



# Ontario Power Generation Landfill

**Terrestrial Biological Inventory  
and Assessment**

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## 1.0 Introduction

In 2013 the Toronto Region Conservation Authority (TRCA) conducted a flora and fauna inventory of the landfill located within the Pickering Ontario Power Generation (OPG) property in preparation for an upcoming management plan. The site had already been inventoried for both fauna and flora in 2008 as part of the larger inventory of the OPG property, but access to the landfill itself had been restricted such that all observations were made from the boundary fence. In 2013 TRCA biologists were allowed complete access in the company of OPG staff.

The purpose of the work conducted by the TRCA during the 2013 field season was to *provide current terrestrial natural heritage data to be used to inform management decisions* regarding the old landfill site. In order to provide this advice, detailed field work was undertaken to *characterize the terrestrial natural heritage features* of the study area. Through the completion of this characterization, the site features can then be understood together with the rest of the OPG property within the larger regional context of the Terrestrial Natural Heritage Program of the TRCA. The question that the inventory addresses is “*How does the area surveyed at Pickering OPG Landfill fit within the regional and the watershed natural systems, and how should its contribution to these systems be protected and maximized?*” The important underlying message presented by this question is that the health of the natural system is measured at the regional scale and specific sites must be considered together for their benefits at all scales, from the site to the larger system.

## 2.0 Study Area Description

The OPG Landfill study area sits in the south east corner of the Frenchman’s Bay on the Toronto waterfront and covers a total of 20.8 ha. The vast majority of the site is fenced off from public access and has no traffic. However, the natural cover patch includes a long narrow strip of public land on the north and east side just outside the fence adjacent to Montgomery Park Road. This strip of public land is bisected by the Waterfront Trail. The Duffins Creek lies immediately to the east, with the extensive Duffins Marsh complex just over 1 km to the east along the Lake Ontario shore (Map 1). The OPG Landfill lies within the Great Lakes – St. Lawrence floristic region, an area composed of mixed coniferous-deciduous forest. At the coarse physiographic level, the site is located on the Clay Plain physiographic zone, a zone that is restricted to the extreme south-east corner of the TRCA region. However, the site is highly altered, being entirely graded and filled (Map 2). The substrate is thus largely relatively recent (post-1970) fill with highly compacted soils that are variable but with a large component of fine clayey and silty material.

The OPG Landfill has created an artificial elevation, the highest contour for a considerable distance on this part of the lake shore. Since being discontinued as a working landfill, the hill has been extensively planted with largely non-native tree species, with areas of non-native forb meadow, particularly on the eastern flank. The 2013 study area also includes the extension of natural cover leading from the south-east corner of the larger landfill to the lakeshore, forming a

narrow corridor of natural cover which is also completely fenced against any human intrusion. This smaller section of the study area contains the most extensive natural vegetation cover to be found across the entire site though it too is largely fill. The surrounding landscape is almost predominantly industrial, with the OPG station to the southwest and a water treatment facility immediately to the east.

The Frenchman's Bay watershed is largely built-up, either with industrial and commercial developments at the southern extent, close to the lakeshore, or urban and suburban development heading further inland. This smallest of watersheds contains limited natural cover connections; the only effective corridor is located along the hydro corridor at Finch Avenue, at the extreme northern end of the watershed. Even in the vicinity of Frenchman's Bay and its smaller wetland neighbour, Hydro Marsh, development has been pushed right to the very edge of the wetlands. Any patches of natural cover are islands in an otherwise extensively paved landscape.

### 3.0 Inventory Methodology

A biological inventory of the OPG Landfill was conducted at the levels of vegetation community and species (flora and fauna) according to the TRCA methodologies for field data collection (TRCA 2007a).

A key component of the field data collection is the scoring and ranking of vegetation communities and flora and fauna species to generate local "L" ranks (L1 to L5 with L+ for exotic species); this process was undertaken in 1996-2000 and ranks are reviewed regularly (TRCA 2010). Vegetation community scores and ranks are based on two criteria: *local occurrence* and the number of *geophysical requirements* or factors on which they depend. Flora species are scored using four criteria: *local occurrence*, *population trend*, *habitat dependence*, and *sensitivity to impacts associated with development*. Fauna species are scored based on seven criteria: *local occurrence*, *local population trend*, *continent-wide population trend*, *habitat dependence*, *sensitivity to development*, *area-sensitivity*, and *patch isolation sensitivity*. With the use of this ranking system, communities or species of *regional concern*, ranked L1 to L3, now replace the idea of *rare* communities or species. *Rarity (local occurrence)* is still considered but is now one of many criteria that make up the L-ranks, making it possible to recognize communities or species of regional concern before they have become rare.

In addition to the L1 to L3 ranked species, a large number of currently common or secure species at the regional level are considered of concern in the urban context. These are the species identified with an L-rank of L4. Although L4 species are widespread and frequently occur in relatively intact urban sites, they are vulnerable to long-term declines.

### 3.1 Landscape Analysis

The quality, distribution and quantity of natural cover in a region are important determinants of the species distribution, vegetation community health and the provision of “ecosystem services” (e.g. air and water quality, recreation, aesthetics) in that region.

#### Base Mapping

The first step in evaluating a natural system or an individual *habitat patch* is to interpret and map land cover using aerial photographs. The basic unit for the evaluation at all scales is the habitat patch in the region, which are then combined and evaluated as a system at any scale. A *habitat patch* is a continuous piece of habitat, as determined from aerial photo interpretation. The TRCA maps habitat according to four broad categories: *forest*, *wetland*, *meadow*, and *coastal* (beach, dune, or bluff). At the regional level, the TRCA jurisdiction is made up of thousands of habitat patches. This mapping of habitat patches in broad categories is conducted through remote-sensing and is used in the evaluation of quality, distribution and quantity of natural cover. It should not be confused with the more detailed mapping of vegetation communities obtained through field surveys and that is used to ground-truth the evaluation (see Section 3.2).

#### Quality Distribution of Natural Cover

The quality of each habitat patch is evaluated according to three criteria: *size* (the number of ha occupied by the patch), *shape* (edge-to-area ratio), and *matrix influence* (measure of the positive and negative impacts from surrounding land use) (TRCA 2007b). A total score for each patch is obtained through a weighted average of the scores for the three criteria. This total score is used as a measure of the ‘quality’ of a habitat patch and is translated into a local rank (L-rank) ranging from L1 to L5 based on the range of possible total scores from 3 to 15 points. Of these L-ranks, L1 represents the highest quality habitat and L5 the poorest.

Species presence or absence correlates to habitat patch quality (size, shape and matrix influence) (Kilgour 2003). The quality target is based on attaining a quality of habitat patch throughout the natural system that would support in the very long term a broad range of biodiversity, specifically a quality that would support the region’s fauna Species of Conservation Concern (Table 1).

**Table 1: Habitat patch quality, rank and species response**

Size, Shape and Matrix Influence	Patch Rank	Fauna Species of Conservation Concern
Excellent	L1	Generally found
Good	L2	Generally found
Fair	L3	Generally found
Poor	L4	Generally not found
Very Poor	L5	Generally not found

In addition to the three criteria that make up the total habitat patch score, another important measure to consider in assessing habitat patch quality is forest interior, i.e. the amount of forest habitat that is greater than 100 m from the edge of the forest patch, using 100 m increments. A recognized distance for deep interior conditions occurs at 400 m from the patch edge. Such conditions are a habitat requirement for several sensitive fauna species.

## Quantity

The amount of natural cover needed in the landscape is based on the quantity required to accommodate and achieve the quality distribution targets described above. The two targets are therefore linked to each other: it will be impossible to achieve the required distribution of natural heritage quality without the appropriate quantity of natural cover. The proportion of the region that needs to be maintained as natural cover in order to achieve the desired quality has been identified as 30%.

## 3.2 Vegetation Community and Flora and Fauna Species

Vegetation community and flora and fauna species data were collected through field surveys. These surveys were done during the appropriate times of year to capture breeding status in the case of birds, and during the optimal growing period of the various plant species and communities.

Vegetation communities and flora species were surveyed concurrently. Botanical field-work for the site was conducted in three visits in late summer 2013 (Table 2). The whole OPG property had been surveyed in 2008 as well, though this survey excluded access to the landfill site itself (TRCA 2009). Vegetation community designations were based on the Ecological Land Classification (ELC) and determined to the level of vegetation type (Lee *et al.* 1998). Community boundaries were outlined onto printouts of 2007 digital ortho-rectified photographs (ortho-photos) to a scale of 1:2000 and then digitized in ArcView. Flora species of regional and urban concern (ranked L1 to L4) were mapped as point data with approximate number of individuals seen. A list of all species observed was documented for the site.

Fauna data were collected by the TRCA in late May and June. These surveys were concerned primarily with the mapping of breeding bird species of regional and urban concern (L1 to L4). As per the TRCA data collection protocol, breeding bird surveys are carried out by visiting all parts of a site at least twice during the breeding season (last week of May to mid-July) to determine the breeding status of each mapped point. The methodology for identifying confirmed and possible breeding birds follows Cadman *et al.* (2007). All initial visits are to be completed by the end of the third week of June. The field-season is to be organized so that by late June only repeat visits are being conducted. It is imperative that any visit made in the first half of June is subsequently validated by a second visit later in the season. For this urban location it was decided that records of both regional species of concern (ranked L1 to L3) and urban species of concern (L4) would be

mapped. Records were mapped as point data with each point representing a possible breeding bird.

**Table 1. Schedule of TRCA biological surveys at OPG Landfill**

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2007/08: ortho-photos	21 hours (whole region)
Vegetation Communities and Flora Species	27 <sup>th</sup> Aug., 4 <sup>th</sup> and 9 <sup>th</sup> Sept. 2013	14 hours
Breeding Songbirds	28 <sup>th</sup> May and 21 <sup>st</sup> June, 2013	4.25 hours

## 4.0 Results and Discussion

Information pertaining to the OPG Landfill study area was collected through both remote-sensing and ground-truthing surveys. This information contains three levels of detail: habitat patch, vegetation community, and species (flora and fauna). This Section provides the information collected and its analysis in the context of the TNHS Strategy.

