

# APPENDICES

## APPENDIX A: APPLICABLE LEGISLATION

### LEGISLATION CITED IN THE YONGE CORPORATE CENTRE CASE

A recent (February 2012) court case (*Podolsky v. Cadillac Fairview Corp.* 2013 ONCJ 65) has brought the issue of Bird-Window Collisions into prominence, and has pointed out that there is a legal requirement in Ontario to prevent Bird-Window Collisions. Three charges were brought against the owners of the Yonge Corporate Centre (YCC) in Toronto: specifically in regard to buildings where some of the highest BWCs in the GTA had been recorded. The three charges were under *Ontario's Environmental Protection Act (EPA)*, the federal *Species at Risk Act (SARA)*, and the *Ontario Society for the Prevention of Cruelty to Animals Act*, as follows:

“During the period beginning on or about September 3, 2010 and ending on or about November 7, 2010 ... did commit the offence of causing animals to be in distress by having or using highly reflective glass, including windows, that caused the death or injury of birds, contrary to subs. 11.2(1) of the *Ontario Society for the Prevention of Cruelty to Animals Act*, RSO 1990, c. O.36, as amended;

During the period beginning on or about March 15, 2010 and ending on or about November 7, 2010 ... did commit the offence of discharging or causing or permitting the discharge of a contaminant, namely radiation (light), from reflective glass, including windows, that caused or was likely to cause an adverse effect, namely death or injury to birds, contrary to subs. 14(1) of the *Environmental Protection Act*, RSO 1990, c. E.19, as amended;

Between the 15th day of March 2010 to 7th day of November 2010 ... did commit the offence of killing, harming, or taking individuals of a wildlife species, namely Canada Warblers or Olive-sided flycatchers, that are listed as a “threatened” species, by having or using highly reflective glass, including windows, contrary to the *Species at Risk Act*, s. 32(1). “

### Legal Decisions

The following sections show the rationale cited behind the judge’s decisions in the Yonge Corporate Centre case. The entire decision can be viewed here: <http://www.ecojustice.ca/cases/migratory-birds-building-collision-ii-judgement-feb.-14-2013-1>.

#### *Ontario Society for the Prevention of Cruelty to Animals*

This legislation was found not to apply to the case of migratory birds that were not held in captivity. The owners of the YCC were therefore acquitted of this charge. Specifically, the judge noted:

“the Legislature’s primary intendment in enacting the OSPCAA [was] the protection of pet, farm, display and performing animals (that is, domesticated and captive animals) and the maintenance of standards of care for their safety and well-being.

For these reasons, and even accepting in arguendo that the defendants caused distress to the birds at issue, I do not believe their conduct is captured by the OSPCAA.”

#### ***Environmental Protection Act***

In this case, the judge found the defendants guilty of the act that harmed birds. He noted:

“The evidence, both expert and circumstantial, called at this trial persuades me to the requisite standard that, in at least most cases of bird strikes at the YCC [Yonge Corporate Centre], the mechanism by which the collisions occurred was a result of the birds mistaking the reflecting surfaces of the buildings’ windows and spandrels as extensions of the safe wooded havens from which they were flying at the time of impact.

Whether or not actual or deemed or constructive knowledge of the impugned harm is essential to establish the actus reus [the “guilty act”] of a regulatory offence of this nature is of no moment in the present prosecution: the defendants, for at least a decade prior to the events at issue, knew that the reflective cladding of their buildings caused or substantially contributed to the death and injury of migrating birds.”

He went on to note:

“the YCC buildings “discharged” (by way “emission”) a “contaminant” (“radiation” in the form of reflected light) into the “natural environment” that caused an “adverse effect” (“injury or damage”, including, here, death, “to ... animal life”).”

This interpretation led the judge to the decision to find that the owners of the YCC had “permitted” the discharge of the contaminant. The “permitting” aspect of the offence centres on the defendant’s passive lack of interference or, in other words, its failure to prevent an occurrence which it ought to have foreseen. Thus, the owners of the YCC were found guilty of this offence.

### ***Species at Risk Act***

Individual birds belonging to species scheduled as “threatened” under the *Species at Risk Act* (SARA) were among those many other birds “killed” between March 15 and November 7, 2010 as a result of collisions with the YCC buildings. The judge noted:

“These deaths were undoubtedly unintentional. However, as I have earlier endeavoured to explain, even inadvertent or accidental deaths of members of a scheduled species fall properly within the physical definition of an offence under s. 32(1) of SARA.”

The owners of the YCC were also found guilty of this offence. The *Species at Risk Act* generally applies only

to (federally) listed species on federal lands. However, listed aquatic species and migratory birds protected under the *Migratory Birds Convention Act*, 1994 are protected wherever they are found.

### **Acquittal because of Due Diligence**

The judge noted that despite the proof that the YCC had caused the harm, the accused could avoid liability by proving that they took reasonable care (so-called “due diligence”). Proof, in this context, would be satisfied on the civil standard, a balance of probabilities (i.e. not beyond reasonable doubt as in a criminal proceeding). If the defendants had not taken reasonable care to avoid harm to the birds, the defendants would necessarily be found guilty of the two offenses.

However the judge noted that:

“the owners’ investment in bird deterrent applications at the YCC appears to have accelerated in the period immediately following the company’s first becoming aware that it faced prosecution for environmental and animal welfare offenses. Some may read this as a response to the litigation and infer that the defendants could earlier have acted with greater dispatch. I do not see it that way. As I construe the evidentiary record, the defendants had committed themselves to moving forward on the bird strike problem before, as one might say, the writ was dropped. The prior delays, on my assessment, were attributable to technological or logistic challenges presented by the YCC’s physical setting and the development of a suitable product”

The judge found that the degree or level of harm or adverse effect must be reasonably balanced with economic considerations and the other factors set out earlier for a due diligence defence. He noted that the YCC apparently complied with municipal building and industry standards, that only a handful, at most, of buildings in the GTA had adopted a more aggressive strategy in deterring bird strikes by 2010, that the YCC implemented and maintained a policy to respond to nocturnal light pollution, that it had co-operated with FLAP Canada's bird retrieval, salvage and documentation efforts for more than a decade, and that it had endeavoured, if intermittently and without tangible success, to find solutions to the problem of daytime collisions since the late 1990s. The YCC had consulted with FLAP Canada about the problem of avian collisions and, on a few occasions, conducted test installations of window treatments that proved ineffective, unappealing to its tenants, or both. The presenting problems were complex and the necessarily site-specific solutions constantly evolving. The judge found that, even balanced against the number of bird deaths caused by the buildings, the due diligence defence applied to the case.

The judge found that though the prosecution had established the actus reus of two of the three offences charged, the defendants had demonstrated that, in all the circumstances, they acted with due diligence and had thus discharged their burden. He found the defendants not guilty of all charges.

### ***Ontario Endangered Species Act, 2007***

*Ontario's Endangered Species Act, 2007* prohibits killing or harming of extirpated, endangered and threatened species, as follows:

9. (1) No person shall,

(a) kill, harm, harass, capture or take a living member of a species that is listed on the Species at Risk in Ontario List as an extirpated, endangered or threatened species;

There is the potential for a building owner to be charged under this act if a provincially extirpated species, an endangered species or a threatened species is injured or killed through striking a window, or even potentially if it becomes trapped within some portion of a building. 70 individuals of 6 endangered and threatened species have been documented by FLAP Canada in window collisions in the GTA. There is the potential for any of these species to strike windows in Markham as well.

---

<sup>1</sup> A species is classified as an extirpated species if it lives somewhere in the world, lived at one time in the wild in Ontario, but no longer lives in the wild in Ontario.

A species is classified as an endangered species if it lives in the wild in Ontario but is facing imminent extinction or extirpation.

A species is classified as a threatened species if it lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation.



