Upper Petticoat Creek

Terrestrial Biological Inventory and Assessment

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Toronto and Region Conservation for The Living City®

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1.0 Introduction

In 2014 the Toronto Region Conservation Authority (TRCA) conducted fauna and flora inventories of the upper part of the Petticoat Creek watershed. These inventories were undertaken primarily to update existing information on the portion of the Petticoat Creek watershed lying within the Rouge National Urban Park. An earlier survey of the Rouge-Duffins Agricultural Preserve (part of the GTA greenbelt lands) was undertaken in 2004 and included the present study area (TRCA 2005). Additionally, the Upper Petticoat Creek Study Area incorporates the Markham East Woodlot, surveyed in 2010 (TRCA 2011). The present survey is also part of TRCA's commitment to maintain up-to-date data on vegetation communities, flora and fauna species across its jurisdiction. Hence, the information can be used for both local and regional natural heritage assessment and planning.

At the larger scale, the purpose of the work conducted by the TRCA during the 2014 field season was to *characterize the terrestrial natural heritage features* of the Upper Petticoat Creek Study Area. Once characterized, the site features can then be understood within the larger Rouge National Urban Park and the regional context of the Terrestrial Natural Heritage Program, enabling a better understanding of biodiversity across the jurisdiction. Results can be used to improve the Terrestrial Natural Heritage System Strategy (TNHSS) targets. The question that the inventory addresses is "*How does the area surveyed at the Upper Petticoat Creek Study Area fit within the regional and watershed natural system, and how should its contribution to this system be protected and maximized?"* The important underlying message offered 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.

1.1 TRCA's Terrestrial Natural Heritage Program

Rapid urban expansion in the TRCA jurisdiction has led to continuous and incremental loss of natural cover and species. In a landscape that probably supported 95% forest cover prior to European settlement, current mapping shows that only 16% forest and wetland cover remains. Agricultural and natural lands are increasingly being urbanized while species continue to disappear from a landscape that is less able to support them. This represents a substantial loss of ecological integrity and ecosystem function that will be exacerbated in the future according to current urbanization trends. With the loss of natural cover, diminishing proportions of various natural vegetation communities and reduced populations of native species remain. Unforeseen stresses are then exerted on the remaining flora and fauna in the natural heritage system. They become even rarer and may eventually be lost. This trend lowers the ability of the land to support biodiversity and to maintain or enhance human society (e.g. through increased pollution and decreased space for recreation). **The important issue is the *cumulative* loss of natural cover in the TRCA region that has resulted from innumerable site-specific decisions.**

In the late 1990s the TRCA initiated the Terrestrial Natural Heritage Program to address the loss of terrestrial biodiversity within the jurisdiction's nine watersheds. This work is based on two landscape-level indicators: the quality distribution of natural cover and the quantity of natural cover. The aim of the program is to create a conservation strategy that both protects elements of the natural system (vegetation communities, flora and fauna species) *before* they become rare and promotes greater ecological function of the natural system as a whole. This preventive approach is needed because by the time a community or species has become rare, irreversible damage has often already occurred. A healthy natural system capable of supporting regional biodiversity in the long term is the goal of the Terrestrial Natural Heritage Systems Strategy, achieved by setting targets – both short- and long-term (100 years) – for the two landscape indicators in order to provide direction in planning at all scales (TRCA 2007a, TRCA 2007b).

A target system that identifies a land base where natural cover should be restored is a key component of the Strategy. Although the objectives of the Strategy are based on making positive changes at all scales, the evaluation models were developed at the landscape scale using a combination of digital land cover mapping and field-collected data. Field-collected data also provides ground-level information in the application of the landscape models at the site scale. The two indicators and the targets that have been set for them are explained in Section 3.1. It is important to understand that habitat quality and distribution are interdependent. For example, neither well-distributed poor-quality natural cover nor poorly-distributed good-quality natural cover achieves the desired condition of sustainable biodiversity and social benefits across the watershed.