### 4.1 Regional Context

Based on 2007/08 ortho-photography, 25% of the land area in the TRCA jurisdiction consists of natural cover but this figure includes meadow and old field. Although historically, the region would have consisted of up to 95% forest cover, currently (i.e. 2007/08) only about 17% is covered by forest and wetland. Of the non-natural cover (i.e. the remaining 75%), 48% is urban and 27% is rural / agricultural.

The regional level analysis of habitat patches shows that the present average patch quality across the TRCA jurisdiction is “fair” (L3); forest and wetland cover is contained largely in the northern half of the TRCA jurisdiction, especially on the Oak Ridges Moraine; and the quantity is 16.7% of the surface area of the jurisdiction (Map 3). In addition, meadow cover stands at 8.1% of the region. Thus the existing natural system stands below the quantity target that has been set for the region (30%) and also has an unbalanced distribution. The distribution of fauna species of concern is also largely restricted to the northern part of the jurisdiction; fauna species of regional concern are generally absent from the urban matrix (Map 4). The regional picture, being the result of a long history of land use changes, confirms that **all** site-based decisions contribute to the condition of a region.

### 4.2 Habitat Patch Findings for OPG Landfill

The following details the site according to the two natural system indicators used in designing the Terrestrial Natural Heritage System Strategy: the *quality distribution* and *quantity* of natural cover. Analysis was based on 2007/08 ortho-photos.

#### 4.2.1 Quantity of Natural Cover

Within the regional natural system, the OPG Landfill occupies a small but significant place along the lakeshore corridor, with coastal habitat providing a pathway particularly for migratory birds and insects. It also lies in the southern, urbanized zone of the TRCA jurisdiction.

The OPG Landfill is in the small Frenchman's Bay watershed, which covers about 2705 ha containing 22.4% natural cover (2007/08), including 275.4 ha as forest and successional (10.2%), 290.2 ha as meadow (10.7 %), 8.9 ha as coastal habitat (beach/bluff) (0.3%) and 30.5 ha as wetland (1.1%). The OPG Landfill contains 2.8% of the total natural cover in the Frenchman's Bay watershed. It has a strategic importance in the corridor of natural cover associated with the Lake Ontario shoreline.

The OPG Landfill has 20.0 ha of natural cover; 0.8 ha are manicured (Table 3; Appendix 1). The natural cover includes 2.9 ha of forest (mostly young plantation), 2.0 ha of successional, 10.1 ha of meadow and 1.9 ha of wetland. The site also includes 0.2 ha of "dynamic" communities: open or semi-open habitat maintained by unique conditions along the Lake Ontario shoreline. Combined with the natural cover of the entire OPG lands, these total 77.4 ha: 10.2 ha of forest, 5.6 ha of successional, 32.1 ha of meadow, 13.1 ha of wetland, 14.5 ha of vegetated aquatic, and 0.7 ha of dynamic communities (TRCA 2009).

#### 4.2.2 Quality Distribution of Natural Cover

The **total score** for quality distribution is derived from habitat patch **size** and **shape**, and **matrix influence**.

The study area and therefore **patch size** is small but the configuration of habitat patches (**shape**) is relatively rounded, which reduces the edge / area ratio. Thus, considering the very small size of the OPG Landfill, the interior of the habitat is relatively sheltered.

The site's isolation in a primarily industrial and commercial landscape dictates the opportunities available for natural recruitment into this entirely artificial patch of cover. The intensively developed surrounding landscape would tend to yield a negative **matrix influence**. However, the complete restriction on public access to the site presents opportunities that might be otherwise lacking in a more residentially developed landscape. On the one hand, it is almost entirely disconnected from any remnant natural system within the Frenchman's Bay watershed. On the other hand, however, the site is insulated from most direct disturbances caused by human activity. The presence of Lake Ontario itself also provides some limit on the exposure of the landscape to urban influences. Habitat patch **total score** on site ranks as "fair" (L3) for these reasons (Map 5).

## 4.2 Vegetation Community Findings for OPG Landfill

### 4.2.1 Vegetation Community Representation

The OPG Landfill is a small site with a total of 23 different ELC vegetation community types (Appendix 1; Map 6). There were six forest communities (all being young and all but one being plantation), six successional communities, seven wetlands, two coastal dynamic communities and two meadows.

Meadow predominates, occupying 10.1 ha, about half the total of the site, especially the landfill slopes. Most of this is dominated by European cool-season grasses (CUM1-b) with a smaller component of Native Forb Meadow (CUM1-A).

The site has 2.9 ha of forest community; however, this is overwhelmingly made up of numerous small fragments of plantation scattered as landscape plantings across the site. Most of the plantings date from the late 1980s, and so are fairly young. Horticultural Deciduous Plantation (CUP1-d), dominated in this case by the invasive Norway maple (*Acer platanoides*); Austrian Pine Coniferous Plantation (CUP3-b) and Colorado Spruce Coniferous Plantation (CUP3-j) are the main types. The sole non-plantation forest type is Fresh-Moist Poplar Deciduous Forest (FOD8-1), occurring mostly along the western side of the southern part of the landfill.

Successional communities cover 2.0 ha, i.e. about 10% of the site. They include areas of more natural regeneration on the landfill as well as a patch of post-agricultural Native Successional Deciduous Woodland (CUW1-A3), with less than 60% tree canopy closure. This is located at the south end of the site just above the Lake Ontario shoreline and has had the least amount of landfill, maintaining some of the natural topography. This is a dense growth of a variety of successional native woody species including poplar (*Populus* spp.), red ash (*Fraxinus pennsylvanica*), red-osier dogwood (*Cornus stolonifera*), and a few planted conifers and silver maple (*Acer saccharinum*).

Wetlands cover just 1.9 ha. Over half of this area is covered by a virtual monoculture of the invasive common reed (*Phragmites australis* ssp. *australis*): Common Reed Mineral Shallow Marsh (MAM2-a) covering 0.9 ha and Common Reed Mineral Shallow Marsh (MAS2-a) covering 0.3 ha. The more diverse wetlands are swamp types in the southern part of the site: Willow Mineral Deciduous Swamp (SWD4-1), Willow Mineral Thicket Swamp (SWT2-2), and Red-osier Dogwood Mineral Thicket Swamp (SWT2-5). Many of the wetland patches show evidence of vernal pooling and hence some degree of habitat diversity potential for amphibians.

Finally, the site includes a short stretch of Lake Ontario shoreline at the extreme south end (Figure 1). The coastal communities: Open Sand Beach (BBO1-1) and Mineral Open Bluff (BLO1) cover 0.2 ha. These are undisturbed because they are restricted from public access.

Exotic species are prominent, even dominant, across the entire site due to the land disturbance of recent decades with some of them having been deliberately planted. Common reed and Norway maple have already been mentioned as community dominants.



**Figure 1. Lake Ontario Shoreline with successional and coastal communities**

## 4.2.2 Vegetation Communities of Concern

The vegetation communities that occur in the TRCA jurisdiction are scored and given a local rank from L1 to L5 based on the two criteria mentioned in Section 3.1. Vegetation communities with a rank of L1 to L3 are considered of regional concern in the jurisdiction while L4 communities are considered of concern in the urban portion of the jurisdiction. On the other hand, community ranks do not take into account the intactness or quality of individual examples of communities; thus, a common type of vegetation community may be of conservation concern at a particular site because of its age, intact native ground layer, or other considerations aside from rank.

The Open Sand Beach community (BBO1-1) found at the very south edge of the OPG Landfill study area is very small but has a rank of L2. This example is valuable because it has little public access or disturbance and natural dynamics predominate. In addition, two successional communities: Raspberry Deciduous Thicket and Red-osier Dogwood Deciduous Thicket (CUT1-5 and CUT1-E) have a rank of L4 largely because they don't cover a lot of territory in the TRCA jurisdiction rather than due to high sensitivity. On the other hand, the L4 wetland communities that aren't dominated by common reed do have some sensitivity, especially to invasive species and hydrological changes. These are Willow Mineral Deciduous Swamp (SWD4-1), Willow Mineral Thicket Swamp (SWD2-2), Red-osier Dogwood Mineral Thicket Swamp (SWT2-5), and Broad-leaved Cattail Mineral Shallow Marsh (MAS2-1A). They also add habitat diversity.

## 4.3 Flora Species Findings for OPG Landfill

### 4.3.1 Flora Species Representation

The OPG Landfill had a total of 204 species of vascular plants recorded in 2013 (see Appendix 2). If the whole OPG property is taken into consideration, including the 2008 records, there are 288 species. Of the 204 species, 9 are present only as planted specimens. There are 78 native species (just 40% of the naturally-occurring total). The modest number of species recorded and very high proportion of exotic species reflects the fact that this is a very disturbed site: mostly landfill. Many of the non-native species, such as common European grasses as well as crown vetch (*Securigera varia*) are clearly originally from seed mixes placed onto the land fill for erosion control and vegetation cover. Others are simply successful super-invaders such as common reed.

### 4.3.2 Flora Species of Concern

There are 2 vascular plant species of regional conservation concern: shining willow (*Salix lucida*) and slender gerardia (*Agalinis tenuifolia*) (with a rank of L3) and an additional 17 L4 species (ranks described in Section 3.0). Appendix 2 lists plant species by ranks and locations are shown on Map 7. The ranks are based on sensitivity to human disturbance associated with development; and habitat dependence, as well as on rarity (TRCA 2010). Rarity is defined as being found in six or fewer of the forty-four 10x10 km UTM grid squares that cover the TRCA jurisdiction. In most cases, the species are not currently rare but are at risk of long-term decline due to the other

criteria. The two species recorded at OPG Landfill as “rare” are in fact not rare but have a low number of records because they have only recently been tracked: heal-all - *Prunella vulgaris* ssp. *lanceolata* and amethyst aster – *Symphotrichum x amethystinum*, which is a hybrid between the two common species New England aster (*S. novae-angliae*) and heath aster (*S. ericoides*).

