	3	Cape May Warbler	10	Brown Creeper	8	Boreal Chickadee	10	Brown Creeper	6		
Boreal Chickadee	2	Cedar Waxwing	5	Canada Goose	1	Brown Creeper	7	Cape May Warbler	16		
Brown Creeper	7	Chipping Sparrow	7	Cape May Warbler	5	Canada Goose	2	Cedar Waxwing	2		
Canada Goose	1	Common Loon	3	Cedar Waxwing	4	Cape May Warbler	3	Chipping Sparrow	22		
Cape May Warbler	6	Common Raven	2	Chipping Sparrow	34	Cedar Waxwing	7	Common Raven	1		
Cedar Waxwing	7	Common Yellowthroat	1	Common Loon	3	Chipping Sparrow	39	Connecticut Warbler	1		
Chestnut-sided Warbler	1	Fox Sparrow	2	Common Raven	6	Common Goldeneye	1	Golden-crowned Kinglet	1		
Chipping Sparrow	10	Golden-crowned Kinglet	1	Common Redpoll	1	Common Loon	10	Gray Jay	7		
Common Loon	4	Gray Jay	5	Common Yellowthroat	5	Common Raven	10	Greater Yellowlegs	3		

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland
Common Yellowthroat	1	Hairy Woodpecker	2	Fox Sparrow	14	Common Redpoll	1	Hermit Thrush	2	
Fox Sparrow	3	Hermit Thrush	13	Golden-crowned Kinglet	15	Common Yellowthroat	5	Least Flycatcher	1	
Golden-crowned Kinglet	2	Least Flycatcher	39	Gray Jay	24	Connecticut Warbler	3	Magnolia Warbler	6	
Gray Jay	25	Magnolia Warbler	17	Greater Yellowlegs	9	Fox Sparrow	48	Orange-crowned Warbler	3	
Greater Yellowlegs	5	Mourning Warbler	1	Hairy Woodpecker	5	Golden-crowned Kinglet	5	Ovenbird	12	
Hairy Woodpecker	2	Northern Waterthrush	2	Hermit Thrush	37	Gray Jay	66	Pileated Woodpecker	2	
HEGU	1	Olive-sided Flycatcher	1	Herring Gull	1	Greater Yellowlegs	28	Red Crossbill	19	
Hermit Thrush	10	Ovenbird	74	Le Conte's Sparrow	1	Hairy Woodpecker	5	Red-breasted Nuthatch	4	
Le Conte's Sparrow	1	Philadelphia Vireo	1	Least Flycatcher	2	Hermit Thrush	51	Red-eyed Vireo	7	
Least Flycatcher	33	Pileated Woodpecker	2	Lincoln's Sparrow	6	Le Conte's Sparrow	3	Red-tailed Hawk	1	
Magnolia Warbler	41	Pine Siskin	1	Magnolia Warbler	26	Least Flycatcher	7	Ruby-crowned Kinglet	8	
Mourning Warbler	11	Red Crossbill	11	Mourning Warbler	1	Lesser Yellowlegs	14	Ruffed Grouse	2	
Nashville Warbler	3	Red-breasted Nuthatch	2	Nashville Warbler	5	Lincoln's Sparrow	17	Swainson's Thrush	21	
Northern Waterthrush	2	Red-eyed Vireo	55	Northern Waterthrush	3	Magnolia Warbler	15	Tennessee Warbler	34	
Olive-sided Flycatcher	3	Ruby-crowned Kinglet	5	Olive-sided Flycatcher	4	Mallard	11	Unidentified Dark-eyed Junco	7	
Orange-crowned Warbler	3	Ruffed Grouse	1	Orange-crowned Warbler	3	Marsh Wren	2	Western Palm Warbler	1	
Ovenbird	64	Sandhill Crane	1	Ovenbird	31	Mourning Warbler	2	White-throated Sparrow	12	
Philadelphia Vireo	3	Sharp-shinned Hawk	1	Philadelphia Vireo	2	Nashville Warbler	11	White-winged Crossbill	2	

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland
Pileated Woodpecker	1	Swainson's Thrush	52	Pileated Woodpecker	1	Northern Harrier	1	Wilson's Warbler	2	
Red Crossbill	7	Tennessee Warbler	51	Pine Siskin	1	Northern Waterthrush	27	Winter Wren	12	
Red-breasted Nuthatch	6	Thrush	1	Red Crossbill	9	Olive-sided Flycatcher	23	Yellow Warbler	7	
Red-eyed Vireo	46	Unidentified Dark-eyed Junco	3	Red-breasted Nuthatch	4	Orange-crowned Warbler	13	Yellow-bellied Sapsucker	3	
Red-tailed Hawk	1	White-throated Sparrow	28	Red-eyed Vireo	14	Ovenbird	12	Yellow-rumped Warbler	6	
Ring-billed Gull	1	White-winged Crossbill	21	Red-tailed Hawk	2	Pied-billed Grebe	1	Yellow-shafted Flicker	2	
RNGR	1	Wilson's Snipe	4	Ring-billed Gull	2	Pileated Woodpecker	2			
Ruby-crowned Kinglet	23	Wilson's Warbler	5	Ruby-crowned Kinglet	47	Pine Grosbeak	2			
Ruffed Grouse	2	Winter Wren	6	Ruffed Grouse	1	Red Crossbill	4			
Sandhill Crane	2	Yellow Warbler	3	Sandhill Crane	2	Red-breasted Nuthatch	3			
Solitary Sandpiper	1	Yellow-bellied Flycatcher	3	Solitary Sandpiper	2	Red-eyed Vireo	7			
Swainson's Thrush	49	Yellow-bellied Sapsucker	4	Swainson's Thrush	41	Red-winged Blackbird	4			
Swamp Sparrow	4	Yellow-rumped Warbler	14	Swamp Sparrow	3	Ring-billed Gull	1			
Tennessee Warbler	55	Yellow-shafted Flicker	2	Tennessee Warbler	55	Ruby-crowned Kinglet	110			
Unidentified Dark-eyed Junco	5			Tree Swallow	1	Rusty Blackbird	6			
UNKWOOD	1			Unidentified Dark-eyed Junco	34	Sandhill Crane	1			
Western Palm Warbler	2			Western Palm Warbler	9	Solitary Sandpiper	10			
White-throated Sparrow	40			Western Tanager	2	Spruce Grouse	1			

Broadleaf Mixed		Broadleaf Pure		BS Mixed		BS Pure		Coniferous Mixed		Grassland	
White-winged Crossbill	3			White-throated Sparrow	70	Swainson's Thrush	39				
Wilson's Snipe	2			White-winged Crossbill	35	Swamp Sparrow	12				
Wilson's Warbler	5			Wilson's Snipe	2	Tennessee Warbler	95				
Winter Wren	15			Wilson's Warbler	2	Three-toed Woodpecker	1				
Yellow Warbler	11			Winter Wren	24	Tree Swallow	1				
Yellow-bellied Flycatcher	5			Yellow Warbler	26	Unidentified Dark-eyed Junco	109				
Yellow-bellied Sapsucker	11			Yellow-bellied Flycatcher	6	Western Palm Warbler	40				
Yellow-rumped Warbler	21			Yellow-bellied Sapsucker	5	White-throated Sparrow	52				
Yellow-shafted Flicker	7			Yellow-rumped Warbler	32	White-winged Crossbill	18				
				Yellow-shafted Flicker	12	Wilson's Snipe	29				
						Wilson's Warbler	7				
						Winter Wren	58				
						Yellow Warbler	39				
						Yellow-bellied Flycatcher	23				
						Yellow-bellied Sapsucker	1				
						Yellow-rumped Warbler	24				
						Yellow-shafted Flicker	12				
Number of Birds	**623**	**Number of Birds**	**501**	**Number of Birds**	**759**	**Number of Birds**	**1240**	**Number of Birds**	**264**	**Number of Birds**	**6**
Number of Plots	**79**	**Number of Plots**	**65**	**Number of Plots**	**109**	**Number of Plots**	**171**	**Number of Plots**	**30**	**Number of Plots**	**1**
Birds Per Point	**7.9**	**Birds Per Point**	**7.7**	**Birds Per Point**	**7.0**	**Birds Per Point**	**7.3**	**Birds Per Point**	**8.8**	**Birds Per Point**	**6.0**
Species Richness	**62**	**Species Richness**	**49**	**Species Richness**	**63**	**Species Richness**	**70**	**Species Richness**	**41**	**Species Richness**	**5**
Species Diversity	**3.4**	**Species Diversity**	**3.1**	**Species Diversity**	**3.5**	**Species Diversity**	**3.6**	**Species Diversity**	**3.2**	**Species Diversity**	**1.6**

JP Mixed		JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Alder Flycatcher	14	Alder Flycatcher	6	Alder Flycatcher	40	Alder Flycatcher	11	Alder Flycatcher	3	Alder Flycatcher	6	Alder Flycatcher	21
American Kestrel	1	American Robin	2	American Redstart	4	American Robin	4	American Robin	4	American Robin	7	American Robin	6
American Robin	5	Bay-breasted Warbler	1	American Robin	9	Black-backed Woodpecker	3	Blackpoll Warbler	1	Black-backed Woodpecker	1	American Wigeon	1
Bay-breasted Warbler	3	Black-and-White Warbler	1	Bald Eagle	2	Blackpoll Warbler	1	Bonaparte's Gull	4	Blackpoll Warbler	5	Bald Eagle	1
Black-and-White Warbler	2	Black-backed Woodpecker	1	Black-backed Woodpecker	4	Blue-headed Vireo	2	Chipping Sparrow	3	Bohemian Waxwing	1	Bay-breasted Warbler	1
Black-backed Woodpecker	3	Blue-headed Vireo	4	Blackpoll Warbler	27	Bonaparte's Gull	5	Clay-colored Sparrow	1	Bonaparte's Gull	13	Black-backed Woodpecker	2
Black-capped Chickadee	1	Boreal Chickadee	2	Bohemian Waxwing	3	Cedar Waxwing	4	Common Loon	6	Boreal Chickadee	1	Blackpoll Warbler	5
Blue-headed Vireo	4	Brown Creeper	2	Bonaparte's Gull	2	Chipping Sparrow	27	Common Redpoll	1	Bufflehead	1	Blue-headed Vireo	2
Boreal Chickadee	2	Canada Goose	1	Boreal Chickadee	1	Clay-colored Sparrow	1	Common Yellowthroat	1	Chipping Sparrow	2	Bohemian Waxwing	1
Brown Creeper	10	Cedar Waxwing	2	Cedar Waxwing	2	Common Grackle	1	Fox Sparrow	9	Common Loon	6	Bonaparte's Gull	8
Canada Warbler	1	Chipping Sparrow	9	Chipping Sparrow	7	Common Loon	7	Gray Jay	5	Common Redpoll	2	Boreal Chickadee	4
Cape May Warbler	1	Common Loon	3	Common Loon	9	Common Raven	2	Greater Yellowlegs	4	Fox Sparrow	29	Brown Creeper	1
Cedar Waxwing	4	Common Raven	5	Common Nighthawk	1	Common Yellowthroat	3	Hermit Thrush	10	Gray Jay	18	Cedar Waxwing	2
Chipping Sparrow	14	Evening Grosbeak	1	Common Raven	2	Connecticut Warbler	25	Le Conte's Sparrow	1	Greater Yellowlegs	11	Chipping Sparrow	16
Clay-colored Sparrow	3	Golden-crowned Kinglet	1	Common Redpoll	5	Eastern Kingbird	1	Least Flycatcher	1	Hermit Thrush	9	Clay-colored Sparrow	1
Common Loon	1	Gray Jay	4	Common Yellowthroat	7	Fox Sparrow	6	Lesser Yellowlegs	6	Lesser Yellowlegs	9	Common Loon	8

JP Mixed		JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Common Raven	1	Greater Yellowlegs	1	Connecticut Warbler	2	Gadwall	1	Lincoln's Sparrow	11	Lincoln's Sparrow	22	Common Redpoll	7
Common Yellowthroat	2	Hermit Thrush	9	Downy Woodpecker	1	Gray Jay	18	Magnolia Warbler	1	Northern Harrier	1	Common Yellowthroat	7
Connecticut Warbler	2	Least Flycatcher	13	Fox Sparrow	68	Great Blue Heron	1	Mallard	1	Northern Waterthrush	10	Fox Sparrow	35
Golden-crowned Kinglet	1	Lincoln's Sparrow	4	Gray Jay	15	Greater Yellowlegs	28	Northern Shoveler	6	Olive-sided Flycatcher	7	Gray Jay	18
Gray Jay	23	Magnolia Warbler	15	Greater Yellowlegs	10	Hermit Thrush	30	Northern Waterthrush	3	Orange-crowned Warbler	4	Greater Yellowlegs	25
Greater Yellowlegs	4	Northern Waterthrush	1	Hairy Woodpecker	1	Herring Gull	2	Olive-sided Flycatcher	4	Pied-billed Grebe	1	Hermit Thrush	10
Hermit Thrush	16	Olive-sided Flycatcher	1	Hermit Thrush	34	Le Conte's Sparrow	1	Orange-crowned Warbler	6	Pine Siskin	1	Le Conte's Sparrow	22
Least Flycatcher	13	Orange-crowned Warbler	6	Horned Grebe	2	Least Flycatcher	1	Pine Siskin	1	Red Crossbill	1	Least Flycatcher	4
Lincoln's Sparrow	2	Ovenbird	10	Le Conte's Sparrow	1	Lesser Yellowlegs	5	Ruby-crowned Kinglet	3	Ruby-crowned Kinglet	17	Lesser Yellowlegs	10
Magnolia Warbler	14	Philadelphia Vireo	2	Least Flycatcher	2	Lincoln's Sparrow	34	Rusty Blackbird	2	Rusty Blackbird	9	Lincoln's Sparrow	36
Mourning Warbler	5	Pileated Woodpecker	1	Least Sandpiper	1	Magnolia Warbler	5	Sandhill Crane	1	Sandhill Crane	3	Magnolia Warbler	2
Nashville Warbler	6	Red-breasted Nuthatch	1	Lesser Yellowlegs	9	Nashville Warbler	4	Savannah Sparrow	11	Solitary Sandpiper	6	Mallard	1
Northern Harrier	1	Red-eyed Vireo	15	Lincoln's Sparrow	38	Northern Harrier	1	Solitary Sandpiper	3	Swainson's Thrush	5	Northern Waterthrush	5
Northern Waterthrush	2	Red-winged Blackbird	1	Magnolia Warbler	11	Northern Waterthrush	1	Swamp Sparrow	3	Swamp Sparrow	3	Olive-sided Flycatcher	15
Olive-sided Flycatcher	2	Ruby-crowned Kinglet	6	Nashville Warbler	1	Olive-sided Flycatcher	13	Tennessee Warbler	7	Tennessee Warbler	13	Orange-crowned Warbler	5