The natural habitat associated with the Upper Petticoat Creek acts as an important link within the Rouge National Urban Park. This small headwater riparian corridor parallels that of the larger Little Rouge Creek to the west and the West Duffins Creek to the east. The persistence of natural cover at sites such as this is extremely important in maintaining effective migration and dispersal routes across the rapidly expanding urban landscape.

2.0 Study Area Description

The TRCA study area in 2014 includes the portion of the Petticoat Creek watershed that lies within the Rouge National Urban Park. The site is bound to the north and west by the watershed boundary, to the east by the York-Durham Townline, and to the south by Steeles Avenue (Maps 1 and 2).

The site comprises several patches of natural cover situated within the upper watershed of Petticoat Creek, and includes the creek's poorly-defined source. It lies entirely within the Municipality of Markham, York Region, covering a total of 617.83 ha - although only 135.9 ha of this is natural cover - and is situated within the Great Lakes – St. Lawrence floristic region, a region which is composed primarily of mixed coniferous-deciduous forest. At the coarse physiographic level, the site is located on the South Slope, but with small areas of Peel Plain associated with

periglacial ponding at the extreme north end above Hwy 7 and also in the southeastern portion (Chapman and Putnam 1984). Topography is generally flat; Petticoat Creek here is small and has not incised a ravine. Surface deposits are almost entirely Halton Till, which is variable in texture but usually dominated by silty clays (Sharpe 1980). Soil types are predominantly characterized as Milliken Loam, which is imperfectly drained, and some Woburn loam, which has good drainage (i.e. drier moisture regime) (Hoffman and Richards 1955). A small area near the 11th Concession Road, corresponding with a wetland patch, has the poorly-drained Lyons Loam, while another wetland patch north of Hwy 7 has organic soils. Several soil samples taken during biological inventory work in 2004 and 2014 corroborate the broader data, revealing mostly fine textured loamy to clayey soils with a small area of very fine sands at the south end.

Land use is heavily agricultural, with natural cover restricted to small patches. This land use has not changed in recent decades and there has been minimal change to the general appearance of the landscape and vegetation since the 2004 survey. The land has been designated greenbelt and so has not been directly encroached upon by urban uses within a couple of kilometres, with the likely exception of increased vehicular commuter traffic along York Durham Townline, 14th Avenue, Hwy 407, and Hwy 7. Highway 407 had already been constructed at the time of the earlier survey. The north end of the study area, where the highways cross it, marks a distinct narrowing of the large greenbelt corridor between the expanding area of Markham to the west and the soon-to-be-developed Seaton lands to the east, across West Duffins Creek.

3.0 Inventory Methodology

A biological inventory of the Upper Petticoat Creek Study Area was conducted at the levels of habitat patch (landscape analysis), vegetation community, and species (flora and fauna) according to the TRCA methodologies for landscape evaluation (TRCA 2007c) and field data collection (TRCA 2007d). Permission was sought to enter all properties but unfortunately the processing of these requests was delayed to the extent that the breeding bird survey period had finished by the time permission had been granted. However, pre-empting this delay, breeding bird surveys were conducted from roadside and property boundaries through June and early July. Habitat patch mapping was taken from the regional 2007/08 mapping of broadly-defined patch categories (forest, wetland, meadow and coastal) and digitized using ArcView GIS software.

For the purposes of this survey, TRCA divided the 2014 Study Area into three blocks in order to handle the extensive area covered and to account for division of the landscape by major roads which constitute breaks in the habitat (Map 2). Block A lies north of Hwy 7; Block B lies between Highway 407 and 14th Ave, and Block C is between 14th Ave and Steeles Ave. Markham East Woodlot and some additional land surveyed in 2004 lie between Blocks A and B, i.e. between Hwys 7 and 407.

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); 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 as 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 2007c). 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

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% (Environment Canada, 2004).

3.2 Vegetation Communities, 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 amphibians and 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 was conducted in the early fall of 2014 (Table 2). Botanical data also includes additional records obtained from the earlier survey associated with the Little Rouge – West Duffins Agricultural Preserve undertaken in the spring and fall of 2004 (TRCA 2005) and the Markham East Woodlot in spring and fall of 2010 (TRCA 2011).