## APPENDIX B: BEST PRACTICES SUMMARY

### BEST PRACTICE IMPLEMENTATION STRATEGIES

Several major municipalities and agencies have taken steps to reduce Bird-Window Collisions, including Toronto, FLAP Canada, the American Bird Conservancy (ABC), Chicago, New York City, San Francisco, Portland, Calgary and United States Green Building Council (USGBC).

Standards from Toronto, Chicago, American Bird Conservancy, New York Audubon, and USGBC are widely adopted by regulation agencies across North America.

Toronto's mandatory bird friendly requirement and light out policies are based on known risk factors. New York City Audubon Society provides evidence of the success of implementation and identifies risk area in relationship with migration, weather, and time of the day. American Bird Conservancy presents mitigation measures in ranking of effectiveness backed by evidence. USGBC LEED developed Bird-Window Collision deterrence as a pilot credit that requires mitigation by building facade, exterior lighting, interior lighting and post construction monitoring program. San Francisco incorporates measurable mitigation standards into zoning ordinance. Chicago's strategies also improve urban design quality and sustainability. Calgary acknowledged risk areas in relationship to natural environment structure. Portland published its design guide in July 2012 based on best practise of bird friendly resources available to date.

### Leadership in Environment and Energy Design (LEED) Pilot Credit

The Leadership in Environment and Energy Design (LEED) green building rating system is the preeminent program for the design, construction, and operation of high-performance green buildings worldwide. American Bird Conservancy, in cooperation with the USGBC, and the Bird-Safe Glass Foundation, have developed a LEED green building certification to earn credit for incorporating design strategies that reduce Bird-Window Collisions.

The strategies described in the LEED Bird Collision Deterrence Pilot Credit consider indoor and outdoor lighting design and operation, building façade design, performance monitoring, and threat factors. This means modifying glass reflectivity, color (including ultra violet), texture, or opacity. It should be noted that LEED would treat the whole of the façade whereas Markham is only considering the area of highest threat (i.e. the bottom 16m). Also, by enhancing window treatments to include energy efficiency, additional LEED credits could be obtained.

It is anticipated that proposed treatments in Section 4 could meet the performance criteria listed in the LEED Pilot Credit 5.5. The methodology to determine the scope of application of treatments would need to be evaluated.

## WHAT ARE THE BEST PRACTICES?

### FEDERAL

**Government of Canada:** protects migratory birds and nests.

**US Congress (Proposed):** Bird Friendly public buildings, adopted Toronto, Chicago, ABC, and New York Audubon standards.

### REGIONAL

**Province of Ontario:** protects non-game birds, regulates the design of built environments, protects species at risk.

**State of New York:** Bird Friendly public buildings, adopted Toronto, Chicago, ABC, and New York Audubon standards.

**State of Minnesota:** Bird Friendly public buildings, public buildings mandatory light off during migratory period, and sustainability development standards for new and renovated buildings.

**Cook County, Illinois:** Bird Friendly new and major renovated buildings, energy conservation requirement.

### MUNICIPAL

**City of Toronto:** Two tiers standards (mandatory tier 1 and optional tier 2), identify effective measures, public building evening and weekend light-out, tier acknowledgment program, and public campaign.

**City of Calgary:** Bird Friendly design and operation of public buildings and affordable housing, downtown BWCs analysis, site design criteria, and schedule cleaning during daytime.

**City of San Francisco:** zoning standards, maximum unbroken glazed area, and voluntary bird-strike hotline.

### Non-Governmental Organizations

**New York City Audubon:** nighttime & inclement weather at-risk elevation level, nighttime migration path at-risk elevation level, minimize building footprint, and district wide light-out strategies.

**American Bird Conservancy:** windowed courtyards & open-topped atria as at-risk area, minimum treated glazing for lower and upper levels, evaluate effectiveness of mitigation measures, and rank light colours.

**United States Green Building Council LEED:** mandatory criteria comprise of building façade, interior & exterior lighting, and post construction monitoring program compliance, specify light angle, and light-off period.

**FLAP Canada:** recommendations for reductions in bird strikes on residential and office buildings include retrofits with patterns using the 5cm x 10cm rule, moving indoor vegetation so it is not visible through the glass, recommendations for treatment of the lower 16m of a building, and modifying lights to minimize exterior trespass.

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: FEDERAL & REGIONAL EXAMPLES

	Government of Canada	Government of Canada	Province of Ontario	Province of Ontario	Province of Ontario
<b>Regulations</b>	<b>1994</b> <i>Migratory Birds Convention Act</i>	<b>2002</b> <i>Species at Risk Act</i>	<b>1997</b> <i>Fish and Wildlife Conservation Act</i>	<b>1990</b> <i>Ontario Planning Act Section 41.7(a)5</i>	<b>2007</b> <i>Endangered Species Act</i>
<b>Adopted Guidelines</b>	Not specified.	Not specified.	Not specified.	Not specified.	Not specified.
<b>Scope of Regulations</b>	Migratory birds: killed, captured, taken.  Nests: damage, destroyed, removed, disturbed. Commercial transaction of migratory birds and nests.	Prevents killing, harassing, harming, capturing or taking of listed extirpated, threatened or endangered species on federal land; applies throughout Canada to listed species that are migratory birds.	Prohibit hunting or trapping of birds belonging to a species that is not designated a game bird.	Development that is subject to site plan applications: Municipality can require developer to provide facilities for the lighting, including floodlighting, of the land and of any buildings or structures thereon to the satisfactory and at no expense to the municipalities.	Prohibits harming, harassing and taking of Threatened and Endangered species; prevents or regulates habitat destruction.
<b>Aligned Regulations</b>	Not specified.	Not specified.	Not specified.	Not specified.	Not specified.



	US Congress (Proposed)	State of New York	State of Minnesota	Cook County Illinois (Includes Chicago)
<b>Regulations</b>	Apr 2011 <i>Federal Bird-Safe Buildings Act of 2011</i> (Proposed)	Mar 2011 <i>Bird-Friendly Buildings Act 4204</i> & <i>Bird-Friendly Building Council 4204A</i>	2009 <i>Bird-Safe Buildings Act, Chapter 101, Article 2, Section 54 [16B2421]</i>  2010 <i>Sustainable Building 2030 Energy Standards (SB2030)</i>	2008 <b>Adopted Bird Safe Building Ordinance</b>
<b>Adopted Guidelines</b>	Building Material defined by Chicago, Toronto, ABC and New York Audubon standards.	Recommendation includes Chicago, Toronto, ABC and New York Audubon standards.	Minnesota Bird-safe Building Guidelines, Audubon Minnesota Sustainable Building Guidelines Version 2.2 Update 2013.	Building Material defined by Chicago, Toronto, and New York Audubon standards.
<b>Scope of Regulations</b>	Public buildings only: construction, alteration, acquisition, interior & exterior lighting.	Public buildings only: construction, alteration, acquisition, interior & exterior lighting, reflective glass.	Public buildings only: turn off light from midnight to dawn during Mar 15 to May 31, and Aug 15 to Oct 31.  For New Construction and Major Renovations with new or replacement glazing scope, all required criteria apply. These include deterrent facades for areas that are bird attractants; reducing bird collision “traps”; monitoring of bird impacts during the building’s first year; and incorporating Lights Out program concepts. For Major Renovations without new or replacement glazing scope, only “Lights Out” light management program is required.	All new construction and major renovation projects must incorporate bird-safe building materials and design features. Existing building where practicable.
<b>Aligned Regulations</b>	Not specified.	Not specified.	SB2030: new and substantially renovated buildings.	All buildings: minimum 8 points in the LEED Energy and Atmosphere category.