Seventeen of the nineteen species of regional or urban concern are habitat specialists to some extent. Most of them, such as shining willow (*Salix lucida*), woolly sedge (*Carex pellita*), tall manna grass (*Glyceria grandis*), and soft-stemmed bulrush (*Schoenoplectus tabernaemontani*) are wetland species occurring in depressions around the base of the landfill. The slender gerardia actually tends to be even more restricted, to coastal meadow-marshes and so reflects the site’s proximity to Lake Ontario. The other specialists are typical of successional habitats: two species of hawthorn (*Crataegus macracantha* and *C. coccinea* var. *coccinea*), smooth wild rose (*Rosa blanda*) and early goldenrod (*Solidago juncea*).

Vulnerability to impacts caused by nearby development or human land use generally is another factor affecting species of concern. In the case of the OPG Landfill, there are 14 L1 to L4 flora species that have a somewhat elevated score. The main risk is from being overrun by invasive exotics, since the flora are fairly disturbance-tolerant in other ways. This is particularly true of the wetland species that may get outcompeted by common reed and hybrid cattail (*Typha x glauca*). Hawthorns and smooth wild rose grow well in disturbed post-agricultural landscapes but do not compete well in the long term with the invasive buckthorn (*Rhamnus cathartica*) or dog-strangling vine (*Cynanchum rossicum*). To some extent, the wetland species are also vulnerable to hydrological interference, drainage ditches, or climate change may render conditions no longer suitable for them. Given the site’s relative isolation, trampling and runoff are currently insignificant factors, although there may be some salt drift from nearby roads and parking lots.

### **Invasive Species**

While exotic plants dominate the site as a whole, many of these largely reflect the disturbance history of the landfill. They are so prevalent that management needs to take a priority view. There are just a few exotic species that are extremely aggressive. Common reed dominates the wetlands and even is moving into some of the uplands. The ground covered by common reed has noticeably increased since the 2008 survey, at least along the east side of the site near the Waterfront Trail. Crown vetch, originating from erosion control seed mixes, dominates much of the meadow on the main landfill hillside. Dog-strangling vine and buckthorn are present on the site but don’t yet dominate most of it, although dog-strangling vine is abundant in the successional and poplar forest areas. Dog-strangling vine is able to invade and dominate areas due to its prolific seed production, high seed viability, and competitive growth (TRCA 2008). At present, there are no effective control measures for large populations; however, a moth has recently been released in Ottawa for biological control trials for dog-strangling vine (Spears 2013). Garlic mustard (*Alliaria petiolata*) dominates the ground layer of many of the tree plantings.

One unusual find at the OPG Landfill is a new record for North America: hairy St. John’s-wort (*Hypericum hirsutum*) (Figure 2). This plant was observed in the 2008 survey and later identified in

2011 (Heydon et al. 2011). It is still present in 2013 on the east side of the site close to the Waterfront Trail. It is difficult to assess the potential invasiveness of this species at this time.



**Figure 2. Hairy St. John's-wort (*Hypericum hirsutum*), new to North America**

#### **4.4 Fauna Species Findings for OPG Landfill**

##### **4.4.1 Fauna Species Representation**

The TRCA fauna surveys at OPG Landfill in 2013 documented a total of 28 bird species and 6 mammal species, bringing the total number of possible breeding vertebrate fauna species identified by the TRCA to 34. The survey previously conducted across the entire OPG property in 2008 did not record any additional species within this current study area.

This total is perhaps a little low given the location of the site to the east of the main city of Toronto, but it is fairly certain that several non-avian species have been missed in the survey, e.g. eastern gartersnake (*Thamnophis sirtalis*) and striped skunk (*Mephitis mephitis*). It should be understood

that the survey protocol is directed primarily at fauna that can be detected by audio clues (birds and frogs). Refer to Appendix 3 for a list of the fauna species and their corresponding L-ranks.

#### 4.4.2 Fauna Species of Concern

Fauna species, like vegetation communities and flora species, are considered of regional concern if they rank L1 to L3 based on their scores for the seven criteria mentioned in Section 3.0. Since the subject site is situated within the urban zone this report also considers those species ranked as L4, i.e. those species that are of concern in urban landscapes.

Fauna surveys at the study area reported six bird species of regional and urban concern (all L4). In addition there were three mammal species of urban concern, bringing the total to nine fauna species of regional and urban concern. Locations of these breeding fauna are depicted on Map 8.

**Local occurrence** is one of seven scoring criteria for fauna species and is based on TRCA data and information from the Natural Heritage Information Centre (NHIC) of the Ontario Ministry of Natural Resources (OMNR) (NHIC 2008). Using local occurrence as a measure of regional rarity, any species that is reported as a probable or confirmed breeder in fewer than ten of the forty-four 10x10 km UTM grid squares in the TRCA jurisdiction is considered regionally rare (i.e. scores three to five points for this criterion) (TRCA, 2010). Just one of the species reported from the OPG Landfill study area satisfies this criterion: gadwall (*Anas strepera*) was observed on the beach at the southern extent of the site in both 2009 and 2013, suggesting that this duck species is at least attempting to nest along the lakeshore, and since the least disturbed patch of natural cover is situated within the restricted area of the site, it is highly likely that gadwall have nested in the vicinity. As is the case with flora, most regionally rare fauna species have other associated factors that explain their vulnerability and need to be taken into account in conservation strategies.

**Sensitivity to development** is another criterion used to determine the L-rank of fauna species. A large number of impacts that result from local land use, both urban and agricultural, can affect the local fauna. These impacts – considered separately from the issue of actual habitat loss – can be divided into two distinct categories. The first category involves changes that arise from local urbanization that directly affect the breeding habitat of the species in question. These changes alter the composition and structure of the vegetation communities; for example, the clearing and manicuring of the habitat (e.g. by removal of dead wood and clearance of shrub understorey). The second category of impacts involves changes that directly affect individuals of the species in question. Examples include increased predation from an increase in the local population of predator species that thrive alongside human developments (e.g. blue jays, *Cyanocitta cristata*; American crows, *Corvus brachyrhynchos*; squirrels, raccoons and house cats); parasitism (from facilitating the access of brown-headed cowbirds, *Molothrus ater*, a species which prefers more open, edge-type habitat); competition (for nest-cavities with bird species such as house sparrows, *Passer domesticus*; and European starlings, *Sturnus vulgaris*); flushing (causing disturbance and abandonment of nest) and, sensitivity to pesticides.

Fauna species are considered to have a high sensitivity to development if they score three or more points (out of a possible five) for this criterion. At the OPG Landfill study area, five of the nine L4 species receive this score and are therefore considered sensitive to one or more of the impacts associated with development. The five species include gadwall, which is especially sensitive to ground-borne disturbance since it is a ground-nesting species. Ground-nesting species are highly susceptible both to increased predation from ground-foraging predators that are subsidized by local residences (house cats, raccoons) and to repeated flushing from the nest (by pedestrians, off-trail bikers and dogs) resulting in abandonment and failed breeding attempts.

Of the remaining four sensitive species, two are meadow obligates: eastern kingbird (*Tyrannus tyrannus*) and willow flycatcher (*Empidonax traillii*), both of which nest at mid-height and are somewhat susceptible to persistent disturbance from hikers. The presence of multiple territories for these two species indicates that disturbance within the site (including the adjacent fenced extension of natural cover) is very low, affording a fairly extensive area free from human disturbance.

Such numbers of relatively sensitive species are persisting at this site because although the habitat quality is poor, the matrix influence is fair, and the access restriction to the site prevents excessive human disturbance. It is important to understand that negative matrix influences are not solely associated with the proximity of urban and suburban developments; many of the negative influences can be transferred deep within an otherwise intact natural matrix by extensive trail networks. Extensive public use of a natural habitat can have substantial negative impact through the cumulative effects of hiking, dog-walking and biking on the site. Currently, these impacts do not have any bearing on the subject lands.

Various studies have shown that many bird species react negatively to human intrusion (i.e. the mere presence of people) to the extent that nest-abandonment and decreased nest-attentiveness lead to reduced reproduction and survival. One example of such a study showed that abundance was 48% lower for hermit thrushes (a ground-nesting/foraging species) in intruded sites than in the control sites (Gutzwiller and Anderson 1999). Elsewhere, a recent study reported that dog-walking in natural habitats caused a 35% reduction in bird diversity and a 41% reduction in abundance, with even higher impacts on ground-nesting species (Banks and Bryant 2007).

The tendency for local urbanization to be accompanied by the clearing and maintenance of woodlands and thickets in the vicinity dramatically disrupts any species that is dependent on such scrub cover for nesting or foraging, and certainly one sensitive bird species at the Landfill site - grey catbird (*Dumetella carolinensis*), - has such specific requirements. Grey catbird requires a relatively intact shrub layer, or at least the shelter and nest-protection afforded by dense shrub foliage. However, the observation of just one grey catbird territory suggests that some other aspect of their preferred shrub habitat is not in place. It is possible excessive deer-browse has reduced the desirability of the remaining tree cover. The fifth L4 species scoring high for sensitivity to development is the northern flicker (*Colaptes auratus*), which has a particular need for standing dead wood in which to excavate nest-holes.

**Area sensitivity** is a scoring criterion that can be closely related to the issue of a species' need for isolation. Fauna species are scored for area sensitivity based on their requirement for a certain minimum size of preferred habitat. Species that require large tracts of habitat (>100 ha in total) score the maximum five points, while species that either show no minimum habitat requirement, or require <1 ha in total, score one point. Species scoring three points or more (require  $\geq 5$  ha in total) are deemed area sensitive species. Researchers have shown that for some species of birds, area sensitivity is a rather fluid factor, dependent and varying inversely with the overall percentage forest cover within the landscape surrounding the site where those species are found (Rosenburg *et al.* 1999). Of the nine fauna species of regional and urban concern that were identified only one species - white-tailed deer (*Odocoileus virginianus*) - is considered area sensitive.

Species' patch-size constraints are due to a variety of factors including foraging requirements and the need for isolation within a habitat block during nesting. In the latter case, regardless of the provision of a habitat patch of sufficient size, if that block is seriously and frequently disturbed by human intrusion, such species will be liable to abandon the site. Given the lack of disturbance at the Landfill site it is highly likely that white-tailed deer are in fact giving birth within the site.