JP Mixed		JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Orange-crowned Warbler	8	Sandhill Crane	1	Northern Waterthrush	18	Orange-crowned Warbler	8	Unidentified Dark-eyed Junco	12	Unidentified Dark-eyed Junco	34	Ovenbird	2
Ovenbird	33	Sora Rail	1	Olive-sided Flycatcher	2	Ovenbird	2	Western Palm Warbler	6	Western Palm Warbler	10	Pine Grosbeak	1
Philadelphia Vireo	4	Swainson's Thrush	16	Orange-crowned Warbler	26	Philadelphia Vireo	1	White-crowned Sparrow	2	White-crowned Sparrow	3	Red Crossbill	5
Pileated Woodpecker	1	Tennessee Warbler	14	Ovenbird	1	Pileated Woodpecker	2	White-throated Sparrow	9	White-throated Sparrow	17	Red-eyed Vireo	3
Red Crossbill	19	Three-toed Woodpecker	1	Pine Grosbeak	1	Pine Siskin	1	Wilson's Snipe	5	White-winged Crossbill	4	Red-tailed Hawk	2
Red-breasted Nuthatch	4	Tree Swallow	1	Pine Siskin	1	Red Crossbill	33	Wilson's Warbler	1	Wilson's Snipe	5	Red-winged Blackbird	1
Red-eyed Vireo	15	Unidentified Dark-eyed Junco	7	Red-eyed Vireo	1	Red-eyed Vireo	8	Winter Wren	2	Wilson's Warbler	2	Ruby-crowned Kinglet	25
Ruby-crowned Kinglet	22	White-throated Sparrow	31	Red-tailed Hawk	1	Red-winged Blackbird	2	Yellow Warbler	2	Winter Wren	2	Ruffed Grouse	1
Rusty Blackbird	1	White-winged Crossbill	1	Red-winged Blackbird	5	Ruby-crowned Kinglet	36	Yellow-bellied Flycatcher	4	Yellow-bellied Flycatcher	6	Rusty Blackbird	8
Sandhill Crane	1	Wilson's Snipe	5	Ruby-crowned Kinglet	30	Rusty Blackbird	4			Yellow-bellied Sapsucker	1	Savannah Sparrow	8
Sharp-shinned Hawk	1	Wilson's Warbler	1	Rusty Blackbird	6	Sandhill Crane	6			Yellow-rumped Warbler	10	Solitary Sandpiper	9
Spruce Grouse	1	Winter Wren	9	Sandhill Crane	3	Solitary Sandpiper	1			Yellow-shafted Flicker	2	Song Sparrow	1
Swainson's Thrush	38	Yellow Warbler	7	Solitary Sandpiper	4	Swainson's Thrush	13					Swainson's Thrush	5

JP Mixed		JP Pure		Shrub		TL Pure		Wetland Herb	Wetland shrub	Wetland Treed	
Swamp Sparrow	2	Yellow-bellied Sapsucker	1	Sora Rail	2	Swamp Sparrow	11			Swamp Sparrow	24
Tennessee Warbler	28	Yellow-rumped Warbler	3	Spotted Sandpiper	1	Tennessee Warbler	53			Tennessee Warbler	21
Unidentified Dark-eyed Junco	16	Yellow-shafted Flicker	2	Swainson's Thrush	15	Tree Swallow	1			Tree Swallow	1
Western Palm Warbler	5			Swamp Sparrow	11	Unidentified Dark-eyed Junco	43			Unidentified Dark-eyed Junco	33
White-throated Sparrow	29			Tennessee Warbler	51	Western Palm Warbler	24			Western Palm Warbler	13
White-winged Crossbill	28			Tree Swallow	1	White-crowned Sparrow	1			White-throated Sparrow	9
Wilson's Snipe	9			Unidentified Dark-eyed Junco	32	White-throated Sparrow	47			White-winged Crossbill	21
Wilson's Warbler	3			Western Palm Warbler	57	White-winged Crossbill	33			Wilson's Snipe	10
Winter Wren	7			White-crowned Sparrow	26	Wilson's Snipe	24			Wilson's Warbler	2
Yellow Warbler	9			White-throated Sparrow	110	Wilson's Warbler	4			Winter Wren	8
Yellow-bellied Flycatcher	3			White-winged Crossbill	3	Winter Wren	11			Yellow Warbler	6
Yellow-bellied Sapsucker	1			Wilson's Snipe	17	Yellow Warbler	8			Yellow-bellied Flycatcher	6

JP Mixed		JP Pure		Shrub		TL Pure		Wetland Herb		Wetland shrub		Wetland Treed	
Yellow-rumped Warbler	17			Wilson's Warbler	15	Yellow-bellied Flycatcher	8					Yellow-bellied Sapsucker	1
Yellow-shafted Flicker	4			Winter Wren	14	Yellow-bellied Sapsucker	1					Yellow-rumped Warbler	6
				Yellow Warbler	14	Yellow-rumped Warbler						Yellow-shafted Flicker	2
				Yellow-bellied Flycatcher	13	Yellow-shafted Flicker	2						
				Yellow-bellied Sapsucker	1								
				Yellow-rumped Warbler	7								
				Yellow-shafted Flicker	2								
Number of Birds	**472**	**Number of Birds**	**232**	**Number of Birds**	**812**	**Number of Birds**	**643**	**Number of Birds**	**166**	**Number of Birds**	**320**	**Number of Birds**	**516**
Number of Plots	**66**	**Number of Plots**	**33**	**Number of Plots**	**73**	**Number of Plots**	**75**	**Number of Plots**	**20**	**Number of Plots**	**35**	**Number of Plots**	**60**
Birds Per Point	**7.2**	**Birds Per Point**	**7.0**	**Birds Per Point**	**11.1**	**Birds Per Point**	**8.6**	**Birds Per Point**	**8.3**	**Birds Per Point**	**9.1**	**Birds Per Point**	**8.6**
Species Richness	**58**	**Species Richness**	**47**	**Species Richness**	**63**	**Species Richness**	**60**	**Species Richness**	**40**	**Species Richness**	**43**	**Species Richness**	**59**
Species Diversity	**3.5**	**Species Diversity**	**3.3**	**Species Diversity**	**3.4**	**Species Diversity**	**3.5**	**Species Diversity**	**3.4**	**Species Diversity**	**3.3**	**Species Diversity**	**3.6**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question.

F-14: Sampled bird species in the Hudson Bay Lowland Ecoregion based on sampled forestry resource inventory habitats

BS Mixed		BS Pure		Shrub		Wetland Herb		Wetland shrub		Wetland Treed	
American Robin	5	Alder Flycatcher	5	Alder Flycatcher	53	Alder Flycatcher	4	Alder Flycatcher	9	Alder Flycatcher	2
Blue-headed Vireo	1	American Goldfinch	1	American Redstart	1	American Robin	11	American Goldfinch	2	American Robin	2
Cedar Waxwing	1	American Robin	42	American Goldfinch	3	Arctic Tern	2	American Robin	23	Blackpoll Warbler	17
Chipping Sparrow	1	Black-backed Woodpecker	4	American Robin	58	Black-capped Chickadee	1	Blue-headed Vireo	6	Boreal Chickadee	1
Cape May Warbler	1	Blue-headed Vireo	1	Black-backed Woodpecker	4	Belted Kingfisher	1	Blackpoll Warbler	29	Common Redpoll	3
Gray Jay	1	Blackpoll Warbler	52	Black-capped Chickadee	1	Blue-headed Vireo	1	Boreal Chickadee	3	Fox Sparrow	25
Hermit Thrush	7	Boreal Chickadee	10	Blackpoll Warbler	68	Blackpoll Warbler	12	Bonaparte's Gull	8	Gray Jay	9
None	1	Bonaparte's Gull	5	Boreal Chickadee	3	Bonaparte's Gull	15	Broad-winged Hawk	1	Greater Yellowlegs	5
Ruby-crowned Kinglet	2	Bohemian Waxwing	4	Bonaparte's Gull	1	Bohemian Waxwing	1	Cedar Waxwing	1	Hairy Woodpecker	1
Swainson's Thrush	7	Brown Creeper	1	Bohemian Waxwing	2	Clay-colored Sparrow	3	Chipping Sparrow	17	Hermit Thrush	2
Tennessee Warbler	7	Blue-winged Teal	1	Clay-colored Sparrow	1	Cedar Waxwing	1	Cape May Warbler	1	Lesser Yellowlegs	4
Unidentified Dark-eyed Junco	1	Clay-colored Sparrow	1	Cedar Waxwing	5	Chipping Sparrow	2	Connecticut Warbler	1	Lincoln's Sparrow	10
Wilson's Warbler	1	Cedar Waxwing	6	Chipping Sparrow	21	Cape May Warbler	1	Common Redpoll	15	Northern Waterthrush	10
Winter Wren	1	Chipping Sparrow	17	Common Loon	4	Common Loon	1	Common Tern	4	Ovenbird	1
White-throated Sparrow	4	Common Loon	1	Common Raven	6	Common Merganser	1	Fox Sparrow	58	Pine Grosbeak	1
White-winged Crossbill	12	Common Raven	2	Common Redpoll	38	Common Nighthawk	1	Golden-crowned Kinglet	2	Ruby-crowned Kinglet	8
Yellow-bellied Flycatcher	1	Common Redpoll	19	Common Yellowthroat	1	Connecticut Warbler	1	Gray Jay	54	Rusty Blackbird	17

BS Mixed		BS Pure		Shrub		Wetland Herb		Wetland shrub		Wetland Treed	
Yellow-rumped Warbler	5	Common Yellowthroat	5	Fox Sparrow	149	Common Raven	2	Greater Yellowlegs	31	Sandhill Crane	1
Yellow Warbler	1	Fox Sparrow	118	Gray-cheeked Thrush	5	Common Redpoll	9	Hairy Woodpecker	1	Solitary Sandpiper	3
		Golden-crowned Kinglet	1	Gray Jay	39	Fox Sparrow	26	Hermit Thrush	42	Swamp Sparrow	2
		Gray-cheeked Thrush	1	Greater Yellowlegs	38	Gray Jay	19	Hudsonian Godwit	2	Tennessee Warbler	5
		Gray Jay	97	Harris's Sparrow	2	Greater Yellowlegs	21	Killdeer	2	Unidentified Dark-eyed Junco	5
		Gray Catbird	1	Hairy Woodpecker	3	Hairy Woodpecker	1	Least Flycatcher	7	White-crowned Sparrow	4
		Greater Yellowlegs	32	Hermit Thrush	115	Hermit Thrush	21	Least Sandpiper	2	Wilson's Snipe	5
		Hairy Woodpecker	2	Le Conte's Sparrow	1	Hudsonian Godwit	1	Lesser Yellowlegs	17	Wilson's Warbler	2
		Hermit Thrush	97	Least Flycatcher	1	Le Conte's Sparrow	9	Lincoln's Sparrow	77	Western Palm Warbler	8
		Le Conte's Sparrow	1	Lesser Yellowlegs	19	Least Flycatcher	2	Mallard	1	White-throated Sparrow	4
		Least Sandpiper	2	Lincoln's Sparrow	138	Least Sandpiper	9	Magnolia Warbler	2	Yellow-bellied Flycatcher	2
		Lesser Yellowlegs	11	Mallard	1	Lesser Yellowlegs	17	Northern Harrier	1	Yellow-rumped Warbler	6
		Lincoln's Sparrow	77	Magnolia Warbler	5	Lincoln's Sparrow	17	Northern Waterthrush	21		
		Magnolia Warbler	1	Nashville Warbler	5	Magnolia Warbler	1	Orange-crowned Warbler	8		
		Nashville Warbler	1	Northern Harrier	1	Nashville Warbler	3	Olive-sided Flycatcher	2		
		Northern Waterthrush	47	Northern Waterthrush	22	Northern Waterthrush	5	Philadelphia Vireo	1		
		Orange-crowned Warbler	17	Orange-crowned Warbler	67	Orange-crowned Warbler	5	Pine Grosbeak	4		
		Olive-sided Flycatcher	11	Olive-sided Flycatcher	12	Olive-sided Flycatcher	2	Pine Siskin	2		