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 2013 digital ortho-rectified photographs (ortho-photos) to a scale of 1:2000 and then digitized in ArcView. Flora regional species of concern (species ranked L1 to L3) were mapped as point data with approximate number of individuals seen. A list of all other species observed was documented for the site.

Prior to 2014, the most complete fauna survey of the study area had been conducted by the TRCA in 2004. The fauna data management protocol imposes a 10 year threshold on use of historical data, and therefore observations made prior to 2005 are not included in the current fauna inventory. The small forest patch located between Hwy 7 and the York-Durham Townline, north of Hwy 407 (Markham East Woodlot), was extensively surveyed as recently as 2010 and therefore was not re-surveyed in 2014. In addition to these data, this inventory considers all incidental fauna observations mapped over the previous 10 years, primarily observations made in Block A as staff accessed the nearby Reesor Road long-term monitoring project stations (forest salamander and bird). Thus a combination of the 2010 Markham East Woodlot survey with the 2014 inventory and the few incidental records provides the most complete indication of fauna species status within the study area.

Roadside fauna surveys were conducted on dates in April, June and July. The spring surveys searched primarily for frog species of regional concern but recorded incidentally the presence of any early-spring nocturnal bird species (owls and American woodcocks). Surveys in June and July were concerned primarily with the mapping of breeding bird species of regional concern. As per the TRCA data collection protocol, breeding bird surveys were carried out by visiting the 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 were 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. Fauna species of regional and urban concern (species ranked L1 to L4) were mapped as point data with each point representing a possible breeding territory.

Table 2. Schedule of TRCA biological surveys at Upper Petticoat Creek

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2007/08: ortho-photos	21 hours
Vegetation Communities and Flora Species	2014: Sep 5th, 9th; Oct 6th, 7th, 8th, 9th 2010: May 21st, July 22nd, Sep 7th. 2004: May 19th; Sep 16th, 17th, 21st; Oct 6th, 7th.	42 hours 9 hours 39 hours
Frogs and Nocturnal Spring Birds	2014: April 13th and 23rd 2010: April 4th (Markham East Woodlot only)	1.25 hours 1 hour
Breeding Songbirds	2014: June 10th,13th, 25th; July 20nd 2010: May 21st; June 21st (Markham East Woodlot only)	3.5 hours 4.5 hours

4.0 Results and Discussion

Information pertaining to the Upper Petticoat Creek 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 2013 ortho-photography, 25.6% of the land area in the TRCA jurisdiction consists of natural cover but this figure includes meadow. Although historically, the region would have consisted of up to 95% forest cover, currently (i.e. 2013) only about 16% 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.

The strips of natural cover along the Upper Petticoat Creek provide continuity in an important bird migration and dispersal route between the more rural areas to the north (e.g. the Oak Ridges Moraine) and significant migrant staging areas in the lower reaches of the Rouge River (Rouge Park) and along the Lake Ontario shoreline.

4.2 Habitat Patch Findings for Upper Petticoat Creek

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; as of the time of press, we have 2013 landscape natural cover stats available but no analysis yet.

4.2.1 Quantity of Natural Cover

The Petticoat Creek watershed covers 2682.2 ha, which adjoins the much larger Rouge watershed (approximately 33,288 ha). Natural cover in the Petticoat Creek watershed as a whole covers 812.1 ha (2013 calculations), including 443.4 ha as forest (16.5% of the watershed), 91.8 ha

successional (3.4%) and 226.0 ha as meadow (8.4%). The study area contains 135.9 ha of natural habitat based on ground-truthed field work (Table 3; Appendix 1), which amounts to 16.7% of the total natural cover in the Petticoat Creek watershed. This is a significant proportion of the watershed total natural cover, and furthermore, the location, lying between the Little Rouge River and West Duffins Creek in the protected Rouge Park lands confers a high degree of importance to the area from a connectivity perspective. The natural cover includes 38.4 ha of forest, 32.4 ha of successional, 18.4 ha of meadow, 0.7 ha of aquatic and 46.0 ha of wetland.