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: SELECTED MUNICIPAL & AGENCIES EXAMPLES

	City of Toronto	City of Calgary
<b>Regulations</b>	<p><b>2010</b> <b>Green Development Tier 1 Requirement</b> for planning applications and inspection process.</p> <p><b>2005</b> <b>Ontario <i>Planning Act</i> Section 41.7(a)5</b> Condition for exterior lighting.</p>	<p><b>2008</b> <b>City of Calgary Sustainable Policy</b> For public buildings: new, renovated, affordable housing, operation.</p>
<b>Guidelines</b>	<p><b>2007</b> <b>Bird-Friendly Development Guidelines.</b></p> <p><b>2009</b> <b>Bird-Friendly Development Rating System &amp; Acknowledgment Program.</b></p>	<p><b>2011</b> <b>Bird-Friendly Design Guidelines.</b></p>
<b>Scope of Regulations / Guidelines</b>	All new buildings except residential low-rise.	Public buildings. All buildings and structures (voluntary).
<b>Exemptions</b>	Heritage designation permits up-lighting from exterior light fixtures. Up to 15% area allowed to be untreated “to be more realistic in terms of what is achievable for a variety of building types.”	Not specified.

	USGBC LEED	City of San Francisco	American Bird Conservancy	New York City Audubon
<b>Regulations</b>	<p><b>Dec 2011 Pilot Credit 55: Bird Collision Deterrence:</b> 1 building facade option, 1 interior lighting option, 1 exterior lighting option, and 1 post construction 3 years monitoring plan.</p> <p><b>Added bird-friendly language to LEED guide.</b></p>	<p><b>Sep 2011 Planning Code, Zoning Section 139: Standards for Bird-Safe Buildings.</b></p> <p><b>Section 101.1: Adopting environmental findings.</b></p> <p><b>Building Code Ch 13C: LEED and green building</b> For all new, renovation, alteration, addition commercial and residential buildings.</p>	Not specified.	Not specified.
<b>Guidelines</b>	Not specified.	<p><b>2011 Standards for Bird-Safe Buildings.</b></p> <p><b>2012 Design Standards for Bird-Safe Buildings.</b></p>	<b>2011 Bird-Friendly Building Design.</b>	<b>2007 Bird-Safe Building Design Guide for New Construction and Renovation.</b>
<b>Scope of Regulations / Guidelines</b>	New construction, Existing buildings: operations & maintenance, core & shell, schools, retail, and healthcare.	New construction, building additions (replacement of 50% or more glazing), building features.	New, retrofit and existing buildings.	New, retrofit and existing buildings.
<b>Exemptions</b>	<p>Building façade with a Threat Factor of 15 or below.</p> <p>Threat Factor is dependent on treated material type, treated area, and total façade area.</p>	<p>Residential buildings with height less than 14m and exposed façade less than 50% glazing.</p> <p>Waive by zoning examiner upon recommendation by a qualified biologist.</p>	Not specified.	Not specified.

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: SELECTED MUNICIPAL & AGENCIES EXAMPLES (CON`T)

	City of Toronto	City of Calgary
<b>Hazardous site areas</b>	Natural area, ravines, woodlot, or other natural feature.	400m from open space, river, valleys, natural parks.  Within City Centre area.
<b>Hazardous building area</b>	0m-12m; Beginning in 2014, 16m for City buildings, 0m-mature tree height. 0m-12m above green roof.  Supplementary buildings & on-site glass features.	0m-16m or 4 storeys.  Abutting courtyard, green roof, habitat area.  Building corners.  Atriums, linkways, bridges.
<b>Mitigation – elevation</b>	Min 85% treated glazing required for first 12m (16m for City buildings beginning in 2014).	Not specified.

	USGBC LEED	City of San Francisco	American Bird Conservancy	New York City Audubon
<b>Hazardous site areas</b>	Not specified.	91m from an Urban Bird Refuge, defined as: any open space greater than 0.8ha dominated by vegetation (including vegetated landscaping, forest, meadows, grassland, water features or wetlands), or open water; green roof that exceeds 0.8ha; and 91m from Wind generators.	Windowed courtyards and open-topped atria.	Daytime: fly through area. Nighttime & inclement weather: area below 152m.  Tall and glass buildings within 400m to 800m from migration route.  Proximate to attractive habitat areas, fog-prone area, dense urban context, natural features, courtyards.
<b>Hazardous building area</b>	0-3 storeys, and 0-1 storey above green roof.  Glazed corners.	0m-18m  Unbroken glazed exceeds 2.2m <sup>2</sup> of other structures.  Mirrored glass. Visible light reflectance exceeds 30%.	0m-12m (under review)	0m-23m  15m-152m inclement weather nighttime migration path.  40-50 storeys nighttime migration path.  Transparent corners, mirrored glass, antennae, spires, guy-wires.
<b>Mitigation – elevation</b>	Collision zone: Min 85% of glazing treated.  Glazed corners treated.	Min 90% treated glazing required for buildings within 91m from hazardous areas.  Min 95% treated glazing required for residential building with height less than 13.7m AND exposed façade with more than 50% glazing.  100% of glazing on feature related hazard (free-standing glass standards) with unbroken segments larger than 2.2m <sup>2</sup> must be treated.	Min 90% treated glazing required for the first 12.2m to deter 70% or more bird collisions.  Min 60% treated glazing required for other areas to deter 70% or more bird collisions.	Not specified.

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: SELECTED MUNICIPAL & AGENCIES EXAMPLES (CON`T)

	City of Toronto	City of Calgary
<b>Mitigation – materials</b>	<p><u>Most effective:</u></p> <p>Pattern by film, decals, Fenestration, grilles and or louvers, artwork. Multiple paned glass.</p> <p><u>Others (considered less effective):</u></p> <p>Angled glass panes, awnings and overhangs to provide muted reflection at the base of window, and external sunshades.</p>	<p>CollidEscape: one-way viewing perforated external window film.</p> <p>Spandrels interrupting a reflective façade.</p> <p>Louvers defining areas as solid.</p> <p>Opaque material or non-reflect glass to clearly define recessed area and courtyards.</p>
<b>Mitigation – specifications</b>	<p>Density pattern max. 10cm apart, pattern min 5mm diameter, the denser the more effective (5cm x 5cm for City buildings beginning in 2014).</p>	<p>Density pattern 10cm (optimal) to maximum 28cm.</p> <p>Angled glass panes between 20 to 40 degrees from vertical.</p>
<b>Mitigation – heritage buildings</b>	<p>Exempt from exterior lighting requirement.</p>	<p>Not specified.</p>
<b>Mitigation – site design</b>	<p>Ventilation grates with porosity of less than 2cm X 2cm.</p> <p>(Optional) Capped all ventilation</p>	<p>Ventilation grates with porosity of less than 2cm X 2cm.</p>

	USGBC LEED	City of San Francisco	American Bird Conservancy	New York City Audubon
<b>Mitigation – materials</b>	Screens, shutters, or louvers.	Fritting, netting, permanent stencils, frosted glass, exterior screens, physical grids, UV patterns visible to birds.	<p><u>Most effective:</u></p> <p>Recessed windows, translucent, etched, stained, frosted glass, netting, screens, grilles, shutters, exterior shades, UV pattern with strong contrast, films, decal.</p> <p><u>Others:</u></p> <p>Angled glass panes, awnings and overhangs.</p> <p><u>Not effective:</u></p> <p>Internals, shades, blinds, curtains.</p>	<p>Visual noise at the whole building scale. Avoid monolithic glazing.</p> <p>0-10% reflectivity glass.</p> <p>0-10% muted reflectivity in spectrally selective glass.</p> <p>Low-e glass.</p> <p>UV glass.</p> <p>Visual noise, screen/scrim/fritting, non-reflective material, lights out, plastic films/diachroic coatings/tints, vegetation near building.</p>
<b>Mitigation – specifications</b>	Max. 5.1cm x 10.2cm (2 inches x 4 inches) of exposed untreated glass area.	Vertical treatment min 6.3mm wide at min 10.2cm spacing, or horizontal treatment at 3.1mm wide at maximum 5.1cm spacing.	<p>Max. 5.1cm x 10.2cm (2 inches x 4 inches) of exposed untreated glass area.</p> <p>Apply pattern on the outside. Min 6mm wide.</p> <p>Angled glass panes at 20 or 40 degrees from vertical.</p>	Angled glass panes between 20 to 40 degrees from vertical.
<b>Mitigation – heritage buildings</b>	Not specified.	Reversible treatment (netting, glass films, grates, and screens).	Not specified.	Not specified.
<b>Mitigation – site design</b>	Not specified.	Trees or tall shrubs to be within 3 feet from glazing or far away.	Place landscape away from building façade.	Maximize open space, minimize building footprint.