BS Mixed	BS Pure		Shrub		Wetland Herb		Wetland shrub		Wetland Treed
	Pine Grosbeak	13	Ovenbird	1	Pine Grosbeak	1	Purple Finch	1	
	Pine Siskin	10	Pine Siskin	6	Purple Finch	1	Ruby-crowned Kinglet	18	
	Purple Finch	2	Ruby-crowned Kinglet	16	Red-breasted Nuthatch	1	Red Crossbill	2	
	Ring-billed Gull	1	Red Crossbill	2	Ruby-crowned Kinglet	10	Red-eyed Vireo	3	
	Ruby-crowned Kinglet	63	Rusty Blackbird	7	Red-tailed Hawk	1	Red-tailed Hawk	1	
	Red Crossbill	13	Red-winged Blackbird	1	Rusty Blackbird	7	Rusty Blackbird	18	
	Red-eyed Vireo	1	Sandhill Crane	3	Sandhill Crane	3	Sandhill Crane	2	
	Red-tailed Hawk	1	Savannah Sparrow	1	Savannah Sparrow	1	Savannah Sparrow	2	
	Rusty Blackbird	13	Solitary Sandpiper	3	Short-billed Dowitcher	1	Spotted Dove	1	
	Sandhill Crane	9	Song Sparrow	1	Snow Bunting	1	Solitary Sandpiper	8	
	Solitary Sandpiper	20	Spruce Grouse	1	Solitary Sandpiper	2	Song Sparrow	1	
	Song Sparrow	1	Spotted Sandpiper	1	Swamp Sparrow	2	Sharp-tailed Grouse	3	
	Spotted Sandpiper	4	Swamp Sparrow	10	Swainson's Thrush	1	Swamp Sparrow	12	
	Swamp Sparrow	23	Swainson's Thrush	3	Tennessee Warbler	23	Swainson's Thrush	7	
	Swainson's Thrush	10	Tennessee Warbler	153	Unidentified Dark-eyed Junco	15	Tennessee Warbler	28	
	Tennessee Warbler	56	Tree Swallow	2	White-crowned Sparrow	9	Unidentified Dark-eyed Junco	48	
	Tree Swallow	1	Three-toed Woodpecker	2	Wilson's Phalarope	3	White-crowned Sparrow	20	
	Three-toed Woodpecker	1	Unidentified Dark-eyed Junco	49	Wilson's Snipe	7	Wilson's Snipe	22	
	Unidentified Dark-eyed Junco	96	White-crowned Sparrow	131	Wilson's Warbler	3	Wilson's Warbler	8	

BS Mixed		BS Pure		Shrub		Wetland Herb		Wetland shrub		Wetland Treed	
		White-crowned Sparrow	13	Wilson's Snipe	20	Western Palm Warbler	5	Winter Wren	3		
		Wilson's Snipe	16	Wilson's Warbler	32	White-throated Sparrow	24	Western Palm Warbler	59		
		Wilson's Warbler	15	Winter Wren	12	White-winged Crossbill	1	White-throated Sparrow	39		
		Winter Wren	23	Western Palm Warbler	82	Yellow-bellied Flycatcher	9	White-winged Crossbill	7		
		Western Palm Warbler	75	White-throated Sparrow	246	Yellow-rumped Warbler	12	Yellow-bellied Flycatcher	6		
		White-throated Sparrow	69	White-winged Crossbill	11			Yellow-rumped Warbler	19		
		White-winged Crossbill	44	Yellow-bellied Flycatcher	56			Yellow-shafted Flicker	1		
		Yellow-bellied Flycatcher	38	Yellow-rumped Warbler	13			Yellow Warbler	14		
		Yellow-bellied Sapsucker	1	Yellow-shafted Flicker	7						
		Yellow-rumped Warbler	44	Yellow Warbler	6						
		Yellow-shafted Flicker	2								
		Yellow Warbler	18								
Number of Birds	**60**	**Number of Birds**	**1390**	**Number of Birds**	**1771**	**Number of Birds**	**372**	**Number of Birds**	**810**	**Number of Birds**	**165**
Number of Plots	**9**	**Number of Plots**	**165**	**Number of Plots**	**165**	**Number of Plots**	**50**	**Number of Plots**	**89**	**Number of Plots**	**15**
Birds Per Point	**6.7**	**Birds Per Point**	**8.4**	**Birds Per Point**	**10.7**	**Birds Per Point**	**7.4**	**Birds Per Point**	**9.1**	**Birds Per Point**	**11.0**
Species Richness	**19**	**Species Richness**	**66**	**Species Richness**	**64**	**Species Richness**	**59**	**Species Richness**	**62**	**Species Richness**	**29**
Species Diversity	**2.5**	**Species Diversity**	**3.4**	**Species Diversity**	**3.2**	**Species Diversity**	**3.5**	**Species Diversity**	**3.5**	**Species Diversity**	**3.0**

* It is important to note that a small number bird species identified within a certain habitat are not commonly found there and this is due to several reasons including: 1) remnant and or uncommon habitats such as white spruce or pure jack pine stands are often found next to lakes and other riparian areas, 2) Land cover data is outdated and immersion of a plot within one habitat type did not always happen 3) Point counts recorded calls and songs of birds that flew over the plot, 4) Songs and calls from some bird species such as common loon can carry over very long distances and are likely not associated with the habitat in question

F-15: Birds observed in sampling sites across six sampled ecoregions during multiple 2010 Bipole III bird surveys

	GROUP															
	Passerines		Waterfowl		Birds of prey		Colonial waterbirds		Shorebirds		Upland game birds		Woodpeckers		All	
ECOREGION	# species	# sampled	# species	# sampled	# species	# sampled	# species	# sampled	# species	# sampled	# species	# sampled	# species	# sampled	# species	# sampled
Lake Manitoba Plain	107	9,270	29	1,625	21	544	18	1,093	11	724	3	153	5	213	199	13,655
Interlake Plain	104	8,079	26	623	17	141	12	284	10	245	2	72	6	122	178	9,571
Mid-Boreal Lowland	83	5,390	28	771	15	198	14	172	8	316	4	18	5	45	158	6,913
Churchill River Upland	59	1,693	7	51	7	35	7	52	4	80	1	2	4	21	90	1,935
Hayes River Upland	70	5,937	22	332	10	212	13	147	6	333	2	9	6	90	130	7,063
Hudson Bay Lowland	64	4,158	5	28	4	9	4	41	10	329	2	4	4	20	93	4,589
All	**123***	**34,527**	**36***	**3,430**	**25***	**1,143**	**21***	**1,789**	**15***	**2,034**	**4***	**258**	**7***	**511***	**236***	**43,718**

*** species totals inclusive of species seen across multiple ecoregions**

F-16: Percentage of habitat loss based on modeled habitat area for Valued Environmental Components along the Bipole III preferred route corridor

Species	Selwyn Lake Upland			Churchill River Upland			Hayes River Upland			Mid-Boreal Lowland		
	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected
Mallard	687.84	2.01	0.29	9076.22	61.64	0.68	27696.79	238.33	0.86	60134.23	711.35	1.18
Sandhill crane	443.26	2.01	0.45	10355.65	108.53	1.05	28050.26	388.42	1.38	76827.05	1026.92	1.34
Great blue heron	0	0	0	8992.66	109.71	1.22	27189.45	399.35	1.47	28971.21	385.69	1.33
Bald eagle	2.89	0	0	679.97	8.70	1.28	3344.93	16.81	0.50	1033.00	2.54	0.25
Ruffed grouse	0	0	0	4476.71	57.19	1.28	18011.80	240.78	1.34	5379.13	55.12	1.02
Sharp-tailed grouse	3523.81	49.69	1.41	9828.69	115.52	1.18	27676.23	440.18	1.59	40153.06	574.22	1.43
Pileated woodpecker	0	0	0	906.37	13.21	1.46	11620.74	150.96	1.30	4563.70	41.04	0.90
Least bittern	0	0	0	0	0	0	0	0	0	0	0	0
Yellow rail	343.37	1.49	0.43	1680.90	12.27	0.73	7257.69	82.49	1.14	26831.83	347.72	1.30
Ferruginous hawk	0	0	0	0	0	0	0	0	0	0	0	0
Burrowing owl	0	0	0	0	0	0	0	0	0	0	0	0
Short-eared owl	343.37	1.49	0.43	1680.90	12.27	0.73	7257.69	82.49	1.14	28486.60	376.63	1.32
Common nighthawk	381.94	1.49	0.39	30304.50	484.61	1.60	80408.75	1118.96	1.39	59458.01	870.42	1.46
Whip-poor-will	0	0	0	0	0	0	0	0	0	118.14	0.00	0.00
Red-headed woodpecker	0	0	0	0	0	0	0	0	0	0	0	0
Olive-sided flycatcher	481.84	2.01	0.42	30046.87	431.85	1.44	72660.99	1052.40	1.45	85286.47	1150.37	1.35
Loggerhead shrike	0	0	0	0	0	0	0	0	0	0	0	0
Sprague's pipit	0	0	0	0	0	0	0	0	0	7.69	0.00	0.00
Gold-winged warbler	0	0	0	0	0	0	0	0	0	0	0	0
Canada Warbler	0	0	0	0	0	0	0	0	0	5378.82	55.12	1.02
Rusty blackbird	478.93	2.01	0.42	10745.74	111.79	1.04	48186.20	678.19	1.41	78377.78	1053.75	1.34

Species	Interlake Plain			Aspen Parkland			Lake Manitoba Plain			Hudson Bay Lowland		
	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in 66m RoW (ha)	% Affected
Mallard	26995.56	322.32	1.19	36.06	0	0	18997.01	218.33	1.15	22377.39	72.83	0.33
Sandhill crane	23798.90	311.54	1.31	1.29	0	0	24303.15	353.87	1.46	17397.84	71.58	0.41
Great blue heron	38688.59	500.89	1.29	436.84	5.21	1.19	36250.68	533.00	1.47	0	0	0
Bald eagle	551.14	8.37	1.52	99.31	0	0	465.31	3.80	0.82	709.90	0	0
Ruffed grouse	29431.94	371.49	1.26	436.84	5.21	1.19	36219.85	531.32	1.47	111.74	0	0
Sharp-tailed grouse	28560.85	382.45	1.34	98.82	0.00	0.00	37710.05	572.58	1.52	20198.77	181.05	0.90
Pileated woodpecker	14266.49	178.94	1.25	436.84	5.21	1.19	22424.65	326.54	1.46	110.48	0	0
Least bittern	575.04	0	0	0	0	0	13349.99	168.92	1.27	0	0	0
Yellow rail	3785.98	57.05	1.51	0	0	0	7544.24	83.28	1.10	2007.61	19.18	0.96
Ferruginous hawk	1046.90	0	0	396.31	3.49	0.88	20675.28	261.59	1.27	0	0	0
Burrowing owl	1046.90	0	0	396.31	3.49	0.88	20502.61	261.59	1.28	0	0	0
Short-eared owl	30508.42	409.07	1.34	396.31	3.49	0.88	64302.48	883.78	1.37	2007.61	19.18	0.96
Common nighthawk	43797.78	543.32	1.24	242.75	3.49	1.44	85897.96	1189.69	1.39	24472.69	137.30	0.56
Whip-poor-will	2710.56	33.63	1.24	436.84	5.21	1.19	0	0	0	0	0	0
Red-headed woodpecker	13881.15	180.45	1.30	436.84	5.21	1.19	31724.40	468.96	1.48	0	0	0
Olive-sided flycatcher	41565.96	538.74	1.30	1.29	0	0	40643.04	554.74	1.36	34604.08	182.57	0.53
Loggerhead shrike	9245.76	121.72	1.32	396.31	3.49	0.88	54506.39	775.85	1.42	0	0	0
Sprague's pipit	8582.49	119.56	1.39	396.31	3.49	0.88	40826.84	555.98	1.36	0	0	0
Gold-winged warbler	39665.31	508.73	1.28	0	0	0	87578.88	1247.98	1.42	0	0	0
Canada Warbler	27579.54	371.49	1.35	0	0	0	120.52	3.79	3.15	0	0	0
Rusty blackbird	26490.04	339.32	1.28	0	0	0	0	0	0	23676.92	0	0

F-17: Effects of Project components on bird habitat

Species	Construction Power Camp Footprint			L61K (Henday-Long Spruce) 60m RoW		
	Habitat in Local Study Area(ha)	Habitat in footprint (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in footprint (ha)	% Affected
Mallard	22377.39	1.53	0.01	22377.39	82.34	0.37
Sandhill crane	17397.84	1.53	0.01	17397.84	77.42	0.44
Great blue heron	0	0	0	0	0	0
Bald eagle	709.90	0	0	709.90	0.40	0.06
Ruffed grouse	111.74	0	0	111.74	0.90	0.80
Sharp-tailed grouse	20198.77	0.72	<0.01	20198.77	42.15	0.21
Pileated woodpecker	110.48	0	0	110.48	0.90	0.81
Least bittern	0	0	0	0	0	0
Yellow rail	2007.61	0	0	2007.61	0	0
Ferruginous hawk	0	0	0	0	0	0
Burrowing owl	0	0	0	0	0	0
Short-eared owl	2007.61	0	0	2007.61	0.22	0.01
Common nighthawk	24472.69	5.76	0.02	24472.69	29.59	0.12
Whip-poor-will	0	0	0	0	0	0
Red-headed woodpecker	0	0	0	0	0	0
Olive-sided flycatcher	34604.08	7.14	0.02	34604.08	104.91	0.30
Loggerhead shrike	0	0	0	0	0	0
Sprague's pipit	0	0	0	0	0	0
Gold-winged warbler	0	0	0	0	0	0
Canada Warbler	0	0	0	0	0	0
Rusty blackbird	23676.92	3.47	0.01	23676.92	81.37	0.34