4.2.2. Quality Distribution of Natural Cover

The results for quality distribution (2007/08 analysis) are reported below under the headings of habitat patch size and shape, matrix influence and total score.

Habitat Patch Size and Shape

The study area is highly fragmented, with patches of mature forest and treed swamp widely-spaced within an agricultural landscape. These patches are linked only by more open moist to wet areas associated with the headwater swales of Petticoat Creek and a few narrow hedgerows. The mature patches occur in Block A (north of Hwy 7), the East Markham Woodlot, and Block C at the south end of the study area (Map 2). The entire mid-section of the study area, Block B, has virtually no treed habitat, although there are somewhat more extensive open areas. Although the forest patches are somewhat square in outline (thus improving patch shape score), they are small with a rather low ("poor") score for patch size (Map 5). Only the fairly extensive open habitat in Block B has a "fair" size score. The shape of the forest patches helps to offset their small size by reducing edge-to-area ratio, and allows for small areas of forest interior (>100 m from edge) in two of the patches: the Markham East Woodlot and the patch on the west side of 11th Concession between Steeles and 14th Ave (in block C) (Map 6).

Habitat Patch Matrix Influence

Analysis based on the 2007/08 ortho-photos shows that the matrix influence score for habitat in the study area is mostly "fair" with some "good" (Maps 6 and 7). This score is the result of extensive agricultural land-use with some areas of natural cover within 2 km of parts of the study area (especially along the river corridors of the Little Rouge and Duffins Creek). The TRCA measures matrix influence at the landscape level by assigning set values; positive, neutral and negative, to the type of landscape use occurring within 2 km of the subject site. The agricultural landscape exerts a neutral or intermediate matrix influence on the site, i.e. less disturbance than the urban landscape but more than adjoining natural habitat.

Habitat Patch Total Score

The combination of mostly "fair" matrix influence on the site, and mostly "poor" habitat patch size with variable patch shape, results in an overall "fair" or L3 habitat patch quality (Map 9). The Markham East Woodlot and another woodlot at the south end of the study area (northeast corner

of Steeles and 11th Concession) have a "good" score. Landscape scores are intended to be applied at the broader landscape level and therefore caution needs to be exercised when referring to such measures at the more refined site level. In the case of Upper Petticoat Creek, both fauna and flora may be less well-represented than the landscape scores would suggest. Flora of regional conservation concern (ranked L1 to L3) are almost entirely restricted to the mature treed patches (see Map 11) and there are no records at all in Block B. Fauna of regional concern follow a similar pattern. There are frog records associated with wetland areas in all parts of the Upper Petticoat Creek Study Area; however, bird species of regional concern are restricted to the areas north of Hwy 407 (Block A and Markham East Woodlot) (Map 13). In this particular case, access during the 2014 bird breeding season was restricted to roadside surveys, which likely led to an under-representation of records. Fauna ranked L4 were mapped at this site, and are more evenly distributed across the entire study area.

4.3 Vegetation Community Findings for Upper Petticoat Creek

4.3.1 Vegetation Community Representation

Upper Petticoat Creek has a total of 50 different vegetation communities. Forest, successional, and wetland communities predominate (Table 3). The overall picture is that of more-or-less isolated woodlots, poorly-drained patches with swamp, small abandoned homestead sites returning to scrubland, all linked by narrow headwater riparian swales and hedgerows (see Map 10). Active agriculture separates these features.

Table 3. Summary of Vegetation Communities, Upper Petticoat Creek Study Area

Class	Number of Types	Area (hectares)
Forest	20	38.4
Successional	9	32.4
Meadow	3	18.4
Wetland	14	46.0
Aquatic	4	0.7
Dynamic (beach,bluff, barren)	0	-
Total	*50*	*135.9*