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: SELECTED MUNICIPAL & AGENCIES EXAMPLES (CON`T)

	City of Toronto	City of Calgary
<b>Mitigation – exterior lighting</b>	<p>No up-lighting. Provide shield for light fixtures. Light fixtures includes bollards, lower-scale pole fixtures along pedestrian routes. No light spill to neighbouring properties.</p> <p>(Optional) Rooftop lighting to be shut off between 11:00 p.m. and 5:00 a.m. (6:00 a.m. under consideration by Council) For institutional /commercial development: install an automatic device that reduces the outward spillage of internal light by 1) reducing the input power to lighting fixtures by at least 50% between the hours of 11:00 p.m. and 5:00 a.m. (6:00 a.m. under consideration by Council); OR 2) shielding all openings in the envelope with a direct line of sight to any non-emergency light fixture between the hours of 11:00 p.m. and 5:00 a.m. (6:00 a.m. under consideration by Council).</p>	<p>In accordance with By-law and Centre City illumination Guidelines:</p> <p>Floodlighting for special events and sensitive to migratory season.</p> <p>Minimize light transpass.</p>
<b>Mitigation – interior lighting</b>	<p>Public buildings Lights-out Policy for after work hours &amp; weekends.</p> <p>(Optional) Motion sensor in linkways or zone lighting program. Individual office lighting.</p>	<p>Use task lighting, motion sensors, timers.</p> <p>Close curtains if lights are on in the evening.</p> <p>Schedule cleaning during daytime.</p>
<b>Mitigation – interior</b>	<p>(Optional) Locate internal greenery distance from glass relative to density pattern of adjacent window treatment.</p> <p>Blinds at individual work stations.</p> <p>Cleaning operations during daylight hours.</p>	<p>Locate interior landscape away from windows.</p>



	USGBC LEED	City of San Francisco	American Bird Conservancy	New York City Audubon
<b>Mitigation – exterior lighting</b>	<p>No direct light at 90 degrees from straight down and shut off non-essential (except safety, entrances, circulation) lights from 12 a.m.- 6 a.m.</p> <p>OR</p> <p>Light pollution Reduction Credit compliance: cap exterior lighting level and 50% interior lighting reduction from 11 p.m.- 5 a.m.</p>	<p>No up-lighting, no event search lighting, lighting shall be shield and minimal.</p>	<p>Shield and direct lighting to minimize attraction to night-migrating birds. Encourage blue and green light, discourage yellow and red light.</p>	<p>Reduce perimeter lighting. Shield streetlights.</p> <p>Minimize light transpass.</p>
<b>Mitigation – interior lighting</b>	<p>Light off between 12 a.m.- 6 a.m. minimum.</p> <p>OR</p> <p>Install auto shutoff system with max. 30 minute vacant period.</p>	<p>(Optional) Motion detectors and timers. See also mitigation – migratory period.</p>	<p>Turn off interior lighting at night or designed to minimize light escaping through windows.</p>	<p>Light off between 11 p.m. and sunrise.</p> <p>No light spill.</p>
<b>Mitigation – interior</b>	<p>Not specified.</p>	<p>(Optional) Move interior plants away from windows. Window coverings for nighttime use.</p>	<p>Not specified.</p>	<p>Minimize visibility of interior landscape.</p>

## BIRD FRIENDLY BEST PRACTICE REGULATIONS AND GUIDELINES: SELECTED MUNICIPAL & AGENCIES EXAMPLES (CON`T)

	City of Toronto	City of Calgary
<b>Mitigation – migratory period</b>	Design to minimize risk of migratory bird collisions.	Spring: Mid-March to early-June  Fall: Late-Aug to early-Nov  Consider festival and advertisement lighting effects during migratory seasons.
<b>Mitigation – Monitoring program</b>	Not specified.	Not specified.
<b>Acknowledgment program</b>	<b>2007 Bird Friendly Development Rating System &amp; Acknowledgment Program.</b>  Three tiers voluntary acknowledgment program.	Not specified.
<b>Aligned municipal requirements</b>	<b>2010 City of Toronto Public Art Policy:</b> Voluntary contribution of 1% of gross construction cost toward public art.	<b>2009 City of Calgary Public Art Policy</b> 1% of capital project costs for City capital budget projects over \$1 million.  <b>Centre City illumination Guidelines.</b>
<b>Agencies alliance</b>	Toronto Hydro, Lights Out Toronto!, Canadian Wildlife Service, FLAP Canada, Building Owners and Managers Association Toronto, Cities of Chicago and New York.	Green Rating Systems such as LEED® Canada, Built Green Canada, BOMA BEST, Green Globes.
<b>Industry alliance &amp; public education</b>	Lights Out Program since 1993. Poster Campaign. Consult with property managers and owners.	Not specified.

	<b>USGBC LEED</b>	<b>City of San Francisco</b>	<b>American Bird Conservancy</b>	<b>New York City Audubon</b>
<b>Mitigation – migratory period</b>	Not specified.	Spring: Feb 15 – May 15  Fall: Aug 15 – Nov 30  Unneeded light off from dusk till dawn.	Not specified.	Spring: Mid-Mar to early-June  Fall: Late-Aug to late-Oct  Unneeded light off from 11 p.m. to sunrise.
<b>Mitigation – Monitoring program</b>	Mandatory post-construction monitoring plan:  3 year routinely monitor. Document number of strikes, time, date, number, features that contribute to collision.	Voluntary bird-strike hotline to report bird-strikes.	Not specified.	Building management daily sweep of building perimeter and roof, document all bird death, partnership for district wide monitoring and light-out strategies, mitigation retrofits, encourage volunteer participation. Bird Safe Flight group.
<b>Acknowledgment program</b>	<b>2011 US Environmental Conservation Department Voluntary Migratory Bird Stamps Program.</b>	<b>2011 US Environmental Conservation Department Voluntary Migratory Bird Stamps Program</b> <b>2012 Design Standards for Birds-Safe Buildings.</b> Three tiers voluntary acknowledgment program.	<b>2011 US Environmental Conservation Department Voluntary Migratory Bird Stamps Program.</b>	<b>2011 US Environmental Conservation Department Voluntary Migratory Bird Stamps Program.</b>
<b>Aligned municipal requirements</b>	Not specified.	<b>2010 City of San Francisco Building Code Chapter 13C: Green Building and LEED requirement.</b>	Not specified.	Not specified.
<b>Agencies alliance</b>	Not specified.	Not specified.	Not specified.	Not specified.
<b>Industry alliance &amp; public education</b>	Not specified.	Lights Out Program since 2008. Public education and outreach partnerships, building owner bird-safe stewardship, encourage treatment, building tenant education.	Not specified.	Lights Out Program since 2005.

## APPENDIX C: MARKHAM RETROFIT PROJECTS

### MARKHAM TREATMENTS: RETROFIT CASE STUDIES

Markham has shown leadership in the implementation of bird friendly measures on several public buildings including 8100 Warden Avenue, Fred Varley Art Gallery, Markham Museum, and Markham Civic Centre. It was documented that these buildings were experiencing BWCs and as a result Markham sought the advice of FLAP Canada. Through extensive consultation the buildings were retrofitted and enhanced to incorporate bird friendly treatments to avoid BWCs. For new buildings such as the Cornell Community Centre and the future South-East Community Centre in eastern Markham, bird friendly design has been incorporated into the design process. Since most of the treatments were installed in 2012 it is too soon to judge whether they are effective, but early indications are that there have been no BWCs associated with these buildings after the treatment was installed (Mesure 2013 pers. comm.).