At 20 ha the Landfill site is extensive enough to accommodate other area sensitive species and it is perhaps a little surprising to note such species' absence. It seems highly likely that another factor is dictating the absence of such species. The final two scoring criteria may in fact have more influence at this site than either sensitivity to development or area sensitivity.

**Patch isolation sensitivity** in fauna measures the overall response of fauna species to fragmentation and isolation of habitat patches. One of the two main aspects of this scoring criterion is the physical ability or the predisposition of a species to move about within the landscape and is related to the connectivity of habitat within a landscape. The second main aspect is the potential impact that roads have on fauna species that are known to be mobile. Thus most bird species score fairly low for this criterion (although they prefer to forage and move along connecting corridors) whereas many herpetofauna score very high (since their life cycle requires them to move between different habitat types which may increase likelihood of roadkill). One example of how this criterion affects species populations is the need for adult birds to forage for food during the nestling and fledgling stage of the breeding season. By maintaining and improving the connectivity of natural cover within the landscape (e.g. by reforestation of intervening lands) we are able to positively influence the populations of such species, improving their foraging and dispersal potential.

Only one of the L4 species – woodchuck (*Marmota monax*) - scores significantly in this criterion. Woodchucks are regularly the victim of roadkill but they are such prolific breeders that their populations can probably withstand a certain level of mortality on the roads, in much the same way as can raccoon and striped skunk. Two species that were not observed at the Landfill site but are suspected as being present are eastern gartersnake and brownsnake (*Storeria dekayi*). Both species are managing to persist within the urban landscape in the City of Toronto and it is thought that they are likely to be present at the OPG Landfill. Both species, however, are sensitive to patch fragmentation and are especially susceptible to roadkill in areas of heavy traffic. It is possible that

numbers of these two common species are reduced at the study area due to its isolation but it is considered much more likely that the species were simply missed by a field protocol which is not designed to effectively inventory such species.

Fauna species that score greater than three points under the **habitat dependence** criterion are considered habitat specialists. These species exhibit a combination of very specific habitat requirements that range from their microhabitat (e.g. decaying logs, aquatic vegetation) and requirements for particular moisture conditions, vegetation structure or spatial landscape structures, to preferences for certain community series and macro-habitat types. The only fauna species that occurs at the OPG Landfill site that is considered a habitat specialist is northern rough-winged swallow (*Stelgidopteryx serripennis*), a species that is dependent on very specific nest requirements, being a cavity-nester in banks and artificial man-made cavities (such as are to be found among the infrastructure associated with the adjacent power generating station).

Representation is essentially the presence or absence of a species at a site. However, beyond mere representation of single species is the idea that a natural system can be considered a healthy functioning system if there is an association of several species thriving within that system. Each habitat type supports particular species associations. As the quality of the habitat patch improves so will the representation of flora and fauna species within that habitat. In this way representation biodiversity is an excellent measure of the health of a natural system. The presence of almost no habitat dependent species, in particular, species that are dependent on meadow habitat – the dominant habitat type at the site - initially suggests that the open habitat at the study area is not functioning at a particularly high level. However, the presence of multiple territories for two sensitive meadow species (willow flycatcher and eastern kingbird) indicates otherwise. What is lacking from the meadow community is any representation of ground- or low-nesting species, such as savannah sparrow (*Passerculus sandwichensis*), eastern meadowlark (*Sturnella magna*) and bobolink (*Dolichonyx oryzivorus*).

The TRCA runs a meadow monitoring station in the nearby hydro corridor and although there have been no savannah sparrows recorded within the station count area, there have been multiple records of pairs of savannah sparrows nesting successfully in the grass banks around the soccer pitch complex. That a ground-nesting meadow species such as this would utilize opportunities in a presumably somewhat disturbed location but meanwhile avoid the several hectares of undisturbed meadow habitat at the nearby Landfill suggests that the habitat quality at the Landfill is severely lacking. Certainly, the vegetation surveys would bear this out. The sward is an impenetrable jungle of non-native crown vetch.

## 5.0 Recommendations

The recommendations for the OPG Landfill study area are given in relation to the regional targets for natural heritage in the TRCA jurisdiction. To reach the regional targets for quality distribution and quantity of natural cover, every site will require its own individualized plan of action. Following is a short summary of the site within the regional context, followed by specific recommendations.

## 5.1 Site Highlights

- Site is a block of predominantly open habitat, isolated but located strategically on important coastal corridor
- Total of 23 vegetation types observed, including a large block of meadow, but also young plantation and poplar forest, wetland, and successional habitats and a small coastal strip with beach and bluff
- A total of 204 flora species observed; 19 L1 to L4 plants; flora include successional and wetland species (total OPG property including area surveyed in 2008) has 288 flora species
- Flora of concern include the Great Lakes coastal meadow-marsh species slender gerardia
- First known North American record of hairy St. John's-wort
- Site has been planted with almost exclusively exotic species – both trees and forbs, which at present provides a constraint on natural quality and function
- Total of 34 vertebrate fauna species observed which is perhaps a little lower than might be expected given the study area size and the matrix influence
- The patch supports multiple territories of two sensitive open-habitat species – willow flycatcher and eastern kingbird
- The site provides a total of 17 ha of undisturbed habitat, fenced from any direct human disturbance. (Vegetation polygons extending outside the fence increase total to 20 ha)
- The site's location right on the lakeshore presents opportunities for migrating birds (and butterflies) to utilize the site for shelter and foraging.

## 5.2 Site Recommendations

### ***Protect and Maximize Benefits between the OPG Landfill and Wider Natural System***

Recommendations based on this objective address the landscape ecology indicators of patch size/shape and matrix influence, as well as connections to the larger system.

#### *Optimize Patch Size and Shape*

The more that natural cover is restored and maintained at the study area and vicinity, the better it can support a healthy level of biodiversity. Furthermore, improving the representation of native plants and vegetation communities will provide excellent food and shelter opportunities for migrating songbirds. This latter is especially true if such restoration efforts can be extended to enhance any corridor that exists between the OPG Landfill site and the lower Duffins watershed. Increasing natural cover through strategic plantings and restoration will improve the patch size and shape and facilitate the reduction of negative matrix influences. The larger a habitat block, the more resilient the associated fauna and flora communities are to developments within the landscape or to increased user pressure.

- Any opportunity to restore natural habitat on land adjacent to the study area, increasing the current 20 ha, will help to ensure the persistence of the existing population of willow flycatchers and eastern kingbirds, and possibly encourage the recruitment of other sensitive early successional species.
- Planting extensive native shrub cover at the site will enhance the foraging opportunities for the large number of fall migrants which undoubtedly pass along this stretch of the Lake Ontario shoreline, especially if such native cover is integrated into an extended network of natural cover connecting to the major migration route along the Duffins and Rouge watersheds. Likewise, managing a native meadow community within the site will provide excellent nectaring opportunities for a host of both migrant and resident invertebrates (e.g. monarch butterflies, *Danaus plexippus*).

### *Minimize Negative Matrix Influence*

Landscape metrics indicate that the matrix influence at the site is largely neutral (emanating from a primarily industrial and commercial matrix). However, the relatively small size of the site means that even a low level of negative matrix influence is likely to have a profound effect. The site's current status, prohibiting and restricting all public access, provides respite from any direct disturbance from hikers and dog-walkers.

- Plans for the site should focus on biological conservation and habitat instead of recreation, because it is currently free of recreational impacts and because it is inaccessible to users.
- All invasive plants that are now present should be controlled. Invasive species control should be set up pro-actively, as part of an extensive restoration of the entire site to native communities. The first species to receive attention should be those whose populations are currently localized, such as buckthorn and garlic mustard.
- Because the site is fairly small and isolated, it may be possible to control the dog-strangling vine and buckthorn as well as the less-established invasive species.
- The common reed is particularly problematic. Options for controlling this plant are limited, although mowing followed by covering the ground with a light-blocking fabric for about two years can have some success. Wetlands dominated by a monoculture of common reed could be considered as candidates for major regrading and replanting.

### *Improve Connectivity to Nearby Habitat*

A feature of this site that has great influence on the condition of the fauna diversity is its almost complete isolation from the surrounding larger landscape. On three sides, west, north and east, the site is bound by roads and industrial uses; to the south is Lake Ontario. The only unobstructed ingress (or egress) to this site is along the lake shore. This relative isolation does not necessarily cause any problems for the avian fauna of the site but may have considerable impact on reptile

populations (e.g. eastern gartersnake). It would be difficult for local recruitment to be able to compensate for any on-site extirpations since movement across the local landscape is so compromised.

- One way to address the existing habitat connectivity issues would be to widen the existing shoreline corridor, connecting this site to the Duffins watershed.
- Other fauna and plants may be less compromised in their dispersal across a landscape that is fragmented by roads, but there should be an investigation into other possible ways to improve connectivity of habitat patches in the area.

### *Improve Habitat Quality*

It is in the criterion of habitat quality that the most improvement is required at this site; fortunately this is also the area in which improvement is most feasible. Efforts should be made to improve the quality of existing habitat, and to ensure that restoration work matches site conditions.