Species	KN36 (Keewatinoow-Construction Power Site) 60m RoW			AC Collectors 310m RoW		
	Habitat in Local Study Area (ha)	Habitat in footprint (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in footprint (ha)	% Affected
Mallard	22377.39	12.93	0.06	22377.39	245.97	1.10
Sandhill crane	17397.84	14.12	0.08	17397.84	246.67	1.42
Great blue heron	0	0	0	0	0	0
Bald eagle	709.90	0	0	709.90	10.26	1.45
Ruffed grouse	111.74	0	0	111.74	0.01	<0.01
Sharp-tailed grouse	20198.77	15.85	0.08	20198.77	155.43	0.77
Pileated woodpecker	110.48	0	0	110.48	0	0
Least bittern	0	0	0	0	0	0
Yellow rail	2007.61	0	0	2007.61	17.85	0.89
Ferruginous hawk	0.00	0	0	0	0	0
Burrowing owl	0.00	0	0	0	0	0
Short-eared owl	2007.61	1.02	0.05	2007.61	17.85	0.89
Common nighthawk	24472.69	5.21	0.02	24472.69	1706.03	6.97
Whip-poor-will	0	0	0	0	0	0
Red-headed woodpecker	0	0	0	0	0	0
Olive-sided flycatcher	34604.08	18.31	0.05	34604.08	672.99	1.94
Loggerhead shrike	0	0	0	0	0	0
Sprague's pipit	0	0	0	0	0	0
Gold-winged warbler	0	0	0	0	0	0
Canada Warbler	0	0	0	0	0	0
Rusty blackbird	23676.92	15.01	0.06	23676.92	396.27	1.67

Species	Northern Electrode Line 50m RoW			NES6 Footprint		
	Habitat in Local Study Area (ha)	Habitat in footprint (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in footprint (ha)	% Affected
Mallard	22377.39	3.96	0.02	22377.39	145.12	0.65
Sandhill crane	17397.84	3.63	0.02	17397.84	151.87	0.87
Great blue heron	0	0	0	0	0	0
Bald eagle	709.90	0	0	709.90	0	0
Ruffed grouse	111.74	0	0	111.74	0	0
Sharp-tailed grouse	20198.77	7.07	0.03	20198.77	107.15	0.53
Pileated woodpecker	110.48	0	0	110.48	0	0
Least bittern	0	0	0	0	0	0
Yellow rail	2007.61	0	0	2007.61	3.06	0.15
Ferruginous hawk	0	0	0	0	0	0
Burrowing owl	0	0	0	0	0	0
Short-eared owl	2007.61	0	0	2007.61	3.06	0.15
Common nighthawk	24472.69	9.69	0.04	24472.69	433.50	1.77
Whip-poor-will	0	0	0	0	0	0
Red-headed woodpecker	0	0	0	0	0	0
Olive-sided flycatcher	34604.08	11.35	0.03	34604.08	59.64	0.17
Loggerhead shrike	0	0	0	0	0	0
Sprague's pipit	0	0	0	0	0	0
Gold-winged warbler	0	0	0	0	0	0
Canada Warbler	0	0	0	0	0	0
Rusty blackbird	23676.92	3.63	0.02	23676.92	208.52	0.88

Species	NES7 Footprint			SES1c Footprint		
	Habitat in Local Study Area (ha)	Habitat in Footprint (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in Footprint (ha)	% Affected
Mallard	22377.39	325.10	1.45	18997.01	0	0
Sandhill crane	17397.84	100.49	0.58	24303.15	0	0
Great blue heron	0	0	0	36250.68	0.17	0.00
Bald eagle	709.90	0	0	465.31	0	0
Ruffed grouse	111.74	0	0	36219.85	0.17	0.00
Sharp-tailed grouse	20198.77	23.12	0.11	37710.05	0	0
Pileated woodpecker	110.48	0	0	22424.65	0.17	0.00
Least bittern	0.00	0	0	13349.99	0	0
Yellow rail	2007.61	1.60	0.08	7544.24	0	0
Ferruginous hawk	0	0	0	20675.28	2.89	0.01
Burrowing owl	0	0	0	20502.61	2.89	0.01
Short-eared owl	2007.61	1.60	0.08	64302.48	2.89	0.00
Common nighthawk	24472.69	462.89	1.89	85897.96	15.82	0.02
Whip-poor-will	0	0	0	0	0	0
Red-headed woodpecker	0	0	0	31724.40	0.17	0.00
Olive-sided flycatcher	34604.08	319.10	0.92	40643.04	0	0
Loggerhead shrike	0	0	0	54506.39	2.06	<0.01
Sprague's pipit	0	0	0	40826.84	2.89	0.01
Gold-winged warbler	0	0	0	87578.88	0	0
Canada Warbler	0	0	0	120.52	0	0
Rusty blackbird	23676.92	224.96	0.95	0.00	0	0

Species	SES3c Footprint			Keewatinoow Converter Station		
	Habitat in Local Study Area (ha)	Habitat in Footprint (ha)	% Affected	Habitat in Local Study Area (ha)	Habitat in Footprint (ha)	% Affected
Mallard	18997.01	24.82	0.13	22377.39	1.53	0.01
Sandhill crane	24303.15	59.64	0.25	17397.84	1.53	0.01
Great blue heron	36250.68	214.79	0.59	0	0	0
Bald eagle	465.31	0	0	709.90	0	0
Ruffed grouse	36219.85	155.15	0.43	111.74	0	0
Sharp-tailed grouse	37710.05	29.45	0.08	20198.77	97.70	0.48
Pileated woodpecker	22424.65	155.15	0.69	110.48	0	0
Least bittern	13349.99	59.64	0.45	0	0	0
Yellow rail	7544.24	0	0	2007.61	0	0
Ferruginous hawk	20675.28	23.93	0.12	0	0	0
Burrowing owl	20502.61	23.93	0.12	0	0	0
Short-eared owl	64302.48	23.93	0.04	2007.61	0	0
Common nighthawk	85897.96	741.79	0.86	24472.69	6.79	0.03
Whip-poor-will	2710.56	15.86	0.59	0	0	0
Red-headed woodpecker	31724.40	0	0	0	0	0
Olive-sided flycatcher	40643.04	59.64	0.15	34604.08	8.31	0.02
Loggerhead shrike	54506.39	0	0	0	0	0
Sprague's pipit	40826.84	0	0	0	0	0
Gold-winged warbler	87578.88	0	0	0	0	0
Canada Warbler	120.52	0	0	0	0	0
Rusty blackbird	0.00	0	0	23676.92	8.31	0.04

F-18: Effects of the Bipole III Project on bird habitat

Species	All Project Components		
	Habitat in Local Study Area (ha)	Habitat in Project Footprint (ha)	% Affected
Mallard	166001.11	2470.12	1.49
Sandhill crane	181177.39	2919.75	1.61
Great blue heron	140529.44	2148.81	1.53
Bald eagle	6886.44	50.88	0.74
Ruffed grouse	94068.01	1417.32	1.51
Sharp-tailed grouse	167750.29	2794.34	1.67
Pileated woodpecker	54329.28	872.13	1.61
Least bittern	13925.03	228.55	1.64
Yellow rail	49451.61	625.99	1.27
Ferruginous hawk	22118.49	291.90	1.32
Burrowing owl	21945.82	291.90	1.33
Short-eared owl	134983.37	1838.97	1.36
Common nighthawk	324964.39	7766.35	2.39
Whip-poor-will	3265.55	54.70	1.68
Red-headed woodpecker	46042.40	654.61	1.42
Olive-sided flycatcher	305290.55	4727.54	1.55
Loggerhead shrike	64148.46	1347.74	2.10
Sprague's pipit	49813.33	681.09	1.37
Gold-winged warbler	127244.19	1759.60	1.38
Canada Warbler	33078.88	430.40	1.30
Rusty blackbird	187955.61	2803.08	1.49

F-19: Dates when species a risk are most abundant, and when breeding, nesting, egg laying, or fledging typically occur in Manitoba

Species	Most Abundant in Manitoba[1]	Nesting, Egg, or Fledging Data[2]	Recommended Setback Distance for High-level Disturbance (m)[3]	Recommended Setback Distance for Low-level Disturbance (m)[3]	Map of Potential Habitat
Least bittern	Late May to late August[2]	Not documented but could be similar to American bittern	400	100	6.1-1
Yellow rail	Mid-May to mid-September	Poorly documented; nests observed in June and July in 1962	350	100	5.4-12
Ferruginous hawk	Mid-March to early November	Nest late March peaking in mid-April; fledge in mid-July	1,000	250	6.1-2
Burrowing owl	Mid-April to mid September	Nest late April to early May, young emerge from nests early July. Juveniles and adults depart in September and October	500	200	6.1-3
Short-eared owl	Mid-March to late October	Eggs mid-April to late June; nestlings observed mid-May to early July	500	100	5.4-13
Common nighthawk	Late May to early September	Eggs mid-June to mid-July	200	100	5.4-14
Whip-poor-will	Mid-April to early June	Eggs late May to mid-July	200	100	5.4-15
Red-headed woodpecker	Late May to late August	Nest late May; eggs early to late June, fledge mid- to late July	200	50	5.4-16

Species	Most Abundant in Manitoba[1]	Nesting, Egg, or Fledging Data[2]	Recommended Setback Distance for High-level Disturbance (m)[3]	Recommended Setback Distance for Low-level Disturbance (m)[3]	Map of Potential Habitat
Olive-sided flycatcher	Late May to late August	Eggs mid-June to early July	300	50	5.4-17
Loggerhead shrike	Early May to late August	Eggs mid-May; hatching early June	400	100	6.1-4
Sprague's pipit	Early May to early August	Eggs late May; hatch early June; second brood mid- to late July	250	50	6.1-5
Golden-winged warbler	Early June to mid-August	Nest late May to early July	300	50	5.4-18
Canada warbler	Late May to late August	No documented nests, although breeding highly probable in Manitoba, and likely to occur in June	300	50	5.4-19
Rusty blackbird	Early April and mid-September to mid-November	Breed late May to early July	100	50	5.4-20

F-20: Residual effects on Valued Environmental Components

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
Waterfowl and Other Waterbirds					
Mallard, sandhill crane	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, nest destruction, and hunting	-Place bird diverters at environmental sensitive sites -Restrict Project activities during nesting and brood rearing season -Limit harvesting of wildlife by Project staff -Restrict firearms at construction sites -Decommission access trails -Maintain shrubby vegetation on RoW where possible	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Avoid IBAs and environmental sensitive sites -Maintain natural buffers around wetlands -Apply timing and spatial buffers during construction	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Colonial Waterbirds					
Great blue heron	Population size	Number of birds killed	Increased mortality due wire strikes and nest destruction	-Place bird diverters at environmental sensitive sites -Restrict Project activities during nesting and brood rearing season	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Avoid IBAs and environmental sensitive sites -Maintain natural buffers around	Small loss of suitable habitat

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				wetlands -Apply timing and spatial buffers during construction -Avoid colonies or other groups of birds during helicopter use for line maintenance -Maintain shrubby vegetation on RoW where possible	
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Birds of Prey					
Bald eagle	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Place bird diverters at environmental sensitive sites -Prohibit disruption of occupied stick nests -Restrict Project activities during nesting and brood rearing season	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers around nesting sites -Maintain shrubby vegetation on RoW where possible	Small loss of suitable habitat
			Increased perching opportunities on transmission towers	NA	Small gain in perching habitat
	Availability of suitable habitat	Net change in nesting sites	Loss or gain of nesting opportunities	-Provide artificial structures to replace nests removed during Project activities -Install perch deterrents on towers where perching and nesting are problematic	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Upland Game Birds					
Sharp-tailed grouse, ruffed grouse	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, nest destruction, predation, and hunting	-Place bird diverters at environmental sensitive sites -Restrict Project activities during nesting and brood rearing season -Install perch deterrents on towers near sharp-tailed grouse leks -Limit harvesting of wildlife by Project staff -Restrict firearms at construction sites -Decommission access trails -Maintain shrubby vegetation on RoW where possible	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Avoid IBAs and environmental sensitive sites -Apply timing and spatial buffers during around sharp-tailed grouse leks during construction	Small loss of suitable habitat
	Disruption of daily movements	Number of movements across the RoW	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	-Restrict Project activities during nesting and brood rearing season	No measurable effect on the population
Woodpeckers					
Pileated woodpecker	Population size	Number of birds killed	Increased mortality due to collisions with vehicles and nest destruction	-Restrict Project activities during nesting and brood rearing season	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the	Physical habitat loss and avoidance of habitat due to	-Retain dead standing trees where possible	Small loss of suitable habitat

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
		Local Study Area	sensory disturbance	-Top, rather than remove, danger trees -Limit clearing of trees with roost cavities to daylight hours -Prohibit removal of danger trees during spring nesting season -Apply timing and spatial buffers during construction	
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Species at Risk					
Least bittern	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Place bird diverters at environmental sensitive sites -Prohibit disruption of occupied stick nests -Restrict Project activities during nesting and brood rearing season -Search for nests prior to spring/summer construction or vegetation management -Apply setback distances if the timing of Project activities overlaps with sensitive time periods	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Avoid IBAs and environmental sensitive sites -Maintain natural buffers around wetlands -Apply timing and spatial buffers during construction -Avoid colonies or other groups of birds during helicopter use for	Small loss of suitable habitat