#### Fred Varley Art Gallery

The Fred Varley Art Gallery in Unionville is adjacent to the Bruce Creek valley, in an area that likely provides habitat for migrating birds. The treatment, an applied film with a dot pattern called Symmetry Duo, was installed in October 2012 as a leadership initiative for bird friendly design.





### Markham Civic Centre

This building was retrofitted in September 2012, as a result of concerns regarding the number of BWCs. The pattern used was Exterior 70 with custom print created for the City of Markham. Since the installation of the film, there have been no BWCs at this building. However, definitive data regarding the effectiveness of retrofitting this building has not been obtained as the amount of time since retrofitting has not been sufficient.



### 8100 Warden Avenue

A pattern of horizontal stripes (Symmetry) was used to retrofit the Fire and Emergency Services building at 8100 Warden Avenue in 2009 and 2010. The treatment included a large glass atrium at the entrance (top right photo) as well as several narrow, but contiguous lines of glass windows where reflections of vegetation had the potential to cause BWCs (bottom right photo). Dots were added later to complete the building treatment in 2012.



*Photo by North-South Environmental Inc.*

## APPENDIX D: EXISTING CONDITIONS SUMMARY

### Bird-Window Collisions in the Greater Toronto Area

FLAP Canada volunteers have documented approximately 45,000 BWCs in the GTA since record keeping began in 2000. These represent the results of monitoring approximately 50 buildings, mainly towers with an abundance of glass. Klem (2006) has estimated that the number of bird casualties at urban office buildings in North America is between 1 and 10 per year. Thus with approximately 950,000 buildings in Toronto, there is the potential for between 1 and 9.5 million birds to be killed in the City of Toronto per year (FLAP Canada 2013).

Two species are involved in BWCs particularly frequently in the GTA: White-throated Sparrow and Golden-crowned Kinglet, with over 5000 BWCs each since record-keeping began. **Table D-1** provides a list of the birds most frequently involved in BWCs in the GTA, with their preferred habitat.

There are several similarities among these species. With the exception of Ruby-throated Hummingbird, all are songbirds. All except Common Yellowthroat are small forest birds (Common Yellowthroat is a bird of open marsh habitat). The top 10 birds feed by gleaning: they walk along the ground or along branches, leaves or bark to glean insects and other food items. None of the top 20 species are aerial foragers. All are nocturnal

Species	Number of BWCs	Habitat	Status in Most Urban Portions of GTA
White-throated Sparrow	5212	Forest	Migrant
Golden-crowned Kinglet	5098	Forest	Migrant
Ovenbird	2150	Forest	Migrant
Ruby-crowned Kinglet	1999	Forest	Migrant
Brown Creeper	1900	Forest	Migrant
Dark-eyed Junco	1742	Forest	Migrant
Nashville Warbler	1487	Forest	Migrant
Hermit Thrush	1383	Forest	Migrant
Common Yellowthroat	1141	Marsh	Migrant, breeding
Black-capped Chickadee	1027	Forest	Migrant, resident
Ruby-throated Hummingbird	924	Forest, urban gardens	Migrant, breeding
Magnolia Warbler	822	Forest	Migrant
Black-throated Blue Warbler	576	Forest	Migrant
Swainson's Thrush	575	Forest	Migrant
Black and White Warbler	562	Forest	Migrant
- UNKNOWN	560		
Yellow-bellied Sapsucker	555	Forest	Migrant
Fox Sparrow	457	Forest, riparian areas	Migrant
American Woodcock	407	Forest	Migrant
Black-throated Green Warbler	395	Forest	Migrant

**Table D-1:** Top 20 birds most frequently involved in Bird-Window Collisions in the GTA from 2000 to 2012.

migrants, though paradoxically they are generally killed in the daytime. It is probable that these are the most likely to be involved in BWCs because they look for food in trees and shrubs among buildings. However, another likely reason these birds are involved in BWCs is that they are the most numerous species in Ontario: population estimates for the top 10 species in Ontario range from 2 million to 15 million (Cadman *et al.* 2007).

Though the numbers of aerial foragers and birds of other habitat guilds involved in BWCs are much fewer, they are still found: for example 48 Whip-poor-wills have been cataloged by FLAP Canada over the period data has been collected. This species is exclusively an aerial forager, and is also a diurnal migrant. It is also a Species at Risk in Canada and Ontario.

Among the species with the lowest BWCs (i.e. those where only 1 to 5 have been involved in collisions since 2000), there are also similarities. Very few large birds are involved in BWCs (e.g. ducks, herons, hawks, owls). There are almost no waterfowl. There are very few swallows involved in BWCs. Many of these species are diurnal migrants (they migrate during the day). It is possible that these species are not drawn to habitat in urban areas because buildings are more visible during the day.

Very few open-country birds (e.g. Eastern Meadowlark, Bobolink, Vesper Sparrow) are involved in BWCs, even though they are also ground-foragers, are small songbirds and populations for some of these species (e.g. the Bobolink population is estimated at 800,000 in Ontario) are relatively numerous. However as pointed out by Klem (2013 pers. comm.), there are very few large glass towers surrounded by open grassland habitats, so it is not known whether these species are less likely to be involved in BWCs because the habitat is not common, or if they are innately less likely to fly into glass.

### Bird-Window Collisions in Markham

Eight hundred and ninety-nine birds were cataloged as BWCs in Markham from 2000 to 2012 (2% of the total in the GTA). **Table D-2** provides a listing of the top 20 species involved in BWCs in Markham, with the numbers of each species involved. There are two likely reasons for the lower number of birds involved in BWCs in Markham: there are fewer glass towers than in Toronto, and there is a much lower search effort in Markham (Mesure 2013 pers. comm.).

The bird species involved in BWCs in Markham are similar to those in the GTA as a whole: they include mainly small forest songbirds that do not usually nest in Markham (there may be very rare instances where some species nest in the largest natural areas such as the Rouge Valley). However, two of the species most often involved in BWCs in Markham, Black-capped Chickadee and Mourning Dove, are residents as well as migrants (Black-capped Chickadees may not migrate, but young of the year may wander in the fall in search of habitat so their numbers are likely inflated in the fall). It is likely that the species distribution is different because BWCs in Markham form a smaller subset of the GTA numbers.

The two resident species are likely higher up on the list in Markham (in the GTA, Mourning Dove is 46th and Black-capped Chickadee is 12th on the list) because the total numbers of birds are smaller, so there are fewer migrants. As in the GTA, there are very few BWCs involving larger birds, waterfowl, raptors, shorebirds, open-country birds and aerial foraging species.

Rank	Species	Number of BWCs	Habitat	Status in Markham
1	Nashville Warbler	97	Forest	Migrant
2	Golden-crowned Kinglet	82	Forest	Migrant
3	White-throated Sparrow	69	Forest	Migrant
4	Ruby-throated Hummingbird	55	Forest, urban gardens	Migrant, breeding
5	Ruby-crowned Kinglet	52	Forest	Migrant
6	Dark-eyed Junco	50	Forest	Migrant
7	Yellow-bellied Sapsucker	29	Forest	Migrant
8	Black-capped Chickadee	23	Forest	Migrant, resident
9	Mourning Dove	21	Variety of habitats	Migrant, resident
	Ovenbird	21	Forest	Migrant
10	Brown Creeper	19	Forest	Migrant
11	Black-throated Green Warbler	17	Forest	Migrant
	Hermit Thrush	17	Forest	Migrant
12	Blackpoll Warbler	16	Forest	Migrant
	Magnolia Warbler	16	Forest	Migrant
	Red-breasted Nuthatch	16	Forest	Migrant, resident
13	Yellow-rumped Warbler	14	Forest	Migrant
14	Blue Jay	13	Forest	Resident
15	Fox Sparrow	12	Forest, riparian areas	Migrant
16	Black-throated Blue Warbler	11	Forest	Migrant
	Pine Warbler	11	Forest	Migrant, rare breeding
	Tennessee Warbler	11	Forest	Migrant
17	Unknown	10		
	White-crowned Sparrow	10	Forest	Migrant
18	American Goldfinch	9	Forest, thicket	Migrant, resident
	Black and White Warbler	9	Forest	Migrant
	Northern Flicker	9	Forest	Migrant, breeding
	Song Sparrow	9	Forest, thicket, urban gardens	Migrant, breeding
19	Unknown Warbler	8		
	American Robin	8	Forest, urban gardens	Migrant, breeding
20	Palm Warbler	7	Forest, riparian areas	Migrant
	Scarlet Tanager	7	Forest	Migrant, rare breeding
	Wilson's Warbler	7	Riparian areas	Migrant