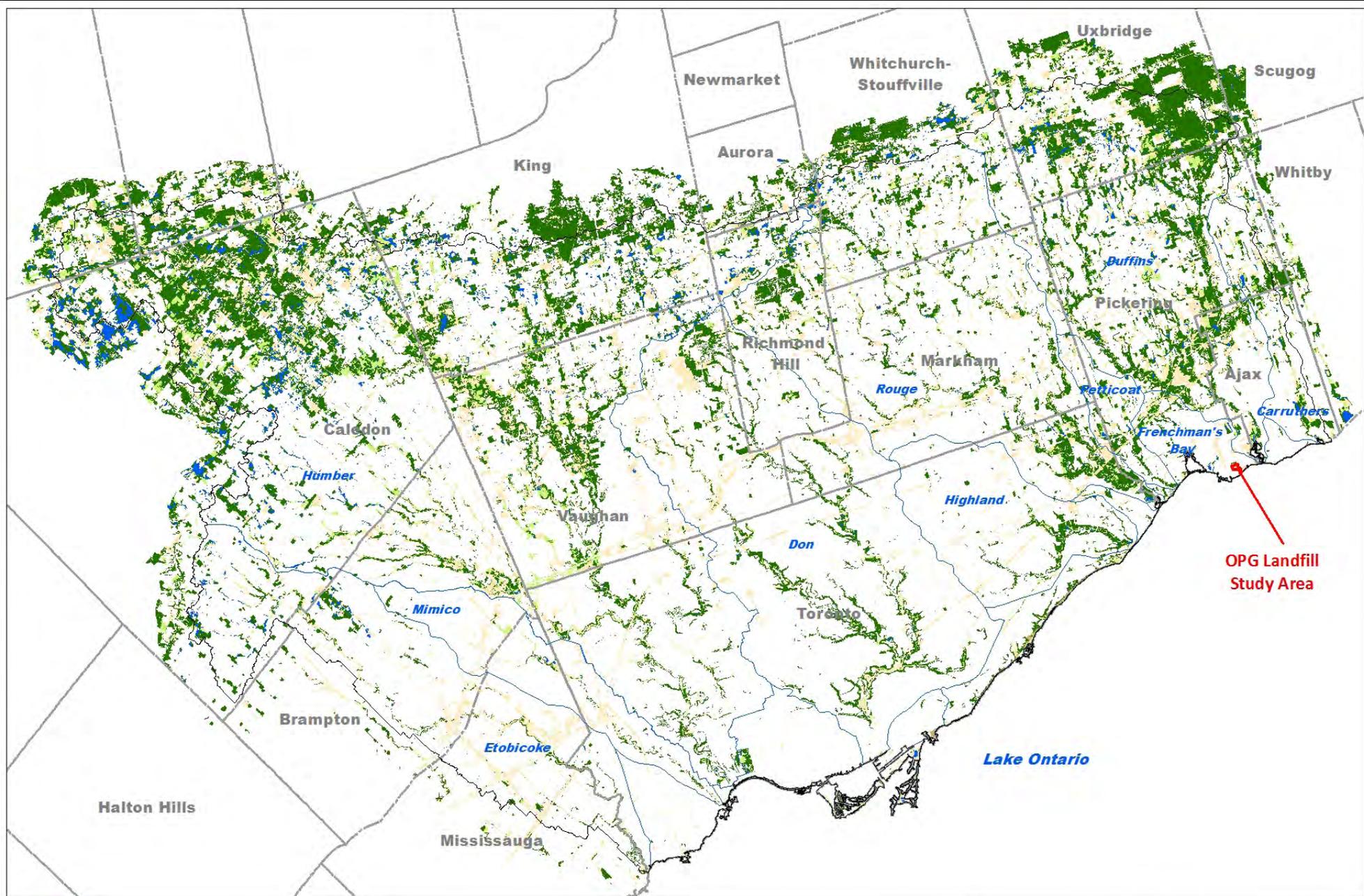
- Vegetation and species selection for planting in restoration areas should be targeted according to topography and drainage. For example, Norway maple plantings should be removed and replaced with the limited number of native tree species suitable for compacted soils, such as bur oak (*Quercus macrocarpa*), hawthorn (*Crataegus* spp.) and red cedar (*Juniperus virginiana*). Existing non-native conifers such as Austrian pine (*Pinus nigra*) and Colorado spruce (*Picea pungens*) should be retained because they provide coniferous cover and habitat diversity while not being very invasive.
- Restoration should be designed around the most feasible natural community and function for this much altered site (i.e. the landfill). Given the site's isolation and disturbed soils it may be more appropriate to concentrate efforts on the behalf of migrating songbirds as opposed to breeding bird communities or sensitive native plant communities.
- Creating foraging and shelter opportunities for migrating songbirds will incidentally provide nesting opportunities for several songbird species associated with early succesional and more open habitats, e.g. grey catbird, clay-coloured sparrow (*Spizella pallida*), field sparrow (*Spizella pusilla*), and brown thrasher (*Toxostoma rufum*).

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Date: December, 2013

\* Landscape analysis based on 2007/2008 Orthophotography

**Map 1:**  
**OPG Landfill in the**  
**Context of Regional Natural Cover**

**Natural Cover \***

-  Forest
-  Successional
-  Meadow
-  Wetland
-  Beach/Bluff

**Legend**

-  OPG Landfill Study Area Boundary
-  TRCA Jurisdiction
-  Watershed
-  Municipal Boundary



Toronto and Region  
**Conservation**  
*for The Living City*

0 25 50 100 150 200 Meters

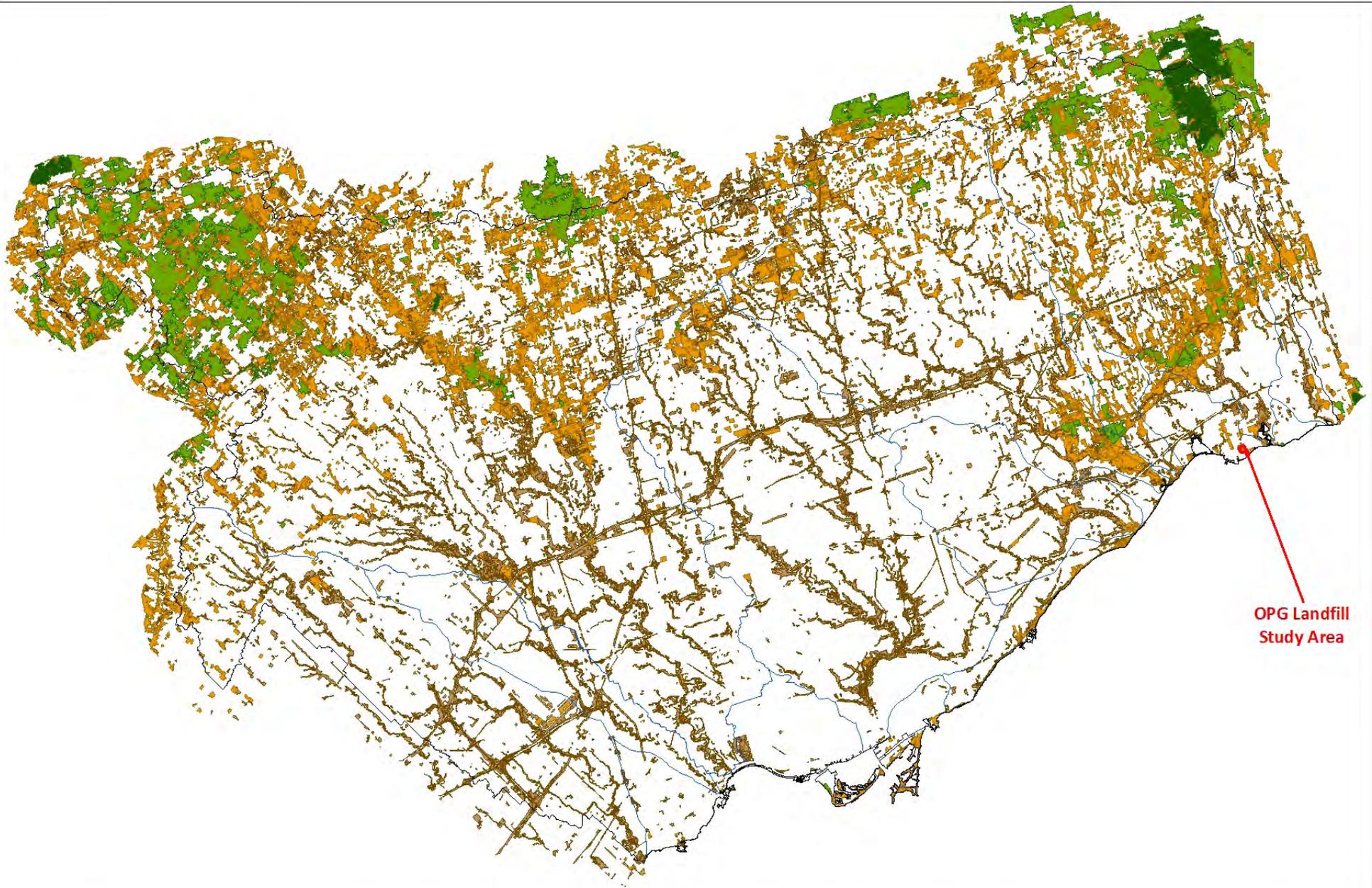
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## Map 2: OPG Landfill Study Area