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				line maintenance	
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Yellow rail	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Place bird diverters at environmental sensitive sites -Prohibit disruption of occupied stick nests -Restrict Project activities during nesting and brood rearing season -Search for nests prior to spring/summer construction or vegetation management -Apply setback distances if the timing of Project activities overlaps with sensitive time periods	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Avoid IBAs and environmental sensitive sites -Maintain natural buffers around wetlands -Apply timing and spatial buffers during construction	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Ferruginous hawk	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Place bird diverters at environmental sensitive sites -Prohibit disruption of occupied stick nests -Restrict Project activities during nesting and brood rearing	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods	
Ferruginous hawk	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers around nesting sites -Restrict Project activities during nesting and brood rearing season -Maintain shrubby vegetation on RoW where possible	Small loss of suitable habitat
			Increased perching opportunities on transmission towers	NA	Small gain in perching habitat
		Net change in nesting sites	Loss or gain of nesting opportunities	-Provide artificial structures to replace nests removed during Project activities -Install perch deterrents on towers where perching and nesting are problematic	No measurable effect on the population
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Burrowing owl	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Avoidance of the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Short-eared owl	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, wire strikes, and nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Avoidance of the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Red-headed woodpecker	Population size	Number of birds killed	Increased mortality due to collisions with vehicles and nest destruction	-Restrict Project activities during nesting and brood rearing season	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Retain dead standing trees where possible -Top, rather than remove, danger trees -Limit clearing of trees with roost cavities to daylight hours -Prohibit removal of danger trees	Small loss of suitable habitat

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				during spring nesting season -Apply timing and spatial buffers during construction -Search for nests prior to spring/summer construction or vegetation management	
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Common nighthawk	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, predation, and nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season	Small loss of suitable habitat
Common nighthawk	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Whip-poor-will	Population size	Number of birds killed	Increased mortality due to collisions with vehicles, predation, and nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				-Search for nests prior to spring/summer construction or vegetation management	
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Olive-sided flycatcher	Population size	Number of birds killed	Increased mortality due to nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
Olive-sided flycatcher	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season -Maintain shrubby vegetation on RoW where possible as potential habitat	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Loggerhead shrike	Population size	Number of birds killed	Increased mortality due to predation and nest destruction	-Restrict Project activities during nesting and brood rearing season	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				-Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season -Maintain shrubby vegetation on RoW where possible as potential habitat	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Sprague's pipit	Population size	Number of birds killed	Increased mortality due nest destruction, decreased productivity due to brood parasitism	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season -Maintain shrubby vegetation on RoW where possible	Small loss of suitable habitat
	Disruption of	Number of movements	Disruption of movements due	NA	No measurable

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
	seasonal and daily movements	across the RoW; altered migratory routes	to physical presence of humans, machinery, RoW, and transmission lines and towers		effect on the population
Golden-winged warbler	Population size	Number of birds killed	Increased mortality due nest destruction, decreased productivity due to brood parasitism	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Avoid night-time activities during the nesting season -Maintain shrubby vegetation on RoW where possible as potential habitat -Maintain habitat by selective basal spraying for vegetation management on southern portion of RoW where feasible	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Canada warbler	Population size	Number of birds killed	Increased mortality due nest destruction, decreased productivity due to brood parasitism	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods	No measurable effect on the population

Valued Environmental Component	Environmental Indicator	Measurable Parameter/Variable	Environmental Effect	Mitigation Measures	Residual Environmental Effect
				-Search for nests prior to spring/summer construction or vegetation management	
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Maintain shrubby vegetation on RoW where possible as potential habitat	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population
Rusty blackbird	Population size	Number of birds killed	Increased mortality due nest destruction	-Restrict Project activities during nesting and brood rearing season -Apply setback distances if the timing of Project activities overlaps with sensitive time periods -Search for nests prior to spring/summer construction or vegetation management	No measurable effect on the population
	Availability of suitable habitat	Percentage of suitable habitat remaining in the Local Study Area	Physical habitat loss and avoidance of habitat due to sensory disturbance	-Apply timing and spatial buffers during construction -Maintain shrubby vegetation on RoW where possible	Small loss of suitable habitat
	Disruption of seasonal and daily movements	Number of movements across the RoW; altered migratory routes	Disruption of movements due to physical presence of humans, machinery, RoW, and transmission lines and towers	NA	No measurable effect on the population

APPENDIX G

Effects of Project Components on VECs

Effects of Project Components on VECs

HVdc Transmission and AC Collector Lines

Clearing and Construction

Mallard

Mortality of mallards could increase slightly during construction. As clearing will occur after the fall migration throughout the Footprint, no increase in mortality is expected during this stage. Opportunistic harvest of mallards by construction workers and the public during the legal hunting season may increase as local access is enhanced by the HVdc transmission and AC collector line RoWs. Legal harvest may not increase if clearing occurs out of season, but opportunities for domestic harvest and illegal harvest may improve, and potentially result in mallard mortality in the Local Study Area. As most access will be controlled along the RoW during clearing and construction for safety reasons, hunting mortality is expected to be limited. Nests in wetlands could inadvertently be damaged or destroyed during spring and summer construction; however construction activities in these habitats will be limited, and consequently, few nests will be affected.

Clearing of the RoWs will result in minimal habitat alteration for mallards, as the HVdc transmission line route was selected to avoid wetlands and other water bodies where possible. Consequently, only an estimated 1.49% of mallard habitat in the Local Study Area is expected to be altered on the HVdc transmission line RoW. An additional 1.10% of mallard habitat is expected to be altered on the AC collector lines. Mallards can benefit from clearings such as RoWs. Small habitat alterations and losses may affect a few individuals in the - but are not expected to have a measurable effect on local mallard populations or on breeding and nesting habitat availability.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of mallards, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations. Limited re-nesting may occur if mallards are disturbed early in the nesting season, and suitable nesting habitat is found elsewhere in the Local Study Area.

Sandhill Crane

Mortality of sandhill cranes could increase slightly during construction. As clearing will occur after the fall migration, no increase in mortality is expected during this stage. Opportunistic harvest of sandhill crane by construction workers and the public during the legal hunting season may increase as local access is enhanced by the HVdc transmission and AC collector line RoWs. Legal harvest may not increase if clearing occurs out of season, but opportunities for domestic harvest and illegal harvest may improve, and potentially result in sandhill crane mortality in the Local Study Area. As most access will be controlled along the RoW during clearing and construction for safety reasons, hunting mortality is expected to be limited. Nests in wetlands could inadvertently be damaged or destroyed during spring and summer construction; however construction activities will most likely be limited to dry areas where machinery can operate, and consequently, few nests will be affected.

Clearing of the RoWs will result in minimal habitat alteration for sandhill crane, as the HVdc transmission line route was selected to avoid wetlands and other water bodies where possible. Consequently, only an estimated 1.42% of sandhill crane habitat in the Local Study Area is expected to be altered on the HVdc transmission line RoW. An additional 1.42% of sandhill crane habitat is expected to be altered on the AC collector lines. Sandhill cranes can benefit from clearings such as RoWs. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local sandhill crane populations or on breeding and nesting habitat availability.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of sandhill cranes, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations. Limited re-nesting may occur if sandhill cranes are disturbed early in the nesting season, and suitable nesting habitat is found elsewhere in the Local Study Area.

Great Blue Heron

Few direct causes of great blue heron mortality are anticipated for the clearing and construction phase. As clearing will occur before the spring migration and after the fall migration, no increase in mortality is expected during this stage. It is unlikely that nests will be damaged during construction, as colonies will have been identified during the clearing stage.

Clearing of the RoWs will result in minimal habitat alteration for great blue herons. An estimated 1.53% of great blue heron habitat in the Local Study Area is expected to be altered on the HVdc transmission line RoW. Small habitat alterations losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of colonial waterbirds, the restriction of clearing and northern construction activities to winter negates these effects. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Bald Eagle

Few direct causes of bald eagle mortality are expected during the clearing and construction phase. Birds of prey are somewhat susceptible to collisions with vehicles (Harness and Wilson 2001; AltaLink Management Ltd. 2006; Stinson *et al.* 2007). Limited increases in local traffic to and from construction sites, and low vehicle speeds along the RoW are expected to result in very few accidental bald eagle injuries or mortalities.

Clearing of the RoW will result in the disruption, alteration, and improvement of some nesting and foraging habitat. Specifically, 0.74% of bald eagle habitat in the Local Study Area is expected to be altered on the HVdc transmission line RoW with an additional 1.45% affected along the AC collector lines RoW. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

While sensory disturbances from clearing and construction could affect bald eagle breeding, nesting, and daily movements, the restriction of clearing and northern construction activities to winter reduces these potential effects. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Ruffed Grouse

Ruffed grouse mortality could increase during clearing and construction. Opportunistic harvest of ruffed grouse by construction workers and the public during the legal hunting season may increase as access is created by the HVdc transmission line and AC collector line RoWs. As the season for these species ends in mid-December (Manitoba Conservation 2010c), legal harvest may not increase if clearing occurs out of season, but opportunities for domestic harvest and illegal harvest may improve, and could result in ruffed grouse mortality in the Local Study Area.

As most access will be controlled along the RoW during clearing and construction for safety reasons, hunting mortality is expected to be limited.

Ruffed grouse habitat will be altered and disrupted during clearing of the RoWs. In some cases, the habitat created on the RoWs could improve ruffed grouse breeding and nesting opportunities. Ruffed grouse will benefit from edge habitat created on the RoW. An estimated 1.51% of ruffed grouse habitat is expected to be altered on the HVdc transmission line RoW, while less than 0.01% of habitat is expected to be altered along the AC collector lines RoW in the Local Study Area. Sufficient habitat is located within the Local Study Area and Project Study Area to sustain ruffed grouse populations. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

Sensory disturbances from clearing and construction could affect ruffed grouse breeding, nesting, and daily movements. As ruffed grouse are not migratory, clearing and construction activities may result in individual birds temporarily abandoning nearby habitat in the vicinity of the RoWs. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals.

Sharp-tailed Grouse

Sharp-tailed grouse mortality could increase during clearing and construction. Opportunistic harvest of sharp-tailed grouse by construction workers and the public during the legal hunting season may increase as access is created by the HVdc transmission and AC collector line RoWs. As the season for these species ends in mid-December (Manitoba Conservation 2010c), legal harvest may not increase if clearing occurs out of season, but opportunities for domestic harvest and illegal harvest may improve, and potentially result in sharp-tailed grouse mortality in the Local Study Area. As most access will be controlled along the RoW during clearing and construction for safety reasons, hunting mortality is expected to be limited.

Sharp-tailed grouse are also susceptible to collisions with vehicles (Clevenger *et al.* 2003). If construction of transmission line RoWs occurs over a lek area, these areas could operate as ecological traps where many individual birds could be killed by collisions with vehicles. Sharp-tailed grouse have strong site fidelity to lek areas (Drummer *et al.* 2011) and will be particularly at-risk if construction activities coincide with higher levels of vehicle traffic.

Sharp-tailed grouse habitat will be altered and disrupted during clearing of the RoWs. In some cases, the altered habitat created on the RoWs could improve sharp-tailed grouse breeding and nesting opportunities. Additionally, sharp-tailed grouse will benefit from edge habitat created on the RoW. An estimated 1.67% of sharp-tailed grouse habitat is expected to be altered on the HVdc transmission line RoW, while less than 0.77% of habitat is expected to be altered along the AC collector lines RoW in the Local Study Area. There is sufficient habitat in the Local Study Area and Project Study Area to sustain sharp-tailed grouse populations. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

As sharp-tailed grouse are not migratory, clearing and construction activities may result in individual birds temporarily abandoning nearby habitat in the vicinity of the RoWs. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals. In particular, male sharp-tailed grouse are displaced from leks by human presence (Baydack and Hein 1987; Connelly *et al.* 1998). Excessive and continual disturbances in the vicinity of a sharp-tailed grouse lek could result in the potential loss of an entire nesting season for the local population.

Pileated Woodpecker

Few direct causes of pileated woodpecker mortality are expected during the clearing and construction phase. These birds are prone to collisions with vehicles when foraging on the ground (Bull and Jackson 1995). Limited increases in local traffic to and from construction sites, and low vehicle speeds along the RoWs are expected to result in very few accidental pileated woodpecker injuries or mortalities.

Clearing of the RoW will result in minimal habitat alteration for woodpeckers, as the preferred transmission line route was selected to avoid core communities with large tracts of forest where possible. As a result, an estimated 1.61% of pileated woodpecker habitat in the Local Study Area will be altered on the HVdc transmission line RoW. As pileated woodpecker habitat alterations are small, these populations are unlikely to be affected by Project. The removal of dead standing trees on or near the RoWs during clearing could result in the loss of woodpecker nesting habitat. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of pileated woodpeckers, the restriction of clearing and northern construction activities to winter negates these potential effects on this migratory species. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Least Bittern

No direct Project-related effects on least bittern mortality are expected in the northern Footprint during the clearing and construction phase, as this species' range is limited mainly to southeastern Manitoba, and potentially, to a few sites west of Lake Manitoba. As this species is migratory, no effects on mortality are anticipated during winter clearing. If construction occurs in wetlands during the nesting period in spring and early summer, least bittern nests in the overlapping construction zone could be damaged or destroyed. However, construction activities in these habitats will most likely be limited to dry areas where machinery can operate, and consequently, few nests will be affected. Collisions with vehicles are a threat to least bittern populations (COSEWIC 2009b). These collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with least bittern range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect local and regional populations, and mitigation measures are required to minimize these potential effects.