**Table D-2:** Top 20 bird species involved in BWCs in Markham From 2000 to 2012

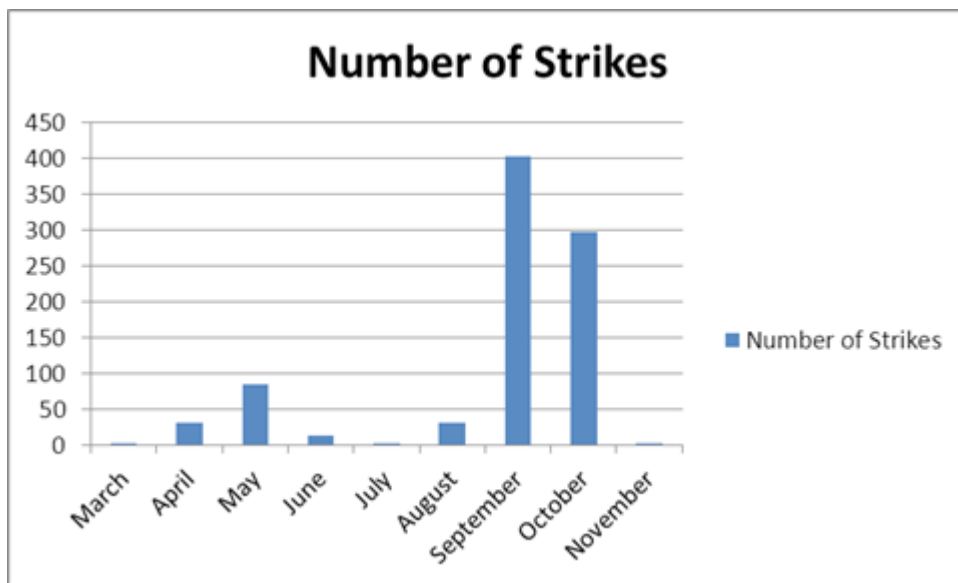


**Timing of Bird-Window Collisions in Markham**

There is overwhelming evidence that BWCs in Markham almost always involve migrants, rather than residents or breeding species. As noted above, most of the species involved in BWCs do not nest in the Markham area. Secondly, as shown by **Table D-3**, almost all BWCs occur during the period when birds are migrating, with most occurring during the fall in September and October, but another peak occurring during the spring migration primarily in April and May. This is consistent with information on BWCs from other jurisdictions (e.g. Chicago and New York).

**Species at Risk Involved in Bird-Window Collisions**

A total of 523 individuals of fourteen Species at Risk have been involved in BWCs in the GTA from 2000 to 2012, as listed below (showing numbers of BWCs/estimated numbers of adults in Ontario according to Cadman *et al.* 2007). In addition, Little Brown Bat, an endangered mammal species, has been cataloged among BWCs. The number of Species at Risk involved in collisions in Markham is low (only 6 have been found) but this is likely because of the lower search effort. Almost all bird Species at Risk in Ontario (listed as of 2013) are represented in BWCs within the GTA. In some cases, it could be said that BWCs have the potential to impact Species at Risk at the population level in Ontario; for example some with very low populations such as Yellow-breasted Chat and Acadian Flycatcher (both of which are estimated at fewer than 100 adults). All species listed in **Table D-4** could potentially collide with windows in Markham.



**Table D-3:** Seasonal Distribution of Bird-Window Collisions from 2000 to 2012

Species	Federal Status	Provincial Status	Number involved in BWCs in the GTA	Number involved in BWCs in Markham	Number of Adults in Ontario (Estimate)
Wood Thrush	Threatened	none	239	5	200,000
Canada Warbler	Threatened	Special Concern	157	1	900,000
Whip-poor-will	Threatened	Threatened	48		?
Eastern Wood-pewee	Special Concern	None	37		300,000
Rusty Blackbird	Special Concern	Special Concern	10		Uncertain: 500,000 to 5 million
Acadian Flycatcher	Endangered	Endangered	9		50 to 70
Chimney Swift	Threatened	Threatened	6		8,000
Eastern Meadowlark	Threatened	Threatened	4		150,000
Peregrine Falcon	Not at Risk	Special Concern	3		78 pairs
Common Nighthawk	Special Concern	Special Concern	2		?
Louisiana Waterthrush	Special Concern	Special Concern	2		200-400
Olive-sided Flycatcher	Special Concern		2		100,000
Bobolink	Threatened	Threatened	2		800,000
Yellow-breasted Chat	Endangered	Endangered	1		80-100

**Table D-4:** Species at Risk involved in BWCs in the GTA and Markham, status (in 2013) and estimates of total populations of each species (from Cadman et al. 2007). A question mark (?) indicates that the population is unknown.

### Areas with Highest BWCs in the Greater Toronto Area and Markham

**Figure D-1** provides an aerial photograph showing the areas with the highest BWCs in the GTA. All of the top sites for BWCs are in Toronto. These sites include the Toronto Dominion bank towers (approximately 5000 BWCs), the buildings centred around 4025 to 4120 Yonge Street, with approximately 4500 BWCs, and Consilium Place in Scarborough (including two buildings and a glass linkway) with nearly 4000 BWCs.

While the high number of BWCs at some of these locations appear to be related to their position near a large natural area (for example the buildings on Yonge Street are in close proximity to the Don River corridor) others are not. For example the TD buildings are within a highly urban setting, and Consilium Place is also within a highly urbanized part of Scarborough, though it is at the west end of a narrow greenspace associated with a tributary of Highland Creek. Rather, the BWCs at these buildings appear to be related to the large areas of planted trees and shrubs that are reflected in the glass (Mesure 2013 pers. comm.).

The building with the highest number of collisions in Markham (8500 Warden Avenue) is included for reference; however, the number of BWCs is much lower (291) at this building than at buildings in Toronto. As noted above, the numbers of BWCs in Markham are likely less than in Toronto because of the lower search effort in Markham.

**Table D-5** provides the numbers associated with the 12 sites in Markham with 10 or more BWCs. The site with the highest number is 8500 Warden Avenue, with 291 BWCs (32% of the total 899 BWCs documented in Markham). BWCs have been noted at 19 other buildings, but the numbers are much lower at these buildings: fewer than 10 collisions at each site since recording began in 2000.