There are 38.4 ha of forest, making up 28% of the natural cover. These forested areas are roughly evenly-split between mature stands dominated by sugar maple (*Acer saccharum* ssp. *saccharum*) (and in one case bur oak, *Quercus macrocarpa*) (Fresh-Moist Bur Oak Deciduous Forest) and younger communities of red ash (*Fraxinus pennsylvanica*), white elm (*Ulmus americana*), and black walnut (*Juglans nigra*). The mature forest occurs at several nodes where it is also associated with treed swamp: the Markham East Woodlot at the northeast end of the study area; a patch north of Hwy 7 at the northwest end of the study area (Block A); a large patch on both sides of 11th Concession south of 14th Avenue, and a patch at the northeast corner of Steeles Ave and 11th Concession (Block C) (Map 2). The younger forest is less restricted to these nodes and can also

be found along some of the small watercourse areas. Some of the younger forest types are from natural regeneration (e.g. Fresh-Moist Ash Deciduous Forest, FOD7-2) and some are plantation (e.g. Red Ash Deciduous Plantation (CUP1-7). There is a noteworthy area of deciduous plantation on the east side of 11th Concession about half-way between Steeles and 14th Avenue that is relatively mature and developing a natural ground layer. This Restoration Deciduous Plantation (CUP1-A) is dominated by sugar maple and red oak (*Quercus rubra*) and is an early example of successful restoration. It looks to be about 60 years old. Conifer plantation is sparse and represented only by small fragments and fencerows.

Successional communities are represented by nine deciduous regenerating communities totalling 32.4 ha. Numerous hedgerows separating agricultural fields make up a large proportion of this; Treed Hedgerow (CUH1-A) covers 14.9 ha. Other regenerating communities, mostly on abandoned house lots and yards, include Sumac Deciduous Thicket (CUT1-1), Native Deciduous Successional Woodland (CUW1-A3), Exotic Successional Savannah (CUS1-b), Hawthorn Successional Woodland (CUW1-D), and Exotic Deciduous Woodland (CUW1-b). These are dominated by varying mixes of trees and shrubs including a large share of exotic species and old ornamental plantings.

Open meadow covers 18.4 ha and occurs on more recently abandoned agricultural lands that have not yet developed much woody cover. The predominant meadow type is Native Forb Meadow (CUM1-A), dominated by tall goldenrod (*Solidago altissima*) and asters (*Symphyotrichum* spp).

Wetlands account for 46.0 ha (34%) of the natural cover. These are divided between higher-diversity swamp (7 types covering 20.2 ha) and lower-diversity meadow- and shallow marsh often dominated by exotic species (6 types covering 25.7 ha) (Table 3; Appendix 1). There is a tiny patch of Mineral Fen Meadow Marsh (MAM5-1) adjacent to the Markham East Woodlot. The main swamp type is Red Ash Mineral Deciduous Swamp (SWD2-2), associated with several poorly-drained tableland areas, the largest of which makes up the majority of the habitat patch on the 11th Concession about half-way between Steeles and 14th Avenue. Silver Maple Mineral Deciduous Swamp (SWD3-2) occurs in the 11th Concession area and at Markham East Woodlot. There is also some Silver Maple Organic Deciduous Swamp (SWD6-2) in the northwestern part of the study area (Block A). Willow Mineral Thicket Swamp (SWT2-2) and Red-osier Mineral Thicket Swamp (SWT2-5) occur in the middle sections of the study area in swales where Petticoat Creek first becomes a visible land form.

Marshes are associated mostly with the headwater swales of Petticoat Creek. Petticoat Creek within the study area has only seasonal flow, and the channel is often poorly-defined and well-vegetated. Reed Canary Grass Mineral Meadow Marsh (MAM2-2) predominates and is associated with a strongly agricultural matrix. Common Reed Mineral Shallow Marsh (MAS2-a) occupies one part of the northwest habitat patch and has replaced a Rice Cut Grass Mineral Meadow Marsh community (MAM2-D) since 2004; this is one of the few significant visible changes to the habitat over the ten-year period 2004-2014. Smaller areas of aquatic communities: Stonewort Submerged Shallow Aquatic (SAS1-3), Duckweed Floating-leaved Shallow Aquatic (SAF1-3), Open Aquatic

(OAO1), and Turbid Open Aquatic (OAO1-T) are associated with old farm ponds and other excavations.