A total of 1.64% of least bittern habitat in the Local Study Area will be affected on the HVdc transmission line RoW. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, least bittern nesting habitat may improve slightly where forest is converted to marsh wetlands.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of least bitterns, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Yellow Rail

Yellow rail range extends throughout the Footprint. No direct effects on yellow rail mortality are anticipated during clearing, as this migratory species will not be the area in winter. In the southern Footprint, nests could be damaged or destroyed if construction occurs during the spring nesting period. Disguised nests can be found on or near the ground in sedge meadows (Brookhout 1995), which can inadvertently be run over by machinery (COSEWIC 2009a). As construction activities in these habitats will most likely be limited to dry areas where machinery can operate, few nests will be affected. Yellow rails have been known to collide with vehicles (Bookhout 1995). Local increases in traffic associated with construction activities may temporarily increase the risk of yellow rail collisions with vehicles, increasing the occurrences of mortality or injury. These types of collisions will be limited to the southern portion of the route.

Habitat loss and degradation are reported as threats to yellow rails (COSEWIC 2009a). A total of 1.27% of yellow rail habitat on the HVdc transmission line RoW, and 0.89% on the AC collector lines RoW, will be affected in the Local Study Area. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, yellow rail nesting habitat may improve slightly where forest is converted to sedge and marsh wetlands.

While sensory disturbances construction could affect breeding, nesting, and daily movements of yellow rails, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Ferruginous Hawk

No direct effects on ferruginous hawk mortality are anticipated in the northern Footprint during clearing and construction, as the species' range is limited to southern Manitoba. As this species is migratory, no effects on mortality are anticipated for winter clearing. In the southern Footprint, ferruginous hawks, like other birds of prey, may be susceptible to collisions with vehicles (e.g., Bechard and Schmutz 1995) due to local traffic increases during spring and summer construction. These collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with ferruginous hawk range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect Local and regional populations, and mitigation measures are required to minimize these potential effects.

Although an estimated 1.32% of ferruginous hawk habitat in the Local Study Area could be affected on the HVdc transmission line RoW, no nesting ferruginous hawks were found during surveys in the Local Study Area. Habitat for this species is most likely underutilized, particularly in areas where suitable nesting and foraging areas exist (Leary *et al.* 1998). Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability, but only if multi-generational stick nests are not disturbed or removed.

Ferruginous hawks are particularly susceptible to disturbance by human activity, often resulting in nest/young abandonment (De Smet 2003a; Hoffman and Smith 2003). Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. The restriction of clearing activities to winter negates some potential effects; however, sensory disturbances from construction in summer may result in nest/young abandonment by some individuals and could disrupt daily movements if any ferruginous hawk nests are found in the Local Study Area.

Burrowing Owl

As burrowing owl range is limited to extreme south-western Manitoba, Project-related effects will be geographically limited. Burrowing owls are migratory, and no effects on mortality are anticipated during winter clearing. As burrowing owls nest on the ground in sparsely vegetated areas (DeSmet 2003b), construction in the southwestern Footprint during the spring nesting season could result in inadvertent damage to or destruction of nests. The tendency of burrowing owls to forage near roads makes them susceptible to collisions with vehicles, which contribute to the species' mortality (Haug *et al.* 1993; COSEWIC 2006b). Local increases in traffic associated with construction activities may temporarily increase the risk of burrowing owl collisions with vehicles; however these collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with burrowing owl range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect local and regional populations, and mitigation measures are required to minimize these potential effects.

Habitat alteration and degradation have been identified as significant contributors to declining burrowing owl populations (COSEWIC 2006b). An estimated 1.33% of burrowing owl habitat in the Local Study Area will be affected on the HVdc transmission line RoW. However, burrowing owls have not occupied apparently suitable habitats in eastern Manitoba for many years and are considered to be extirpated from the province with the last breeding pair found in 1999 (COSEWIC 2006b). Consequently, small habitat alterations and losses could affect a few individuals but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability, but only if nesting burrows are not disturbed. In some cases, burrowing owl foraging habitat could also increase slightly where forest is converted to grassland.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of burrowing owls, effects will be limited to the species' range. Although there is some uncertainty as to how far these effects may extend, they are not anticipated to extend beyond 1 km, and only where heavy machinery and construction noise are the greatest. The restriction of clearing activities to winter negates some potential effects; however, sensory disturbances from construction in summer may result in nest or young abandonment by some individuals and could disrupt daily movements if burrowing owl burrows are found in the Local Study Area.

Short-eared Owl

Short-eared owl range extends throughout the Project Study Area. As this species is migratory, no effects on mortality are anticipated during winter clearing. Short-eared owls are ground nesters (Holt and Leasure 1993) and their nests and eggs can be destroyed by machinery (COSEWIC 2008a). Many short-eared owls nest in wetlands, and are unlikely to be affected given limited construction activities in this habitat. Some nest in agricultural areas such as haylands, where construction may occur. Collisions with vehicles contribute to short-eared owl mortality (COSEWIC 2008a), and temporary increases in local traffic may affect individuals in the southern Footprint during spring and summer construction. These collisions are generally infrequent, and the limited temporal overlap of construction activities with short-eared owl range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect local and regional populations, and mitigation measures are required to minimize these potential effects.

Habitat alteration or conversion has been identified as contributing to short-eared owl population decline in the Prairie Provinces (COSEWIC 2008a). An estimated 1.36% of short-eared owl habitat on the HVdc transmission line RoW, and 0.89% along the AC collector lines RoW, will be affected in the Local Study Area. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, short-eared owl nesting habitat may improve slightly where forest is converted to grasslands and wet shrublands.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of short-eared owls, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from spring and summer construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Common Nighhawk

Common nighthawk range extends throughout the Project Study Area. No effects on this migratory species' mortality are anticipated during winter clearing. These birds lay eggs directly on the ground in open areas (Taylor 2003j), and eggs or hatchlings could be destroyed during construction in summer. Common nighthawks frequently roost on bare patches on the ground, and are susceptible to collisions with vehicles (COSEWIC 2007b). Local increases in traffic associated with construction activities may temporarily increase the risk of common nighthawk collisions with vehicles. These collisions are generally infrequent, and the limited temporal overlap of construction activities with common nighthawk range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect local and regional populations, and mitigation measures are required to minimize these potential effects. A common nighthawk was found dead on the roadside during 2010 bird surveys, indicating that collisions with vehicles are possible in the Project Study Area.

COSEWIC (2007b) reports that habitat loss or alteration may contribute to the decline of common nighthawk populations in the Prairie Provinces. Approximately 2.39% of common nighthawk habitat on the HVdc transmission line RoW, and 6.97% on the AC collector lines RoW, will be affected in the Local Study Area. With the exception of the AC collector line RoW, small habitat alterations and potential losses may affect a few individuals but are not expected to have a measurable effect on the common nighthawk population or to breeding and nesting habitat availability. The effect of habitat alteration along the AC collector lines is considered to be greater in magnitude than the HVdc transmission line RoW as greater than 5% of the available habitat will be affected. In some cases, common nighthawk nesting habitat may improve slightly where forest is converted to open habitats where nighthawks nest on the ground and often forage in open habitats.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of common nighthawks, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Whip-poor-will

Whip-poor-will range extends throughout southern Manitoba, and no effects are anticipated in the northern Footprint. No effects on this migratory species' mortality are anticipated during winter clearing. Whip-poor-wills tend to rest beside roadways, making them susceptible to collisions with vehicles (Cink 2002; COSEWIC 2009c), and local increases in traffic associated with construction activities may temporarily increase the risk of collisions with vehicles. These collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with whip-poor-will range in Manitoba will limit the risk of increased mortality. All sources of mortality are important to species at risk as they can affect local and regional populations, and mitigation measures are required to minimize these potential effects.

Habitat alteration or conversion is thought to contribute to whip-poor-will population decline in the Prairie Provinces (Cink 2002), but no direct link has been identified (COSEWIC 2009c). Approximately 1.68% of whip-poor-will habitat in the Local Study Area will affected on the HVdc transmission line RoW. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, whip-poor-will nesting habitat may improve slightly where forest is converted to open habitats where they nest and often forage.

While sensory disturbances from construction could affect breeding, nesting, and daily movements of whip-poor-wills, effects will be geographically and temporally limited. Clearing will be limited to the winter months, thus there will be no sensory disturbance effects at this time. Sensory disturbances and disruption of movements during construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Red-headed Woodpecker

Red-headed woodpecker range extends throughout southern Manitoba, and no effects are anticipated in the northern Footprint. As this species is migratory, no effects on mortality are anticipated during winter clearing. Collisions with vehicles during roadside foraging are a source of red-headed woodpecker mortality (COSEWIC 2007c). Local increases in traffic associated with construction activities may temporarily increase the risk of collisions with vehicles. These collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with red-headed woodpecker range in Manitoba will limit the risk of increased mortality. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

The decline in red-headed woodpecker populations has been attributed to the past loss of large tracts of mature deciduous forests (COSEWIC 2007c). The removal of dead trees for nesting and roosting is a more recent limiting factor for red-headed woodpeckers (COSEWIC 2007c). Approximately 1.68% of red-headed woodpecker habitat in the Local Study Area will be affected on the HVdc transmission line RoW. The removal of dead or dying trees on or near the RoW within red-headed woodpeckers' range could result in the loss of some nesting habitat. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability.

While sensory disturbances during construction could affect breeding, nesting, and daily movements of red-headed woodpeckers, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Olive-sided Flycatcher

Olive-sided flycatcher range overlaps most of the Project Study Area. No effects on this migratory species' mortality are anticipated during winter clearing. Olive-sided flycatchers are unlikely to nest on the cleared RoWs where shrubs are not yet present, and collisions with vehicles were not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2007d) indicates that habitat loss and alteration are thought to contribute to declining olive-sided flycatcher populations. A total of 1.55% of olive-sided flycatcher habitat in the Local Study Area will be affected on the HVdc transmission line RoW, and 1.94% on the AC collector lines RoW. Small habitat alterations and losses may affect a few individuals where suitable perch trees are removed, but are not expected to have a measurable effect on local populations or to breeding and nesting habitat availability. In some cases, olive-sided flycatcher nesting habitat may improve slightly where forest is converted to open wetland or shrubland.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of olive-sided flycatchers, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Loggerhead Shrike

Loggerhead shrike range is limited to southern Manitoba. Although this species is unlikely to be encountered as its currently known range is essentially restricted to the area around Winnipeg (COSEWIC 2004), there is minor potential for the western race to occur along the route in pasturelands and shelterbelts. As this species is migratory, no effects on mortality are anticipated during winter clearing. As loggerhead shrikes often forage near roads, collisions with vehicles can be a major source of mortality (DeSmet 2003c; COSEWIC 2004). Local increases in traffic associated with construction activities may temporarily increase the risk of collisions with vehicles. These collisions are generally infrequent, and the limited spatial and temporal overlap of construction activities with loggerhead shrike range in Manitoba will limit the risk of increased mortality. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

Habitat loss or degradation has been identified as contributing to declining loggerhead shrike populations (COSEWIC 2004). The reduction of native grassland in the Prairie Provinces and the central Great Plains of the United States has eliminated breeding habitat, and foraging habitat in migration and wintering areas has also been lost (COSEWIC 2004). Although an estimated 2.10% of loggerhead shrike habitat in the Local Study Area could be affected on the HVdc transmission line RoW, no nesting loggerhead shrikes where not found during surveys in the Local Study Area In some cases, loggerhead shrike nesting habitat may improve slightly where forest is converted to grassland and shrubland.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of loggerhead shrikes, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Sprague's Pipit

No direct effects on Sprague's pipit mortality are anticipated in the northern Footprint during clearing and construction, as the species' range is limited to southern Manitoba. As this species is migratory, no effects on mortality are anticipated for winter clearing Sprague's pipits nest on the ground in tall grass (Holland *et al.* 2003a), and could nest on the cleared RoW in spring; these nests could be potentially be destroyed during spring and summer construction.

Clearing of the RoW will result in minimal habitat alteration for sensitive grassland birds such as Sprague's pipit, as the transmission line route was selected to avoid large core communities of grasslands where possible. Although approximately 1.37% of Sprague's pipit habitat in the Local Study Area will be affected on the HVdc transmission line RoW, nesting Sprague's pipits were not found during surveys in the Local Study Area. Habitat carrying capacity for this species is most likely underutilized (Holland *et al.* 2003).In some cases, Sprague's pipit nesting habitat may improve slightly where forest is converted to grassland, although there is a moderate level of uncertainty as to whether these habitats will be occupied by local populations.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of Sprague's pipits, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Golden-winged Warbler

Golden-winged warbler range is limited to southern Manitoba. No effects on this migratory species' mortality are anticipated during winter clearing. Golden-winged warblers are unlikely to nest on the cleared RoW where shrubs are not yet present, and collisions with vehicles were not reported in the literature reviewed. No Project-related effects on mortality are expected during the clearing and construction phase.

Golden-winged warblers thrive on human-caused disturbances such as RoWs (COSWEIC 2006c), and could benefit from the habitat created by clearing the RoW in southern and west-central Manitoba, where this species is an uncommon breeder (Edie *et al.* 2003a). An estimated 1.38% of golden-winged warbler habitat in the Local Study Area will be affected on the HVdc transmission line RoW.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of golden-winged warblers, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Canada Warbler

Canada warbler range extends throughout southern to central Manitoba. As this species is migratory, no effects on mortality are anticipated during winter clearing. Canada warblers are unlikely to nest on the cleared RoW where shrubs are not yet present, and collisions with vehicles were not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2008b) reports that loss and alteration of breeding and wintering habitat are contributing factors in the decline of Canada warbler populations. Clearing of the RoW will result in minimal habitat alteration for Canada warblers, as the transmission line route was selected to avoid large core communities of deciduous forest where possible (WRCS 2011).An estimated 1.30% of Canada warbler habitat in the Local Study Area will be will be affected on the HVdc transmission line RoW. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, Canada warbler nesting habitat may improve slightly where forest is converted to tall shrublands.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of Canada warblers, effects will be geographically and temporally limited. Clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. Sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations.