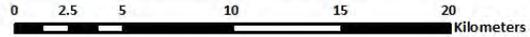
### Legend



OPG Landfill Study Area Boundary



OPG Landfill Study Area

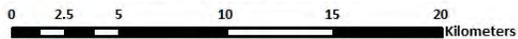
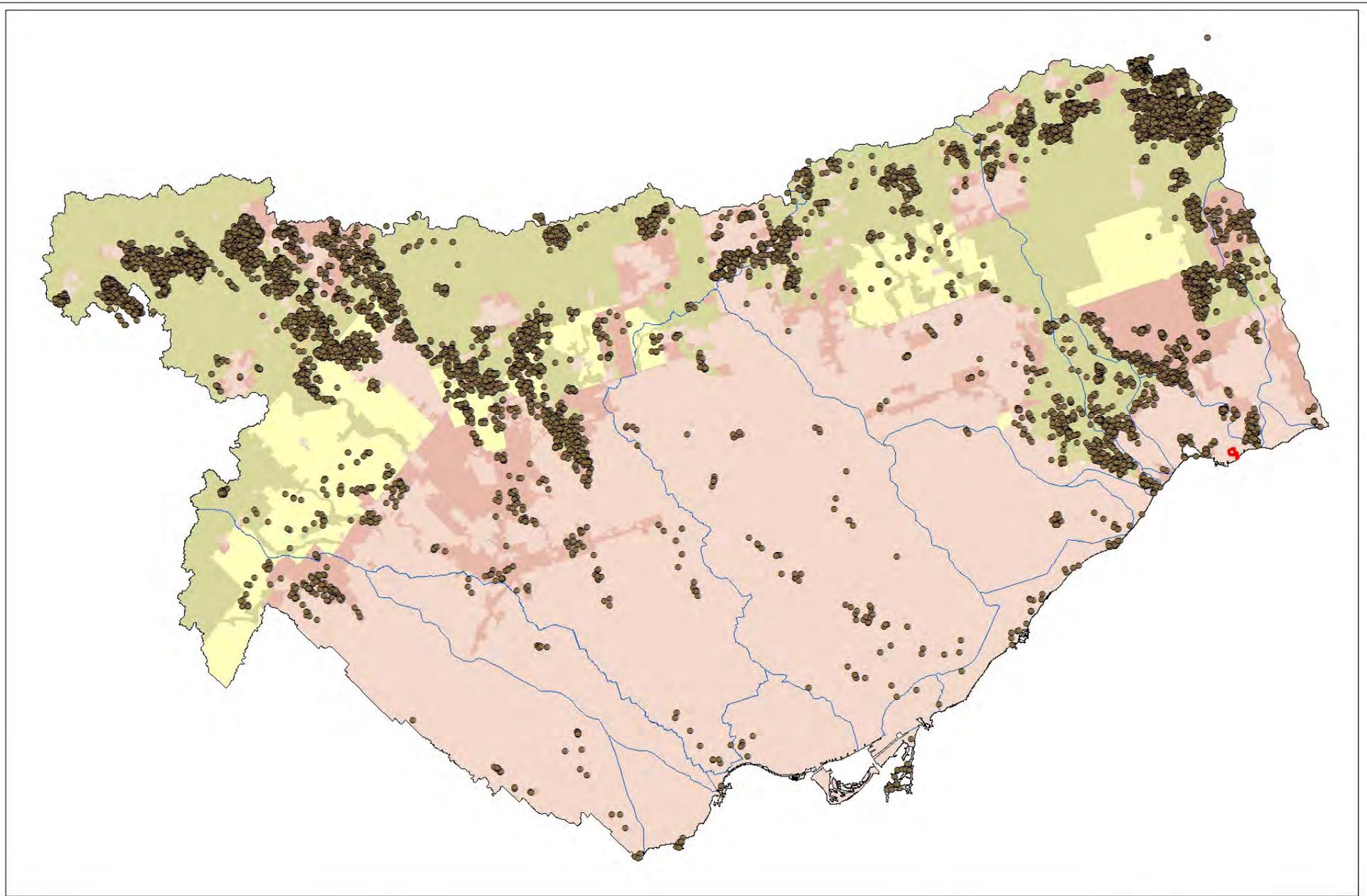


Date: December, 2013

\* Landscape analysis based on 20072008 Orthophotography

### Map 3: Regional Natural System Habitat Patch Quality

Habitat Patch Quality *		Legend	
	L1 - Excellent		OPG Landfill Study Area Boundary
	L2 - Good		TRCA Jurisdiction
	L3 - Fair		Watershed
	L4 - Poor		
	L5 - Very Poor		

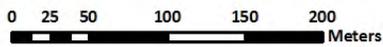


Date: December, 2013

### Map 4: Distribution of Fauna Regional Species of Concern

#### Legend

-  Fauna Species of Concern (L1 - L3)
-  OPG Landfill Study Area Boundary
-  TRCA Jurisdiction
-  Watershed
-  Agricultural & Rural Area
-  Built-up Area
-  Designated Greenfield Area
-  Greenbelt Area



Date: December, 2013

Orthophoto: Spring 2010, First Base Solutions Inc.  
\* Landscape analysis based on 2007/2008  
Orthophotography

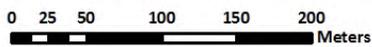
### Map 5: Habitat Patch Quality

#### Legend

##### Habitat Patch Quality \*

- L1 - Excellent
- L2 - Good
- L3 - Fair
- L4 - Poor
- L5 - Very Poor

OPG Landfill Study Area Boundary



Date: December, 2013

Orthophoto: Spring 2010, First Base Solutions Inc.

### Map 6: Vegetation Communities with their Associated Local Ranks

**Legend**

**Vegetation Community Ranks**

	L1		L4
	L2		L5
	L3		L+

 OPG Landfill Study Area Boundary

NOTE: All vegetation communities with their associated scores and ranks can be found in Appendix #1.






0 25 50 100 150 200  
 Meters

Date: December, 2013  
 Orthophoto: Spring 2010, First Base Solutions Inc.

## Map 7: Location of Flora Species of Concern

**Legend**

<p><b>Flora Species of Concern (L1-L4)</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">●</span> L1    <span style="color: orange;">●</span> L3</li> <li><span style="color: green;">●</span> L2    <span style="color: orange;">●</span> L4</li> </ul>	<p><b>Planted Flora Species of Concern (L1-L4)</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">⊕</span> L1    <span style="color: orange;">⊕</span> L3</li> <li><span style="color: green;">⊕</span> L2    <span style="color: orange;">⊕</span> L4</li> </ul>
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OPG Landfill Study Area Boundary




  
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0 25 50 100 150 200  
 Meters

Date: December, 2013  
 Orthophoto: Spring 2010, First Base Solutions Inc.

**Map 8:**  
**Locations of Fauna Species of Concern**

**Legend**

**Fauna Species of Concern**

	L1		L3
	L2		L4

 OPG Landfill Study Area Boundary

<b>Appendix 1: OPG Landfill Vegetation Communities (2013)</b>						
ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank (2012-08)
			Local Occur.	Geophy. Requir.	Total Score	
<b>Forest</b>						
FOD8-1	Fresh-Moist Poplar Deciduous Forest	0.3	1.0	0.0	1.0	L5
CUP1-4	Hybrid Poplar Deciduous Plantation	0.3	3.0	0.0	3.0	L5
CUP1-5	Silver Maple Deciduous Plantation	0.1	3.0	0.0	3.0	L5
CUP1-d	Horticultural Deciduous Plantation	1.0	3.5	0.0	3.5	L+
CUP3-b	Austrian Pine Coniferous Plantation	0.7	3.5	0.0	3.5	L+
CUP3-j	Colorado Spruce Coniferous Plantation	0.5	5.0	0.0	5.0	L+
<b>Successional</b>						
CUT1-1	Sumac Deciduous Thicket	0.2	2.0	0.0	2.0	L5
CUT1-5	Raspberry Deciduous Thicket	0.1	3.0	0.0	3.0	L4
CUT1-E	Red Osier Dogwood Deciduous Thicket	0.1	3.0	0.0	3.0	L4
CUH1-A	Treed Hedgerow	0.1	1.5	0.0	1.5	L5
CUS1-A1	Native Deciduous Successional Savannah	1.1	1.5	0.0	1.5	L5
CUW1-A3	Native Deciduous Successional Woodland	0.5	1.0	0.0	1.0	L5
<b>Wetland</b>						
SWD4-1	Willow Mineral Deciduous Swamp	0.1	2.0	1.0	3.0	L4
SWT2-2	Willow Mineral Thicket Swamp	0.3	2.0	2.0	4.0	L4
SWT2-5	Red-osier Mineral Thicket Swamp	0.1	2.0	2.0	4.0	L4
MAM2-a	Common Reed Mineral Meadow Marsh	0.9	3.0	0.0	3.0	L+
MAS2-1A	Broad-leaved Cattail Mineral Shallow Marsh	0.02	2.0	1.0	3.0	L4
MAS2-1b	Narrow-Leaved Cattail Mineral Shallow Marsh	0.1	2.0	0.0	2.0	L+
MAS2-a	Common Reed Mineral Shallow Marsh	0.3	3.0	0.0	3.0	L+
<b>Dynamic (Beach, Bluff, Barren, Prairie, Savannah)</b>						
BBO1-1	Sea Rocket Open Sand Beach	0.1	3.5	3.0	6.5	L2
BLO1	Mineral Open Bluff	0.1	2.5	2.0	4.5	L4
<b>Meadow</b>						
CUM1-A	Native Forb Meadow	0.8	1.5	0.0	1.5	L5
CUM1-b	Exotic Cool-season Grass Graminoid Meadow	9.3	1.0	0.0	1.0	L+

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Agalinis tenuifolia</i>	slender gerardia	3	4	5	4	16	L3
<i>Salix lucida</i>	shining willow	2	4	5	3	14	L3
<i>Acer saccharinum</i>	silver maple	1	2	5	3	11	L4
<i>Carex pellita</i>	woolly sedge	2	3	4	3	12	L4
<i>Carex pseudocyperus</i>	pseudocyperus sedge	2	3	3	4	12	L4
<i>Crataegus coccinea</i> var. <i>coccinea</i>	scarlet hawthorn	3	2	3	3	11	L4
<i>Crataegus macracantha</i>	long-spined hawthorn	2	2	4	3	11	L4
<i>Glyceria grandis</i>	tall manna grass	2	3	4	2	11	L4
<i>Juncus articulatus</i>	jointed rush	3	2	4	2	11	L4
<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>	heal-all (native)	4	2	3	2	11	L4
<i>Rosa blanda</i>	smooth wild rose	2	3	3	4	12	L4
<i>Salix amygdaloides</i>	peach-leaved willow	1	2	5	3	11	L4
<i>Salix bebbiana</i>	Bebb's willow	2	3	3	4	12	L4
<i>Salix discolor</i>	pussy willow	2	3	4	3	12	L4
<i>Schoenoplectus tabernaemontani</i>	soft-stemmed bulrush	1	2	5	3	11	L4
<i>Solidago juncea</i>	early goldenrod	3	3	4	2	12	L4
<i>Symphotrichum</i> x <i>amethystinum</i>	amethyst aster	5	2	2	2	11	L4
<i>Thuja occidentalis</i>	white cedar	1	4	1	5	11	L4
<i>Typha latifolia</i>	broad-leaved cattail	1	4	4	4	13	L4
<i>Acer saccharum</i>	sugar maple	2	3	0	2	7	L5
<i>Achillea millefolium</i> ssp. <i>lanulosa</i>	woolly yarrow	3	2	0	1	6	L5
<i>Agrimonia gryposepala</i>	agrimony	2	2	0	2	6	L5
<i>Ambrosia artemisiifolia</i>	common ragweed	2	1	3	0	6	L5
<i>Anemone canadensis</i>	Canada anemone	2	2	2	2	8	L5
<i>Apocynum cannabinum</i> var. <i>cannabinum</i>	hemp dogbane	3	2	2	2	9	L5
<i>Asclepias syriaca</i>	common milkweed	2	2	0	2	6	L5
<i>Bidens frondosa</i>	common beggar's-ticks	2	1	4	0	7	L5
<i>Carex granularis</i>	meadow sedge	3	2	1	3	9	L5
<i>Carex stipata</i>	awl-fruited sedge	2	3	2	3	10	L5
<i>Cornus stolonifera</i>	red osier dogwood	2	2	0	3	7	L5
<i>Echinocystis lobata</i>	wild cucumber	2	2	3	1	8	L5
<i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>	sticky willow-herb	3	2	2	2	9	L5