4.3.2 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 3.2. Vegetation communities with a rank of L1 to L3 are considered of concern across the entire jurisdiction while L4 communities are considered of concern in the urban portion of the jurisdiction. In addition, 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. For example, an old-growth sugar maple forest may belong to a relatively common and adaptable vegetation type but should still be considered of high conservation concern.

There are just two vegetation communities of regional conservation concern: the Silver Maple Organic Deciduous Swamp (SWD6-2) and Mineral Fen Meadow Marsh (MAM5-1). These have a rank of L2. There are also fourteen L4 communities (communities are listed with ranks in Appendix 1; location and boundaries shown on Map 10). The L2 communities occupy 1.3 ha and the L4 communities occupy 28.0 ha.

Mineral Fen Meadow Marsh occupies a small, wet exposure on the west side of the Markham East Woodlot by Hwy 7, while the Silver Maple Organic Deciduous Swamp community lies within the forest-and-wetland feature at the northwest end of the study area (in Block A). This swamp is also home to a heronry (see Figure 2, Section 4.5.2).

The L4 ranked communities include four forest types, one successional type, and nine wetland/aquatic types. Notable are the Fresh-Moist Bur Oak Deciduous Forest (FOD9-3), Red Ash Mineral Deciduous Swamp, Silver Maple Mineral Deciduous Swamp, White Elm Mineral Deciduous Swamp (SWD4-2), and Poplar Mineral Deciduous Swamp (SWD4-1). In addition the L5 ranked sugar maple forests: Dry-Fresh Sugar Maple Deciduous Forest (FOD5-1), Dry-Fresh Sugar Maple – Beech Deciduous Forest (FOD5-2), Dry-Fresh Sugar Maple – Basswood Deciduous Forest (FOD5-6), Dry-Fresh Sugar Maple – Ash Deciduous Forest (FOD5-8), Fresh-Moist Sugar Maple – Ash Deciduous Forest (FOD6-1), and Dry-Fresh Sugar Maple – Hardwood Deciduous Forest (FOD6-5), have mature native-dominated ground vegetation with some spring ephemerals. Vernal pools occur in many of the swamp communities and some of the moister forests.

In light of the high prevalence of red ash in many of the forest and swamp communities, the Emerald Ash borer is an immediate threat and we can expect to see massive tree mortality and in some cases, total clearing of tree cover from these vegetation types. Some dieback is already visible.

The landscape's conventional agricultural matrix, while not having as severe an impact as would urbanization, still contributes disturbance in the form of fertilizer runoff with some erosion and

deposition of sediment. Given the small habitat patch size with virtually no interior there is also more penetration of drying winds and heat than would occur in larger, continuous habitat patches. These conditions favour invasive species, especially in wetlands and headwater swales that receive a lot of the runoff burden. Hence the prevalence of weedy vegetation types in the more open meadow-marsh and shallow marsh communities. This can only be expected to accelerate with the loss of ash. Mature deciduous forests dominated by sugar maple, on the other hand, are probably less threatened.

4.4 Flora Findings for Upper Petticoat Creek

4.4.1 Flora Species Representation

Floristic surveys conducted by TRCA in 2004, 2010 and 2014 identified a total of 420 species of vascular plants (Table 4; Appendix 2). Of these, 412 species recorded were naturally occurring; there were also 8 planted species associated with farm yards. Of the non-planted species recorded, 238 are native (58%). Biodiversity of this site is moderate given the study area size, and reflects the presence of forest and wetland communities; each with their own unique suite of species. The relatively high proportion of exotic species (42%) is larger than what is normally found in a high quality rural natural area (typically exotics comprise only about 25% of a rural natural area in TRCA). An urban ravine typically has a 50% mix. The high proportion of exotics reflects the disturbed, fragmented character of the landscape with intensive agriculture.