Rusty Blackbird

Rusty blackbird range extends throughout Manitoba. As this species is migratory, no effects on mortality are anticipated during winter clearing. Rusty blackbirds nest mainly in northern treed muskeg habitat (Nero and Taylor 2003), and are unlikely to nest on the cleared RoW where regenerating vegetation is not yet present. Collisions with vehicles were not reported in the literature reviewed. No Project-related effects are expected during the clearing and construction phase.

COSEWIC (2006a) indicates that alteration of wintering habitat is the most important threat to rusty blackbird populations, and loss of breeding habitat also contributes to this species' decline. The estimated 1.49 % of rusty blackbird habitat in the Local Study Area will be affected on the HVdc transmission line RoW, and 1.67% along the AC collector lines RoW. Small habitat alterations and losses may affect a few individuals in the Footprint but are not expected to have a measurable effect on local populations or on breeding and nesting habitat availability. In some cases, rusty blackbird nesting habitat may improve slightly where forest is converted to grassland and shrubland.

While sensory disturbances from clearing and construction could affect breeding, nesting, and daily movements of rusty blackbirds, the restriction of clearing and northern construction activities to winter negates these potential effects. Similarly, clearing in the south will be limited to the winter months, and potential sensory disturbance effects will not occur. In the southern Footprint, sensory disturbances and disruption of movements from construction will be limited to daily effects including site abandonment and avoidance by a few individuals, and will most likely occur around heavy construction locations. As most rusty blackbird breeding habitat is found in the boreal forest, sensory disturbance will be minimal in the southern Footprint.

Operation and Maintenance

Mallard

Improved access to the Project area via the RoWs and access roads could lead to a small increase in harvest of mallards. Mallards account for a large portion of deaths due to collisions with power lines (Faanes 1987; Brown and Drewien 1995; Training Unlimited Inc. 2000). While individual birds may occasionally collide with wires, otherwise healthy populations should not be affected by such incidents (Bevanger 1998). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires.

Provincial harvest management strategies and regulations are important considerations in ensuring sustainable mallard population goals are met.

As vegetation management is expected to occur only during the winter in the north no loss of effective habitat or disruption of movements is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of mallards. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be some loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, all terrain vehicles (ATVs)) along the route.

Sandhill Crane

Improved access to the Project area via the RoWs and access roads could lead to a small increase in harvest of sandhill crane. Sandhill cranes account for a large portion of deaths due to collisions with power lines (Faanes 1987; Brown and Drewien 1995; Training Unlimited Inc. 2000). While individual birds may occasionally collide with wires, otherwise healthy populations should not be affected by such incidents (Bevanger 1998). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. Provincial harvest management strategies and regulations are important considerations in ensuring sustainable sandhill crane population goals are met.

As vegetation management is expected to occur only during the winter in the north no loss of effective habitat or disruption of movements is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of sandhill crane. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be some loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, all terrain vehicles (ATVs)) along the route.

Great Blue Heron

Colonial waterbirds such as great blue heron account for a large portion of deaths due to collisions with power lines (Faanes 1987; Brown and Drewien 1995; Training Unlimited Inc. 2000). While individual birds may occasionally collide with wires, otherwise healthy populations should not be affected by such incidents (Bevanger 1998). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires.

As vegetation management is expected to occur only during the winter in the north no loss of effective habitat or disruption of movement is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting and daily movements of colonial waterbirds. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, ATVs) along the route.

Bald Eagle

Electrocution can be a significant source of bird of prey mortality (Lehman *et al.* 2007). As large birds of prey such as bald eagle are susceptible to electrocution (Harness and Wilson 2001; Millsap *et al.* 2004), mortality could increase where they are attracted to the transmission line and structures. With the configuration of the Bipole III HVdc transmission line, electrocutions are highly unlikely to occur. Collisions with wires are a potential source of mortality, and species that fly at high speeds in pursuit of prey, such as northern goshawk, are most prone to collisions (Bevanger 1994). The potential for bird-wire collisions was minimized when the HVdc transmission line route was selected, as raptor migration corridors were avoided where possible. Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. While individual birds may occasionally collide with transmission wires, otherwise healthy populations should not be affected by such incidents.

As vegetation management is expected to occur only during the winter in the north no loss of effective habitat or disruption of movement is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of birds of prey. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, ATVs) along the route.

Ruffed Grouse

Improved access to the Project Study Area via the RoWs and access roads could lead to a small increase in harvest of ruffed grouse. Provincial harvest management strategies and regulations are important considerations in ensuring sustainable ruffed grouse population goals are met. Ruffed grouse are vulnerable to collisions with transmission wires (Janss 2000; Bevanger and Brøseth 2001). Ground wires tend to increase the susceptibility of some bird species to collisions, as the risk of collisions increases with the number of levels of wires (Bevanger and

Brøseth 2001). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires.

As ruffed grouse are not migratory, vegetation management may affect breeding, nesting, and daily movements of individuals regardless of the time of year. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, ATVs) along the route.

Sharp-tailed Grouse

Improved access to the Project Study Area via the RoWs and access roads could lead to a small increase in harvest of sharp-tailed grouse. Provincial harvest management strategies and regulations are an important consideration in ensuring sustainable sharp-tailed grouse goals are met. Mortality due to predation could increase, as raptors could perch on transmission towers above sharp-tailed grouse leks. Sharp-tailed grouse are vulnerable to collisions with transmission wires (Janss 2000; Bevanger and Brøseth 2001). Ground wires tend to increase the susceptibility of some bird species to collisions, as the risk of collisions increases with the number of levels of wires (Bevanger and Brøseth 2001). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires.

As sharp-tailed grouse are not migratory, vegetation management may affect breeding, nesting, and daily movements of individuals regardless of the time of year. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, ATVs) along the route.

Pileated Woodpecker

Few Project-related effects on pileated woodpecker mortality or other woodpecker species are anticipated. The removal of danger trees in the vicinity of the RoW in spring could damage or destroy woodpecker nests.

For migratory woodpeckers vegetation management is not expected to result in any loss of effective habitat or disruption of movements as this work is limited to the winter in the north. For woodpeckers found in the south and non-migratory woodpeckers, such as pileated woodpeckers, vegetation management may affect the breeding, nesting, and daily movements of individuals regardless of the time of year. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., snowmobiles, ATVs) along the route.

Least Bittern

Collisions with overhead wires are a locally serious threat to least bitterns (COSEWIC 2009b), particularly at wetland sites. Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. If vegetation maintenance activities coincide with the spring nesting season, nests could inadvertently be damaged or destroyed. Effects on mortality will be limited to the extreme southern portion of the transmission line, the extent of least bittern range in Manitoba. As this species is migratory, no effects on mortality are anticipated during the winter. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

Vegetation management may occur year round in the known range of least bitterns and consequently may affect their breeding, nesting, and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) along the route.

Yellow Rail

Collisions with tall structures contribute to yellow rail mortality (Goldade *et al.* 2002). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. As all sources of mortality are important to species at risk since they can affect local and regional populations, mitigation measures are required to minimize these potential effects. Collisions with transmission towers and lines will most likely occur at wetland sites. If vegetation maintenance activities coincide with the spring nesting season, nests could inadvertently be damaged or destroyed. As this species is migratory, no effects on mortality are anticipated during the winter.

As vegetation management will only occur in winter in the north no loss of effective habitat or disruption of movements is expected. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of yellow rails. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from access such as recreational use (e.g., ATVs) along the route.

Ferruginous Hawk

Ferruginous hawks have been reported to occasionally strike overhead wires (Bechard and Schmutz 1995). Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. Such collisions will be geographically limited, as the species' range is limited to southern Manitoba. The potential for bird-wire collisions was minimized when the HVdc transmission line route was selected, as raptor migration corridors were avoided where possible. No direct effects on ferruginous hawk mortality are anticipated in the northern Footprint during operation and maintenance. As this species is migratory, no effects on mortality are anticipated during the winter. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

Vegetation management may occur year round in the known range of ferruginous hawks and consequently may affect their breeding, nesting, and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Burrowing Owl

Burrowing owl collisions with transmission wires are seemingly uncommon, and do not appear to be a large source of mortality. Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires. The potential for bird-wire collisions was minimized when the HVdc transmission line route was selected, as raptor migration corridors were avoided where possible. No direct effects on burrowing owl mortality are anticipated in the northern Footprint during operation and maintenance. As this species is migratory, no effects on mortality are anticipated during the winter. If vegetation maintenance activities coincide with the spring nesting season, nests could be damaged or destroyed. Effects on mortality will be limited to the south-western portion of the transmission line, the extent of burrowing owl range in Manitoba. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

Vegetation management may occur year round in the known range of burrowing owls and consequently may affect their breeding, nesting, and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Short-eared Owl

Collisions with transmission wires contribute to short-eared owl mortality (COSEWIC 2008a). The potential for bird-wire collisions was minimized when the HVdc transmission line route was selected, as raptor migration corridors were avoided where possible. Potential collision occurrences can be minimized in areas of high incidents with the use of deflectors to increase the visibility of these wires As this species is migratory, no effects on mortality are anticipated during the winter. As this species nests on the ground in open areas (Holland and Taylor 2003f), vegetation management during the spring nesting season could damage or destroy nests. As all sources of mortality are important to species at risk as they can affect local and regional populations, mitigation measures are required to minimize these potential effects.

As vegetation management is expected to occur only during winter in the north, no loss of effective habitat or disruption of movements is expected. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of short-eared owls. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Common Nighthawk

Predation by terrestrial predators such as raccoon and striped skunk is a source of common nighthawk mortality (COSEWIC 2007b), and could increase due to improved predator mobility on the cleared RoWs. As common nighthawks lay eggs on the ground in clearings (Taylor 2003j), eggs or hatchlings could be damaged or destroyed during vegetation maintenance in spring. As this species is migratory, no effects on mortality are anticipated during the winter.

As vegetation management is expected to occur only during winter in the north no loss of effective habitat or disruption of movement is expected to occur. In the south, vegetation management may occur year round and may affect the breeding, nesting, and daily movements of common nighthawks. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. There may also be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Whip-poor-will

Whip-poor-wills lay their eggs directly on the ground on the forest floor (Cink 2002), and the cleared RoW could provide suitable nesting habitat if sites are maintained within a state of early to mid-forest succession (COSEWIC 2009c). Collisions with transmission wires are seemingly uncommon, and do not appear to be a large source of mortality. No Project-related effects on whip-poor-will mortality are anticipated during the operation and maintenance phase.

Vegetation management may occur year round in the known range of whip-poor-wills and may affect their breeding, nesting, and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Red-headed Woodpecker

Few Project-related effects on red-headed woodpecker mortality are anticipated during the operation and maintenance phase. As this species is migratory, no effects on mortality are anticipated during the winter. The removal of dead standing trees in the vicinity of the RoW during vegetation management in spring could damage or destroy red-headed woodpecker nests. Effects will be limited to the southern portion of the transmission line, the extent of red-headed woodpecker range in Manitoba.

Vegetation management may occur year round in the known range of red-headed woodpecker and may affect their breeding, nesting, and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. There may also be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Olive-sided Flycatcher

Few Project-related effects on olive-sided flycatcher mortality are anticipated during the operation and maintenance phase. As olive-sided flycatchers are associated with semi-open forests, edges, and clear-cuts (Altman and Sallabanks 2000), nests could be destroyed during vegetation management on the RoW in spring. As olive-sided flycatchers are generally found in northern Manitoba, no measurable effects on olive-sided flycatcher populations are anticipated.

Vegetation management is expected to occur only during the winter in the north, and therefore, no loss of effective habitat or disruption of movements is anticipated. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of olive-sided flycatcher. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. As most olive-sided flycatchers are found in the northern Footprint, effects in the south will be further limited. Finally, there may also be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Loggerhead Shrike

No direct effects on loggerhead shrike mortality are anticipated in the northern Footprint during operation and maintenance, as the species' range is limited to southern Manitoba. As this species is migratory, no effects on mortality are anticipated during the winter. As this species is migratory, no effects on mortality are anticipated during the winter. Predation on loggerhead shrike adults and eggs can increase near openings that attract predators (COSEWIC 2004), potentially contributing to mortality on the RoW. Effects on mortality will be limited to the southern portion of the transmission line, particularly around Winnipeg.

Vegetation management may occur year round in the known range of loggerheaded shrikes and consequently may affect their breeding, nesting, and daily movements. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Sprague's Pipit

No direct effects on Sprague's pipit mortality are anticipated in the northern Footprint during operation and maintenance, as the species' range is limited to southern Manitoba. As this species is migratory, no effects on mortality are anticipated during the winter. Sprague's pipits are susceptible to brood parasitism by brown-headed cowbirds (Flashpoehler *et al.* 2001; Holland *et al.* 2003a). Brood parasitism could reduce Sprague's pipit nest success, contributing to mortality. As Sprague's pipits nest on the ground in tall grasses (Holland *et al.* 2003a), nests could be damaged or destroyed during vegetation management in spring. Effects on mortality will be limited to the south-western portion of the route, the extent of Sprague's pipit range, where the landscape is already highly fragmented.