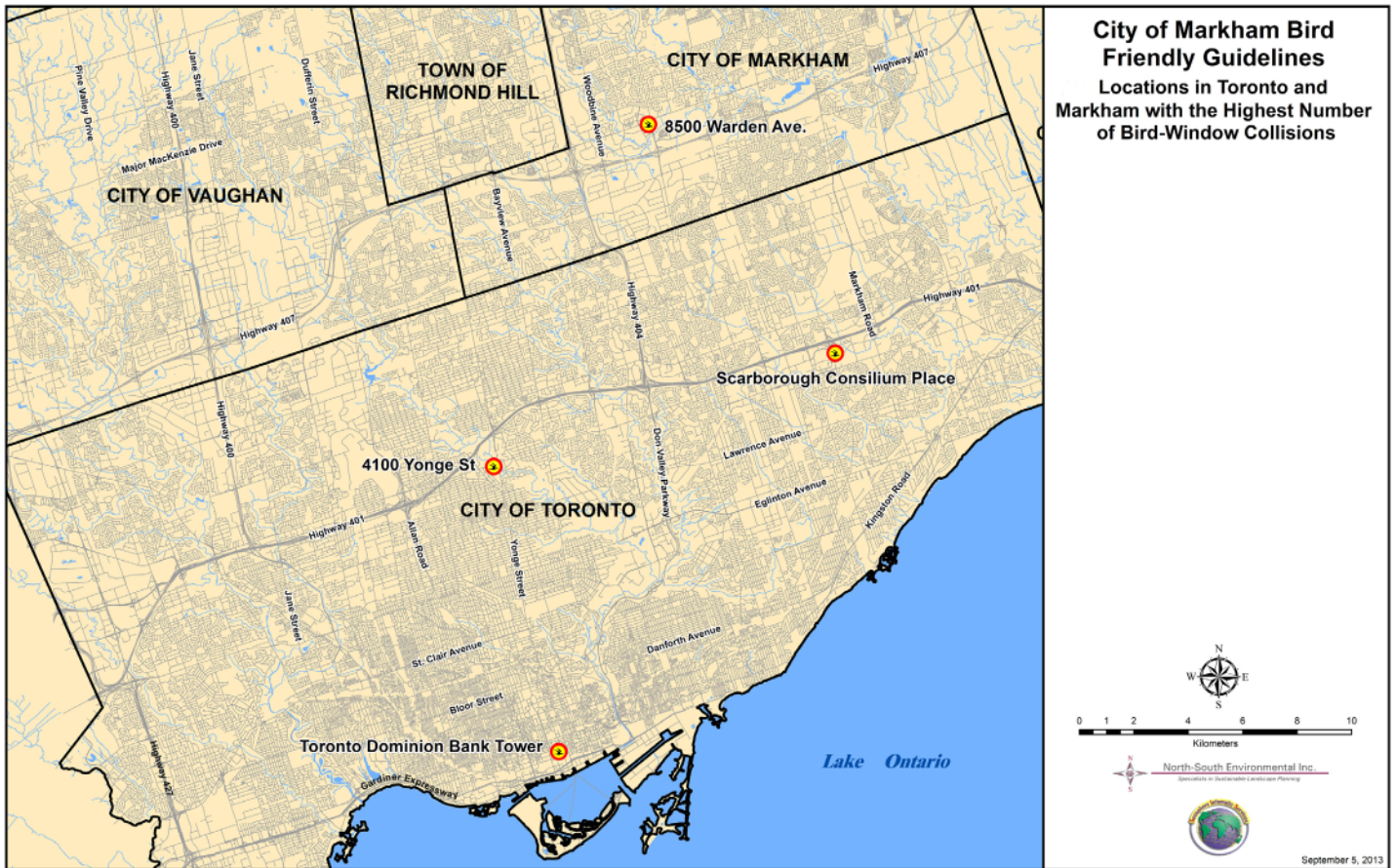
The lower number of BWCs is at least partly due to the fact that information on BWCs in Markham is not nearly as extensive as in Toronto due to the much smaller number of volunteers patrolling for birds under the towers, and the lower effort spent looking under the towers. This is especially true on days when there are numerous BWCs at other sites, because volunteers are focused on rescuing as many birds as possible (Mesure 2013 pers. comm.). It is not possible to determine whether there are significantly fewer migrants in Markham. There are, at least at present, fewer glass towers.

As in the rest of the GTA, most BWCs in Markham occur during the day (Mesure 2013 pers. comm.). Forty-seven percent of collisions occur in September, and 35% occur in October, indicating that, as in the rest of the GTA, fall migrating birds are by far the most often involved in BWCs. Three percent of collisions occur in April, and 10% occur in May. Collisions during all other months make up less than 1% of the total number.

Location	Number of BWCs
8500 Warden Avenue (Hilton Suites)	291
100 Allstate Parkway	169
55 Town Centre Boulevard	58
Markham Hydro	56
Allstate Building	46
260 Town Centre Boulevard	45
675 Cochrane Drive	37
75 Tiverton Court	31
90 Allstate Parkway	26
625 Cochrane Drive	20
101 McNabb Street	14
131 McNabb Street	10

**Table D-5:** Locations of Buildings in Markham where there were 10 or more collisions from 2000 to 2012

D



**Figure D-1:** Aerial photograph indicating highest BWCs in the GTA  
Photo by North-South Environmental Inc.

### **Results of Analysis to Determine whether Concentrations of Birds affects BWCs**

The possibility was examined that there could be factors that lead to concentrations of birds, and could predict most likely locations for BWCs. Two factors were examined: whether there are documented areas where migrants, breeding birds or resident birds concentrate, which might be associated with higher numbers of BWCs, and whether there were obvious landscape factors (such as the presence of a natural corridor) that might be associated with large numbers of BWCs.

### **Areas of Bird Concentration: Migrant Bird Concentration in Markham**

Information on areas of migrant bird concentration was sought in order to determine if BWCs were associated with areas where migrants were concentrated. Section 2 provides sight records of migrants have been recorded within the City of Markham. Records were obtained through consultation with three birders knowledgeable about Markham (Stan Long, Barrie Kent-McKay and Roy Smith), and through scanning through any available archives of three websites most frequently used by birders in southern Ontario: Ontbirds from 2013 to 1999 (the website of the Ontario Federation of Ornithologists) and the Toronto and Southern Ontario Bird Forum website from 2013 to 2006. Records were also obtained from E-bird, a website used throughout the world to record bird observations; however this website is of relatively recent origin and there were few records available. It was hoped that records could be obtained from the Toronto Ornithological Club database but Smith (2013 pers. comm.) noted that there were very few records for Markham in that database.

There were few records of migrant bird concentrations in Markham; most records involved only small numbers of birds. Long (2013 pers. comm.) explained that this is likely because birds are spread out among many small woodlots in Markham, as opposed to the situation in Toronto where birds are very concentrated along the waterfront. In addition, there are fewer birders in Markham than in Toronto.

Hotspots represent areas where a high number of BWCs occur, based on the E-bird website. Hotspots receive this designation based on birders' perceptions. The most popular birding sites in Markham are generally those where people go to see shorebirds and waterfowl, and hotspots are therefore biased toward ponds in Markham where these species are most often seen, though records indicate that songbirds are noted here as well. Since waterfowl and shorebirds are among the least numerous birds to be involved in BWCs these locations do not represent concentrations of birds that would be most susceptible to BWCs. Blue spots represent areas that are mentioned by birders without any reference to unusual numbers.

It is evident that locations of BWCs appear to be related to the locations of glass buildings rather than any known areas of migrant concentrations.

### **Areas of Bird Concentration: Breeding Bird Concentrations in Markham**

The birds involved in BWCs are primarily migrants, but concentrations of breeding birds were used to suggest where concentrations of migrants might also occur, since there were so few records of migrants. Breeding bird records of birds with a Conservation Concern score of L1 to L4 (as determined by bird surveys conducted by the Toronto and Region Concentration Authority (TRCA) were plotted to determine if there were concentrations of breeding birds in the City. As illustrated in Section 2, it is evident that areas of concentration of breeding birds are not related to areas where most BWCs occur.

There are two caveats associated with the use of this data. The first is that most of the species that have the highest susceptibility to BWCs do not generally breed in the GTA: this includes for example White-throated Sparrow, Ruby-crowned Kinglet, Golden-crowned Kinglet, Ovenbird, Dark-eyed Junco and Nashville Warbler. Therefore, the classification of susceptibility of breeding species to BWCs was derived from their relative susceptibility as calculated from FLAP Canada's data for the GTA: birds with higher than 1000 BWCs were considered very highly susceptible, with 200 to 1000 BWCs were considered highly susceptible, with 20 to 200 BWCs were considered moderately susceptible and with fewer than 20 BWCs were considered to have low susceptibility.