Table 4. Summary of Flora Species, Upper Petticoat Creek

Total # of species	420
Naturally-occurring species	412
Planted species	8
Native (naturally-occurring) species	238
Number of L1 to L3 species	20
Number of L4 species	78
Exotic species (established)	174

4.4.2 Flora Species of Concern

There are 20 vascular plant species of regional conservation concern (rank L1 to L3) in the Upper Petticoat Creek Study Area; an additional 78 are ranked L4, of intermediate sensitivity and would be considered of concern in an urban environment. Appendix 2 lists plant species by ranks and locations are shown on Map 11. The ranks are based on sensitivity to human disturbance associated with development; and habitat dependence, as well as on rarity (TRCA 2010). Two of these species are considered to be regionally-rare, with records in six or fewer of the forty-four 10x10 km UTM grid squares that cover the TRCA jurisdiction. These are sleepy catchfly (*Silene antirrhina*) (the only L2 plant species found) and fan-leaved hawthorn (*Crataegus flabellata*). Sleepy catchfly was found in gravel along a railway track near the north end of Upper Petticoat

Creek in 2014. The fan-leaved hawthorn, found in 2004, could not be identified with certainty because of timing of the survey (it was tagged with a “cf” in the species list, Appendix 2). The other species of concern at Upper Petticoat Creek are not currently rare but are at risk of long-term decline due to the other criteria.

All of the L2 and L3 flora species and many of the L4 species in the Upper Petticoat Creek Study Area are sensitive to development, being vulnerable to at least one kind of disturbance that is associated with land use changes (see Map 7 for sensitivity to development scores). This site is not subject to the more intensive disturbances associated with urbanization, such as trampling (there is little public access) or the more extreme kind of flooding and erosion associated with runoff from paved surfaces. Increased public use, however, could lead to concerns about trampling which affects forest ground vegetation such as bellwort (*Uvularia grandiflora*) and trilliums (*Trillium erectum* and *T. grandiflorum*) as well as possible collection or picking of edible or showy species such as Michigan lily (*Lilium michiganense*) and wild leek (*Allium tricoccum*) (Figure 1).

Figure 1: Michigan lily may be vulnerable to collection (photo by Vladimir Kricsfalusy, June 2005)

The intensive agriculture is associated with some hydrological issues such as drainage and runoff from farm fields. The runoff is likely laden with sediment, nutrients, and agricultural chemicals. The impact of these changes at the community level has already been discussed (Section 4.3.2). At the level of individual species, plants of swamps and mixed forests such as swamp red currant (*Ribes triste*), Clinton's wood fern (*Dryopteris clintoniana*), and rose twisted-stalk (*Streptopus lanceolatus*) require cool, moist, sheltered conditions, often with groundwater close to the surface. Increasing warmth and dryness (associated with small habitat fragments in an agricultural landscape, reduced ground water recharge, and higher temperatures) will cause these species to decline. Some L4 ranked trees such as yellow birch (*Betula alleghaniensis*) and eastern hemlock (*Tsuga canadensis*) are also vulnerable to such impacts and seem to be slowly declining across most of the TRCA jurisdiction.

Habitat fragmentation can lead to increased populations of herbivores such as white-tailed deer (*Odocoileus virginianus*); deer have had significant impacts in parts of the TRCA jurisdiction such as the main part of Rouge Park south of Steeles (TRCA 2012, TRCA 2014). Evidence of deer browse was variable at Upper Petticoat Creek, but it may have contributed to the decline or absence of such species as Canada yew (*Taxus canadensis*) which was seen in 2004 but not in 2014.

Hydrological and nutrient disturbances can also encourage invasive species that displace some of the smaller and more sensitive species. In wetter areas, common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*) can exclude less-competitive natives such as turtlehead (*Chelone glabra*) and drooping bulrush (*Scirpus pendulus*). Upland species may be affected by dog-strangling vine (*Cynanchum rossicum*), which is one exotic that is gradually spreading through the site especially in successional areas. Its ability to spread rapidly through disturbed habitats along various pathways such as the edge of farm fields and openings created by dying trees can have dire consequence for the less aggressive natives that currently exist at the site.