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Equisetum arvense</i>	field horsetail	2	2	1	1	6	L5
<i>Erigeron canadensis</i>	horse-weed	3	1	2	0	6	L5
<i>Erigeron philadelphicus</i> var. <i>philadelphicus</i>	Philadelphia fleabane	3	2	0	1	6	L5
<i>Erigeron strigosus</i>	rough fleabane	4	2	1	1	8	L5
<i>Euthamia graminifolia</i>	grass-leaved goldenrod	2	1	4	1	8	L5
<i>Fraxinus americana</i>	white ash	2	2	0	3	7	L5
<i>Fraxinus pennsylvanica</i>	red ash	1	2	0	3	6	L5
<i>Galium aparine</i>	cleavers	3	1	3	2	9	L5
<i>Galium palustre</i>	marsh bedstraw	2	2	3	3	10	L5
<i>Juglans nigra</i>	black walnut	2	1	2	1	6	L5
<i>Juncus bufonius</i>	toad rush	4	1	4	1	10	L5
<i>Juncus dudleyi</i>	Dudley's rush	2	2	3	1	8	L5
<i>Leersia oryzoides</i>	rice cut grass	2	2	3	2	9	L5
<i>Lemna turionifera</i>	common duckweed	2	2	4	2	10	L5
<i>Oenothera biennis</i>	common evening-primrose	2	1	1	1	5	L5
<i>Oxalis stricta</i>	common yellow wood-sorrel	5	1	1	1	8	L5
<i>Panicum capillare</i>	panic grass	3	1	4	1	9	L5
<i>Parthenocissus inserta</i>	thicket creeper	2	2	0	1	5	L5
<i>Persicaria lapathifolia</i>	pale smartweed	3	1	4	0	8	L5
<i>Plantago rugelii</i>	red-stemmed plantain	3	2	0	1	6	L5
<i>Poa palustris</i>	fowl meadow-grass	2	2	3	2	9	L5
<i>Populus balsamifera</i>	balsam poplar	2	2	3	2	9	L5
<i>Populus deltoides</i>	cottonwood	2	1	4	1	8	L5
<i>Populus tremuloides</i>	trembling aspen	2	3	1	3	9	L5
<i>Potentilla anserina</i> ssp. <i>anserina</i>	silverweed	3	2	3	2	10	L5
<i>Prunus virginiana</i> var. <i>virginiana</i>	choke cherry	2	2	0	1	5	L5
<i>Rhus typhina</i>	staghorn sumach	2	1	2	2	7	L5
<i>Rubus idaeus</i> ssp. <i>strigosus</i>	wild red raspberry	1	1	0	1	3	L5
<i>Salix eriocephala</i>	narrow heart-leaved willow	2	1	3	1	7	L5
<i>Salix interior</i>	sandbar willow	2	1	5	2	10	L5
<i>Sambucus canadensis</i>	common elderberry	2	3	2	2	9	L5
<i>Scirpus atrovirens</i>	black-fruited bulrush	2	2	4	2	10	L5

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Scirpus microcarpus</i>	barber-pole bulrush	1	2	4	3	10	L5
<i>Solanum ptychanthum</i>	American black nightshade	4	1	4	0	9	L5
<i>Solidago altissima</i>	tall goldenrod	2	2	0	0	4	L5
<i>Solidago gigantea</i>	late goldenrod	3	1	1	1	6	L5
<i>Solidago nemoralis</i> ssp. <i>nemoralis</i>	grey goldenrod	3	2	2	2	9	L5
<i>Symphotrichum cordifolium</i>	heart-leaved aster	2	1	0	2	5	L5
<i>Symphotrichum ericoides</i> var. <i>ericoides</i>	heath aster	2	1	2	1	6	L5
<i>Symphotrichum lanceolatum</i> var. <i>lanceolatum</i>	panicked aster	2	2	3	1	8	L5
<i>Symphotrichum novae-angliae</i>	New England aster	2	2	2	1	7	L5
<i>Tilia americana</i>	basswood	2	3	2	3	10	L5
<i>Viburnum lentago</i>	nannyberry	2	3	1	2	8	L5
<i>Vitis riparia</i>	riverbank grape	2	1	0	0	3	L5
<i>Xanthium strumarium</i>	clotbur	3	1	4	0	8	L5
<i>Fragaria virginiana</i> ssp. <i>glauca</i>	blue-leaved wild strawberry	5		5	0	10	L5?
<i>Abutilon theophrasti</i>	velvet-leaf	5	0	0	2	7	L+
<i>Acer platanoides</i>	Norway maple	4				4	L+
<i>Agrostis gigantea</i>	redtop	4				4	L+
<i>Ailanthus altissima</i>	tree-of-heaven	5				5	L+
<i>Alliaria petiolata</i>	garlic mustard	4				4	L+
<i>Anagallis arvensis</i>	scarlet pimpernel	4				4	L+
<i>Arctium lappa</i>	great burdock	4				4	L+
<i>Arctium minus</i>	common burdock	5				5	L+
<i>Artemisia biennis</i>	biennial wormwood	5				5	L+
<i>Betula pendula</i>	European white birch	5				5	L+
<i>Bromus commutatus</i>	upright chess	5				5	L+
<i>Bromus inermis</i>	smooth brome grass	4				4	L+
<i>Centaurea stoebe</i> ssp. <i>micranthos</i>	spotted knapweed	5				5	L+
<i>Centaureum pulchellum</i>	branching centaury	5				5	L+
<i>Chaenorhinum minus</i> ssp. <i>minus</i>	dwarf snapdragon	5				5	L+
<i>Chenopodium album</i>	lamb's quarters	5				5	L+
<i>Chenopodium glaucum</i>	oak-leaved goosefoot	4				4	L+
<i>Cichorium intybus</i>	chicory	5				5	L+

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Cirsium arvense</i>	creeping thistle	4				4	L+
<i>Cirsium vulgare</i>	bull thistle	4				4	L+
<i>Convolvulus arvensis</i>	field bindweed	3				3	L+
<i>Crepis tectorum</i>	narrow-leaved hawk's beard	5				5	L+
<i>Cynanchum rossicum</i>	dog-strangling vine	4				4	L+
<i>Dactylis glomerata</i>	orchard grass	4				4	L+
<i>Daucus carota</i>	Queen Anne's lace	4				4	L+
<i>Digitaria ischaemum</i>	smooth crab grass	5				5	L+
<i>Digitaria sanguinalis</i>	hairy crab grass	5				5	L+
<i>Diplotaxis muralis</i>	wall rocket	5				5	L+
<i>Echinochloa crus-galli</i>	barnyard grass	5				5	L+
<i>Echium vulgare</i>	viper's bugloss	3				3	L+
<i>Elaeagnus angustifolia</i>	Russian olive	4				4	L+
<i>Elaeagnus umbellata</i>	autumn olive	5				5	L+
<i>Elymus repens</i>	quack grass	5				5	L+
<i>Epilobium hirsutum</i>	European willow-herb	5				5	L+
<i>Epilobium parviflorum</i>	small-flowered willow-herb	5				5	L+
<i>Eragrostis minor</i>	little love grass	4				4	L+
<i>Erucastrum gallicum</i>	dog mustard	4				4	L+
<i>Fallopia convolvulus</i>	black bindweed	5				5	L+
<i>Festuca filiformis</i>	hair fescue	5				5	L+
<i>Festuca rubra</i> ssp. <i>rubra</i>	red fescue	5				5	L+
<i>Galium mollugo</i>	white bedstraw	5				5	L+
<i>Geum urbanum</i>	urban avens	4				4	L+
<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	squirrel-tail barley	4				4	L+
<i>Hypericum hirsutum</i>	hairy St. John's-wort	5				5	L+
<i>Hypericum perforatum</i>	common St. John's-wort	4				4	L+
<i>Inula helenium</i>	elecampane	4				4	L+
<i>Juncus compressus</i>	round-fruited rush	4				4	L+
<i>Kochia scoparia</i>	summer-cypress	5				5	L+
<i>Lactuca serriola</i>	prickly lettuce	3				3	L+
<i>Leonurus cardiaca</i> ssp. <i>cardiaca</i>	motherwort	4				4	L+