Vegetation management may occur year round in the known range of Sprague's pipits and consequently may affect their breeding, nesting and daily movements. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Additionally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Golden-winged Warbler

Golden-winged warblers are susceptible to brood parasitism by brown-headed cowbirds (COSEWIC 2006c). As shrubby or disturbed habitat is preferred for nesting (Askins 1994; Edie *et al.* 2003a), nests could be damaged or destroyed during vegetation management on the RoW in spring. Effects on mortality will be limited to the south-western portion of the route, the extent of golden-winged warbler range. As this species is migratory, no effects on mortality are anticipated during the winter.

As vegetation management is expected to occur only during the winter in the north, no loss of effective habitat or disruption of movement is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of golden-winged warbler. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there also may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Canada Warbler

Canada warblers are susceptible to brood parasitism by brown-headed cowbirds (Conway 1999), which could reduce nest success and contribute to mortality. Such effects will be limited to the southern and central portion of the route, the extent of Canada warbler range, where the landscape is already highly fragmented. As this species is migratory, no effects on mortality are anticipated during the winter.

As vegetation management is expected to occur only during the winter in the north no loss of effective habitat or disruption of movements is expected to occur. In the south, vegetation management may occur year round and consequently may affect the breeding, nesting, and daily movements of Canada warblers. Sensory disturbances and disruption of movements will be limited to infrequent, temporary effects including site abandonment and avoidance by a few individuals. Finally, there may be occasional, temporary loss of effective habitat associated with sensory disturbances arising from recreational use (e.g., ATVs) and agricultural machinery along the route.

Rusty Blackbird

Rusty blackbirds most often breed in northern Manitoba (Nero and Taylor 2003), where maintenance activity will occur in winter; no effects on rusty blackbird mortality are anticipated for the northern portion of the route. Rusty blackbirds are uncommon breeders in south-central Manitoba, and will not likely be affected In the southern Footprint during the operation and maintenance phase. As this species is migratory, no effects on mortality are anticipated during the winter.

As vegetation management is expected to occur only during the winter in the north, no loss of effective habitat or disruption of movements is expected. Additionally, there may be occasional, temporary loss of effective habitat associated sensory disturbances arising from recreational use and agricultural machinery along the route.

Keewatinoow Converter Station

No direct Project-related effects on least bitterns, ferruginous hawks, burrowing owls, whip-poor-wills, red-headed woodpeckers, loggerhead shrikes, Sprague's pipits, golden-winged warblers, and Canada warblers are anticipated, as the Keewatinoow converter station is beyond the northern extent of these species' ranges.

Clearing and Construction

Mallard

Project-related effects on mallard mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see Section 9.7.3.1.1). It is estimated that less than 0.01% of the existing mallard habitat will be lost from the clearing and construction of the Keewatinoow converter station. Conversely, the creation of a sewage lagoon in proximity to Keewatinoow Converter Station for the construction camp, it is expected to temporarily increase a small amount of mallard habitat.

Sandhill Crane

Project-related effects on sandhill crane mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). It is estimated that less than 0.01% of sandhill crane habitat will be lost from the clearing and construction of the Keewatinoow converter station.

Great Blue Heron

Project-related effects on colonial waterbird mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). There is no great blue heron habitat at the Keewatinoow converter station site.

Bald Eagle

Project-related effects on bird of prey mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). There is no bald eagle habitat at the Keewatinoow converter station site.

Ruffed Grouse

No direct Project-related effects on ruffed grouse are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Sharp-tailed Grouse

Project-related effects on sharp-tailed grouse mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). It is estimated that less than 0.08% of sharp-tailed grouse habitat will be lost from the clearing and construction of the Keewatinoow converter station.

Pileated Woodpecker

Project-related effects on woodpecker mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). No pileated woodpecker habitat is expected to be lost at the Keewatinoow converter station site.

Yellow Rail

No direct Project-related effects on yellow rail are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Short-eared Owl

No direct Project-related effects on short-eared owl are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Common Nighthawk

Project-related effects on common nighthawk mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). It is estimated that less than 0.03% of common nighthawk habitat will be lost from the clearing and construction of the Keewatinoow converter station.

Olive-sided Flycatcher

Project-related effects on olive-sided flycatcher mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). It is estimated that less than 0.02% of olive-sided flycatcher habitat will be lost from the clearing and construction of the Keewatinoow converter station.

Rusty Blackbird

Project-related effects on rusty blackbird mortality, sensory disturbance, and disruption of movements during construction of the Keewatinoow converter station will be similar to those on the RoWs (see section 9.7.3.1.1). It is estimated that less than 0.04% of rusty blackbird habitat will be lost from the clearing and construction of the Keewatinoow converter station.

Operation and Maintenance

Mallard

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of mallards. Increased bird-wire collisions may result in additional mallard mortalities. No mitigation measures are proposed. Following the decommissioning of the sewage lagoon in proximity to Keewatinoow Converter Station for the construction camp, it is expected that this temporary waterfowl habitat will be lost.

Sandhill Crane

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of sandhill crane.

Great Blue Heron

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of colonial waterbirds.

Bald Eagle

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of birds of prey.

Ruffed Grouse

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of ruffed grouse.

Sharp-tailed Grouse

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of sharp-tailed grouse.

Pileated Woodpecker

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of woodpeckers.

Yellow Rail

No direct Project-related effects on yellow rail are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Short-eared Owl

No direct Project-related effects on short-eared owl are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Sharp-tailed Grouse

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of sharp-tailed grouse.

Ruffed Grouse

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of ruffed grouse.

Pileated Woodpecker

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of woodpeckers.

Short-eared Owl

No direct Project-related effects on short-eared owl are anticipated, as no habitat for this VEC has been identified in the vicinity of the Keewatinoow converter station.

Common Nighthawk

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of common nighthawk.

Olive-sided Flycatcher

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of olive-sided flycatcher.

Rusty Blackbird

Sensory disturbances from the operation of the Keewatinoow converter station may occur year round and consequently may affect the breeding, nesting, and daily movements of rusty blackbird.

Riel Converter Station

As there is no suitable habitat for VECs in the vicinity of the Riel converter station there are no anticipated effects for any VEC during clearing, construction, or operation. No direct Project-related effects on olive-sided flycatcher and rusty blackbird are anticipated, as the Riel converter station is beyond the southern extent of these species' ranges. No Project-related effects on sandhill crane, great blue heron, bald eagle, ruffed grouse, sharp-tailed grouse, pileated woodpecker, least bittern, yellow rail, ferruginous hawk, burrowing owl, short-eared owl, common nighthawk, whip-poor-will, red-headed woodpecker, olive-sided flycatcher, loggerhead shrike, Sprague's pipit, golden-winged warbler, Canada warbler, or rusty blackbird, as no habitat for these VECs was identified in the vicinity of the Riel Converter Station.

Clearing and Construction

Mallard

Sensory disturbances from the construction of the Riel converter station may occur during the spring and summer and consequently may affect the breeding, nesting, and daily movements of mallard which typically nest near a lagoon adjacent to the converter station. No mitigation measures are proposed as this area already experiences high levels of sensory disturbance from traffic and other industrial development. Birds in the area will most likely habituate to the noise if any mallards chose to nest in habitat adjacent to the site.

Operation and Maintenance

Mallard

Sensory disturbances from the operation of the Riel converter station may occur during the spring and summer and consequently may affect the breeding, nesting, and daily movements of mallards which typically nest near a lagoon adjacent to the converter station. No mitigation measures are proposed as this area already experiences large levels of sensory disturbance from traffic and other industrial development. Birds in the area will most likely habituate to the noise if any mallards chose to nest in habitat adjacent to the site.

Ground Electrodes and Lines

Clearing and Construction

Effects of clearing and construction of the ground electrodes and lines on VECs are expected to be the same as for the HVdc transmission line in the same geographic region, with the exception of the degree of habitat alteration (Table 9.7-3). Refer to section 9.7.3.1 for the effects at the HVdc transmission and AC collector lines.

Table 9.7-3. Percent of habitat affected by clearing for northern and southern ground electrodes and lines

Environmental Component	VEC	% Habitat Affected	
		NES6	SES1C
Waterfowl and other waterbirds	Mallard	0.65	0
	Sandhill crane	0.87	0
	Yellow rail	0.15	0
Colonial waterbirds	Great blue heron	0	<0.01
	Least bittern	0	0
Birds of prey	Bald eagle	0	0
	Ferruginous hawk	0	0.01
	Burrowing owl	0	0.01
	Short-eared owl	0.15	<0.01
Upland game birds	Ruffed grouse	0	<0.01
	Sharp-tailed grouse	0.53	0
Woodpeckers	Pileated woodpecker	0	<0.01
	Red-headed woodpecker	0	<0.01
Songbirds and other birds	Common nighthawk	1.77	0.02
	Whip-poor-will	0	0
	Olive-sided flycatcher	0.17	0
	Loggerhead shrike	0	<0.01
	Sprague's pipit	0	0.01

Environmental Component	VEC	% Habitat Affected	
		NES6	SES1C
	Golden-winged warbler	0	0
	Canada warbler	0	0
	Rusty blackbird	0.88	0

Operation and Maintenance

For all VECs, the effects of vegetation management of the ground electrodes and lines are expected to be the same as those of the HVdc transmission and AC collector lines. The amount of habitat created by regenerating vegetation is not expected to have any measurable effect on bird populations. Refer to section 9.7.3.1.

Borrow Sites and Excavated Material Disposal Area and General Borrow Areas

Clearing and Construction

Effects of clearing and construction of the borrow sites and excavated material disposal areas and general borrow areas on VECs are expected to be the similar as for the Keewatinoow Converter Station, with the exception of the degree of habitat alteration, as the area affected by the borrow sites and excavated material disposal areas and general borrow areas could be much larger.

Table 9.7-10 illustrates the maximum number of VECs with potential habitat within the borrow sites and excavated material disposal areas and general borrow areas. Borrow sites with the least number of potential species include Mount Kumagi Stockpile, N-3 Area-I, B-5-3 and N-9. The largest borrow sites, including N – 6, N – 4, and N – 8, have the greatest potential for habitat effects. Borrow sites with the largest potential number of species at risk include N-10-1, N-10-2, and N-7 Area-I while N-3 Area-II and Mount Kumagai Stockpile had the fewest potential number. Finally, borrow sites that intersect creeks are potentially at a higher risk for project related effects due to the higher degree of bird diversity associated with riparian zones. Excavated material disposal areas with the least number of potential species 1E and 1F. The largest excavated material disposal areas, including 1E and 1A, have the greatest potential for habitat effects. All excavated material disposal areas have the same number of potential species at risk. As the utilization area of the borrow sites and excavated material disposal areas and general borrow areas is not known at this time the amount of habitat affected cannot be determined.

Sensory disturbance is expected to have a greater affect than at the Keewatinoow Converter Station due to blasting while mortality from road collisions. Mitigation measures proposed for the Keewatinoow Converter Station should be followed. Refer to section 9.9.4.2 for the effects at Keewatinoow Converter Station, It is important

Table 9.7-10. Percent of habitat affected by clearing for the Borrow Sites and Excavated Material Disposal Areas and General Borrow Areas.

Borrow Sites	Potential No.	
	VEC	Species at Risk
B-5-1	7	3
B-5-3	5	3
N - 10 - 1	9	5
N - 10 - 2	9	5
N - 3 Area - II	2	1
N - 4	9	3
N - 5	7	3
N - 6	9	3
N - 7 Area - I	9	5
N - 7 Area - II	7	3
N - 7 Area - III	7	3
N - 8	6	3
N - 9	5	3
Limestone Quarry Stockpile	5	3
"Mount Kumagai" Stockpile	2	1
Excavated Material Disposal Areas		
1A	7	3
1B	7	3
1C	7	3
1D	6	3
1E	5	3
1F	5	3

Based on the mitigation measures proposed in Section 9.9.4.2, residual effects for species at the borrow sites and excavated material disposal areas including all VECs are characterized as negative in direction, ranging from low to high ecological importance, low to high societal importance, small magnitude, limited to the Local Study Area, short-term in duration, regular/continuous in frequency, and range from reversible to irreversible, and therefore are not considered significant.

No Project effects are anticipated for least bittern, burrowing owl, red-headed woodpecker, whip-poor-will, loggerhead shrike, Sprague's pipit, golden-winged warbler and Canada warbler for borrow sites and excavated material disposal areas because this geographic location is beyond the northern extent of these species ranges.

Operation and Maintenance

The disposition of the borrow sites located in the Local Study Area includes site rehabilitation. Selection, development and reclamation of new borrow sites will be undertaken in accordance with provincial regulations and with the approval of the local Natural Resources Officer and local government authorities. Where borrow pits are required, exposed soils will be reclaimed by promoting re-growth of native vegetation and other mitigation measures in accordance with The Mines Act. There is however, a moderate level of uncertainty as to the timing of borrow site rehabilitation due to the potential need for the construction of Conawapa (see Project Description Chapter 3). Timing of decommissioning and clean-up of some temporary facilities (e.g., borrow areas, etc.) may be subject to future development requirements (e.g., development of Conawapa Generating Station).

For all VECs, where potential borrow sites and excavated material disposal areas and General Borrow Areas are rehabilitated, the operation of these facilities will not result in any additional mortality or sensory disturbances for the Bipole III Project. However, habitat alteration or fragmentation effects may result in small but long term changes to the local bird community where habitat has been altered.

No Project effects are anticipated for least bittern, burrowing owl, red-headed woodpecker, whip-poor-will, loggerhead shrike, Sprague's pipit, golden-winged warbler and Canada warbler for borrow sites and excavated material disposal areas because this geographic location is beyond the northern extent of these species ranges.