The second caveat is that these records only include L1 to L4 species (i.e. those that have more conservative habitat requirements such as dependence on larger areas of habitat). Therefore, some of the birds that do breed in Markham, and have a high susceptibility to BWCs (for example Black-capped Chickadee) are not recorded. The birds that were recorded breeding in Markham are thus used as a surrogate to indicate where birds with different rates of BWCs were concentrated.

It appears that birds that occur in high, moderate and low numbers of BWCs breed throughout natural areas in Markham, with a few areas of concentration in larger patches of natural habitat near water bodies. Areas of breeding bird concentration are not always immediately adjacent to areas of BWC concentration. Breeding birds are found along a wide variety of natural corridors, in a variety of habitats, in large and small patches of habitat. This is likely true of migrants as well. As with migrant species, the points noted here relate to areas that have been studied by TRCA: there has been no random sampling of all natural habitat to determine relative abundance in different areas.



### **Areas of Bird Concentration: Resident Bird Concentrations**

Resident birds are those that reside in Markham year-round. These consist of species that do not migrate, with the most common including Northern Cardinal, Black-capped Chickadee, American Crow, Blue Jay, Downy and Hairy Woodpecker, Mourning Dove and American Goldfinch.

With the exception of Black-capped Chickadee and Mourning Dove, resident species do not appear to be commonly involved in BWCs. As noted in Section 2, the birds killed in BWCs are primarily migrants.

In addition, resident birds are likely to be more widely distributed than breeding birds, as like migrants they are relatively mobile (they are not tied to breeding territories, for example) and their distribution corresponds to areas where they can find food, particularly bird feeders, during the winter. Resident birds include several that are highly susceptible to BWCs, but there are very few BWCs during the winter (fewer than 1% of total BWCs), and predicting the areas where BWCs would be most likely to occur in winter would be problematic.

### **Landscape Setting of Towers with High BWCs in the GTA and Markham**

There are few similarities between the landscape settings of sites in the GTA with the highest numbers of BWCs. In some cases, buildings are adjacent to a large natural corridor while in other cases there is no substantial natural corridor nearby.

The site with the highest number of BWCs in Markham is 8500 Warden Avenue. As with 4025 to 4200 Yonge Street, which are located close to the Don River, the reason for the high number of BWCs may be related partly to the location of the tower (close to a tributary which may channel migrating birds from larger natural areas) but since the surrounding area is highly developed the high number of BWCs is puzzling.

The 8100 Warden Avenue building is similar to Toronto's glass towers in that it reflects the surrounding planted vegetation to a high degree. Mesure (2013 pers. comm.) and Klem (2013 pers. comm.) both stated that it is the reflectivity of the glass, which is not perceived as a barrier by birds, that is primarily responsible for BWCs. Birds are attracted to a wide variety of natural vegetation as they migrate, and even if they travel to Markham along a larger corridor, could conceivably cross the space between a natural corridor and a well-vegetated garden around a glass building in seconds.

## APPENDIX E: BIRD IDENTIFICATION

The following provides a brief guide to the top 10 birds involved in BWCs in Markham, as well as the two Species at Risk involved in BWCs. Note that the photos show birds in breeding plumage only: females, many migrants and juvenile birds encountered in the fall have drab plumage that may not resemble breeding plumage.



*Photo by USFWS/Creative Commons*

**Species:** Nashville Warbler

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest



*Photo by Jim Flynn*

**Species:** Golden-crowned Kinglet

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest





Photo by Shenandoah NPS/Creative Commons

**Species:** White-throated Sparrow

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest, swamp



Photo by thefixer/Creative Commons

**Species:** Ruby-throated Hummingbird

**Breeding/Migrant/Resident:** Migrant, breeding

**Species At Risk Status:** None

**Habitat:** Forest, urban gardens



Photo by cheepshot/Creative Commons

**Species:** Ruby-crowned Kinglet

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest



Photo by USFWS/Creative Commons

**Species:** Dark-eyed Junco

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest, swamp

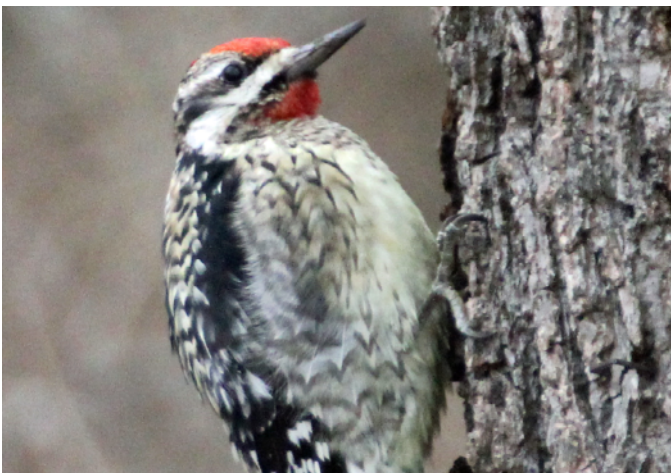


Photo by ptgbirdlover/Creative Commons

**Species:** Yellow-bellied Sapsucker

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest, swamp



Photo by USFWS/Creative Commons

**Species:** Black-capped Chickadee

**Breeding/Migrant/Resident:** Resident

**Species At Risk Status:** None

**Habitat:** Forest





Photo by Tonyotter/Creative Commons

**Species:** Mourning Dove

**Breeding/Migrant/Resident:** Resident, Migrant

**Species At Risk Status:** None

**Habitat:** Residential areas

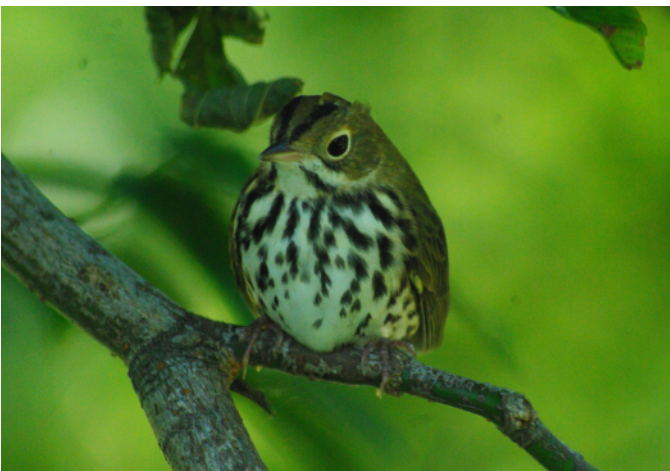


Photo by Brian Armstrong/FLAP Canada

**Species:** Ovenbird

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest



Photo by Bruce Guenter/Creative Commons

**Species:** Brown Creeper

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** None

**Habitat:** Forest



Photo by Dendroica Cerulea/Creative Commons

**Species:** Wood Thrush

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** Federal: Threatened

**Habitat:** Forest



Photo by Jeremy Meyer/Creative Commons

**Species:** Canada Warbler

**Breeding/Migrant/Resident:** Migrant

**Species At Risk Status:** Federal: Threatened, Provincial: Special Concern

**Habitat:** Forest, swamp

### Photo Credits (all Creative Commons)

Nashville Warbler Dave Menke, U.S. Fish and Wildlife Service; Brown Creeper HarmonyonPlanetEarth; Ruby-throated Hummingbird thefixer; Canada Warbler Jeremy Meyer; Wood Thrush Dendroica cerulea; Brown Creeper Bruce Guenther; Mourning Dove Larry Page; Black-capped Chickadee U.S. Fish and Wildlife Service; Yellow-bellied Sapsucker ptgbirdlover; White-throated Sparrow –Shenandoah NPS; Ruby-crowned Kinglet – ptgbirdlover/Creative Commons. FLAP Canada photos: Ovenbird, Golden-crowned Kinglet.