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Lepidium campestre</i>	field pepper-grass	5				5	L+
<i>Leucanthemum vulgare</i>	ox-eye daisy	2				2	L+
<i>Linaria vulgaris</i>	butter-and-eggs	5				5	L+
<i>Lithospermum officinale</i>	Eurasian gromwell	5				5	L+
<i>Lonicera morrowii</i>	Morrow's honeysuckle	5				5	L+
<i>Lonicera x bella</i>	shrub honeysuckle	4				4	L+
<i>Lotus corniculatus</i>	bird's foot trefoil	4				4	L+
<i>Lythrum salicaria</i>	purple loosestrife	4				4	L+
<i>Malus pumila</i>	apple	4				4	L+
<i>Matricaria discoidea</i>	pineappleweed	4				4	L+
<i>Medicago lupulina</i>	black medick	5				5	L+
<i>Medicago sativa</i> ssp. <i>sativa</i>	alfalfa	5				5	L+
<i>Melilotus albus</i>	white sweet clover	4				4	L+
<i>Nepeta cataria</i>	catnip	5				5	L+
<i>Panicum dichotomiflorum</i>	fall panic grass	5				5	L+
<i>Persicaria maculosa</i>	lady's thumb	5				5	L+
<i>Phleum pratense</i>	Timothy grass	4				4	L+
<i>Phragmites australis</i> ssp. <i>australis</i>	common reed	4				4	L+
<i>Plantago lanceolata</i>	English plantain	5				5	L+
<i>Plantago major</i>	common plantain	2				2	L+
<i>Poa compressa</i>	flat-stemmed blue grass	4				4	L+
<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky blue grass	4				4	L+
<i>Polygonum aviculare</i>	prostrate knotweed	5				5	L+
<i>Populus alba</i>	white poplar	5				5	L+
<i>Potentilla recta</i>	sulphur cinquefoil	5				5	L+
<i>Prunella vulgaris</i> ssp. <i>vulgaris</i>	heal-all (European)	5				5	L+
<i>Puccinellia distans</i>	alkali grass	4				4	L+
<i>Ranunculus acris</i>	tall buttercup	4				4	L+
<i>Rhamnus cathartica</i>	common buckthorn	4				4	L+
<i>Robinia pseudoacacia</i>	black locust	3				3	L+
<i>Rosa canina</i>	dog rose	4				4	L+
<i>Rosa multiflora</i>	multiflora rose	4				4	L+

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Rumex crispus</i>	curly dock	5				5	L+
<i>Salix alba</i>	white willow	5				5	L+
<i>Salix purpurea</i>	purple-osier willow	4				4	L+
<i>Schedonorus arundinaceus</i>	tall fescue	4				4	L+
<i>Schedonorus pratensis</i>	meadow fescue	4				4	L+
<i>Securigera varia</i>	crown vetch	5				5	L+
<i>Setaria pumila</i> ssp. <i>pumila</i>	yellow foxtail	4				4	L+
<i>Setaria viridis</i>	green foxtail	3				3	L+
<i>Silene vulgaris</i>	bladder campion	3				3	L+
<i>Solanum dulcamara</i>	bittersweet nightshade	4				4	L+
<i>Solanum lycopersicum</i>	tomato (incl. cherry tomato)	5				5	L+
<i>Sonchus arvensis</i> ssp. <i>arvensis</i>	glandular perennial sow-thistle	5				5	L+
<i>Sonchus asper</i>	spiny sow-thistle	4				4	L+
<i>Sonchus oleraceus</i>	annual sow-thistle	5				5	L+
<i>Symphotrichum ciliatum</i>	rayless aster	5				5	L+
<i>Taraxacum officinale</i>	dandelion	4				4	L+
<i>Tragopogon pratensis</i>	meadow goat's beard	3				3	L+
<i>Trifolium arvense</i>	rabbit-foot clover	5				5	L+
<i>Trifolium aureum</i>	hop-clover	5				5	L+
<i>Trifolium pratense</i>	red clover	5				5	L+
<i>Tussilago farfara</i>	coltsfoot	4				4	L+
<i>Typha angustifolia</i>	narrow-leaved cattail	3				3	L+
<i>Typha x glauca</i>	hybrid cattail	3				3	L+
<i>Verbascum thapsus</i>	common mullein	4				4	L+
<i>Veronica serpyllifolia</i> ssp. <i>serpyllifolia</i>	thyme-leaved speedwell	5				5	L+
<i>Viburnum opulus</i> ssp. <i>opulus</i>	European highbush cranberry	4				4	L+
<i>Vicia cracca</i>	cow vetch	4				4	L+
<i>Vicia tetrasperma</i>	slender vetch	4				4	L+
<i>Acer negundo</i>	Manitoba maple	4	0	0	2	6	L+?
<i>Agrostis stolonifera</i>	creeping bent grass	5				5	L+?
<i>Atriplex prostrata</i>	spreading orache	5				5	L+?
<i>Cyperus esculentus</i>	yellow nut-sedge	5	0	4	1	10	L+?

Appendix 2: OPG Landfill Flora Species (2008 & 2013)							
		Local	Popn.	Hab.	Sens.	Total	Rank
		Occur.	Trend	Dep.	Dev.	Score	TRCA
New Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Euphorbia vermiculata</i>	hairy spurge	5				5	L+?
<i>Phalaris arundinacea</i>	reed canary grass	3				3	L+?
<i>Sporobolus vaginiflorus</i>	ensheathed dropseed	5				5	L+?
<i>Picea glauca</i>	white spruce	1	5	4	4	14	pL3
<i>Pinus strobus</i>	white pine	1	4	3	4	12	pL4
<i>Celtis occidentalis</i>	hackberry	5				5	pL+
<i>Fraxinus mandshuriaca</i>	Manchurian ash						pL+
<i>Gleditsia triacanthos</i>	honey locust	5				5	pL+
<i>Picea pungens</i>	Colorado spruce	5				5	pL+
<i>Pinus nigra</i>	Austrian pine	5				5	pL+
<i>Pinus sylvestris</i>	Scots pine	4				4	prL+
<i>Populus x canadensis</i>	Carolina poplar	4				4	prL+

Appendix 3: Fauna List for OPG Landfill Site, 2004 - 2013.

Common Name	Code	Scientific Name	'04 - '13	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
<b>Survey Species: species for which the TRCA protocol effectively surveys.</b>													
<b>Birds</b>													
eastern kingbird	EAKI	<i>Tyrannus tyrannus</i>	3	0	4	2	2	1	1	3	0	13	L4
gadwall	GADW	<i>Anas strepera</i>	1	4	1	2	1	2	1	3	0	14	L4
grey catbird	GRCA	<i>Dumetella carolinensis</i>	1	0	2	2	1	1	1	3	0	10	L4
northern flicker	NOFL	<i>Colaptes auratus</i>	1	0	3	2	1	1	2	3	0	12	L4
northern rough-winged swallow	NRWS	<i>Stelgidopteryx serripennis</i>	1	0	1	2	1	1	3	2	0	10	L4
willow flycatcher	WIFL	<i>Empidonax traillii</i>	4	0	4	2	1	1	1	3	0	12	L4
American goldfinch	AMGO	<i>Carduelis tristis</i>	x	0	2	2	1	1	0	1	0	7	L5
American robin	AMRO	<i>Turdus migratorius</i>	x	0	1	2	1	1	0	1	0	6	L5
Baltimore oriole	BAOR	<i>Icterus galbula</i>	x	0	2	2	1	1	0	1	0	7	L5
black-capped chickadee	BCCH	<i>Parus atricapillus</i>	x	0	1	2	1	1	0	1	0	6	L5
blue jay	BLJA	<i>Cyanocitta cristata</i>	x	0	4	2	1	1	0	1	0	9	L5
brown-headed cowbird	BHCO	<i>Molothrus ater</i>	x	0	2	2	1	1	0	1	0	7	L5
Canada goose	CANG	<i>Branta canadensis</i>	x	0	1	1	1	2	1	0	0	6	L5
cedar waxwing	CEDW	<i>Bombycilla cedrorum</i>	x	0	1	2	1	1	0	1	0	6	L5
chipping sparrow	CHSP	<i>Spizella passerina</i>	x	0	2	2	1	1	0	2	0	8	L5
common grackle	COGR	<i>Quiscalus quiscula</i>	x	0	3	2	1	1	0	1	0	8	L5
downy woodpecker	DOWO	<i>Picoides pubescens</i>	x	0	3	2	1	1	1	1	0	9	L5
killdeer	KILL	<i>Charadrius vociferus</i>	x	0	2	2	1	2	0	2	0	9	L5
mourning dove	MODO	<i>Zenaidura macroura</i>	x	0	2	2	1	1	0	0	0	6	L5
northern cardinal	NOCA	<i>Cardinalis cardinalis</i>	x	0	2	2	1	1	1	2	0	9	L5
northern mockingbird	NOMO	<i>Mimus polyglottos</i>	x	0	2	0	1	1	1	1	0	6	L5
orchard oriole	OROR	<i>Icterus spurius</i>	2	1	2	1	1	1	0	1	0	7	L5
red-winged blackbird	RWBL	<i>Agelaius phoeniceus</i>	x	0	2	2	1	1	0	2	0	8	L5
song sparrow	SOSP	<i>Melospiza melodia</i>	x	0	2	2	1	2	0	2	0	9	L5
warbling vireo	WAVI	<i>Vireo gilvus</i>	x	0	1	2	1	1	1	2	0	8	L5
yellow warbler	YWAR	<i>Setophaga petechia</i>	x	0	1	2	1	1	1	3	0	9	L5
European starling	EUST	<i>Sturnus vulgaris</i>	x										L+
house finch	HOFI	<i>Carpodacus mexicanus</i>	x										L+
<b>Incidental Species: species that are reported on as incidental to the TRCA protocol.</b>													
<b>Mammals</b>													
meadow vole	MEVO	<i>Microtus pennsylvanicus</i>	1	2	2	2	1	2	1	2	0	12	L4

Appendix 3: Fauna List for OPG Landfill Site, 2004 - 2013.

Common Name	Code	Scientific Name	'04 - '13	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
white-tailed deer	WTDE	<i>Odocoileus virginianus</i>	1	0	2	1	3	2	2	1	0	11	L4
woodchuck	WOOD	<i>Marmota monax</i>	1	1	2	2	1	3	0	1	0	10	L4
coyote	COYO	<i>Canis latrans</i>	x	0	2	2	1	3	0	1	0	9	L5
grey squirrel	GRSQ	<i>Sciurus carolinensis</i>	x	0	2	2	1	3	0	0	0	8	L5
raccoon	RACC	<i>Procyon lotor</i>	x	0	2	2	1	3	1	0	0	9	L5
<b>LEGEND</b>													
LO = local occurrence		PIS = Patch Isolation Sensitivity											
PTn = population trend, continent-wide		STD = sensitivity to development											
PTt = population trend, TRCA		+ = additional points											
HD = habitat dependence		TS = total score											
AS = area sensitivity		L-rank = TRCA Rank, October, 2008											