Likewise all of the L1 to L3 species and many of the L4 species can also be considered habitat specialists, scoring relatively high in *habitat dependence*. Habitat dependence scores are shown on Map 12. Roughly, they are found in seven or fewer vegetation cohorts (groupings of vegetation types with similar floristic characteristics) (TRCA 2010). They will not readily recover when these habitats are lost or altered. Upper Petticoat Creek has habitat specialists corresponding to forest, swamp, marsh, aquatic, and successional habitats. Species of concern are concentrated in and around the deciduous swamps (north of Hwy 7 at the extreme north end of the site and in the vicinity of 11th Concession south of 14th Avenue). These two habitat patches also have upland forest associated with them.

Forest species are found in the more mature deciduous forests such as the Markham East Woodlot (TRCA 2011) and a couple of other patches. They include both species with southern affinities such as moonseed (Carex laxiculmis) and (*Menispermum canadense*) and spreading wood sedge (*Carex laxiculmus*); and northern affinities such as rose twisted-stalk.

Wetland species are well-represented. Clinton's wood fern, swamp red currant, and Tuckerman's sedge (*Carex tuckermanii*) occur in deciduous swamps. The meadow and shallow marshes contain drooping bulrush and turtlehead, with pondweeds (*Potamogeton foliosus* and *Stuckenia pectinata*) and star duckweed (*Lemna trisulca*) in areas with more persistent water. Marsh cinquefoil (*Comarum palustre*) was associated with a persistent vernal pool in Markham East Woodlot (TRCA 2011).

Successional areas, especially associated with past or present pasture, support several species of hawthorns such as Pringle's hawthorn (*Crataegus coccinea* var. *pringlei*). Given the time of survey, we were not able to positively identify all of these, but they represent a large and interesting group of small trees and tall shrubs in our area.

The regionally-rare sleepy catchfly is an anomaly on this generally silty – clayey site, since this is a species of sand barrens. It was found on loose gravelly material along a railway line in 2014.

4.4.3 Invasive Species

The most immediate invasive threat is the insect emerald ash borer (EAB) (*Agrillus planipennis*). By killing off the red ash (*Fraxinus pennsylvanica*) which is probably the most abundant tree species on the site, it will alter many of the habitats, opening them up and releasing the invasive plant species already present in this somewhat disturbed agricultural watershed. In particular, deciduous swamps now dominated by red ash are likely to degrade into open areas dominated by reed canary grass, common reed, and buckthorn (*Rhamnus cathartica*).

Dog-strangling vine is patchily abundant in the open meadows and semi-open successional habitats across the Upper Petticoat Creek Study Area. This species is particularly problematic in the TRCA jurisdiction and other parts of the Lower Great Lakes (TRCA 2008). The best hope to control dog-strangling vine is through a regional biological control program, for which the leaf-eating moth *Hypena opulenta* is the most promising. This moth was released in 2014 in Ottawa and on the Carden Alvar near Orillia, with caged trials occurring at Scarborough Campus, University of Toronto (on Highland Creek) (Smith 2014).

Buckthorn is abundant and often dominant in the hedgerows and forest edges. It benefits particularly well from the loss of ash to emerald ash borer (and elm to Dutch elm disease). It is important to consider replacing the ash as they die with native trees and shrubs.

Garlic mustard (*Alliaria petiolata*) and dame's rocket (*Hesperis matronalis*) are locally abundant in forests. The best approach is to minimize disturbance to allow the existing vigorous native species to hold their own against these species; to maintain and restore hydrology, and to prevent farmyard waste dumping.

Japanese knotweed (*Fallopia japonica*) and periwinkle (*Vinca minor*) have escaped from abandoned gardens or farmyards into forest areas at the north and south ends of the site respectively. These have the potential of forming large clonal patches that smother native species.

Common reed is invading marshy wetlands in several places. One of the few readily-observed changes between 2004 and 2014 was the replacement of a rice cut-grass (*Leersia oryzoides*) marsh at the north end of the site with common reed. It may be possible to contain common reed with wick application of herbicide; otherwise, this huge grass may take over much of the network of wetlands at Upper Petticoat, at least the open ones that are not already dominated by reed canary grass.

Hybrid cattail (*Typha* x *glauca*) dominates several open marshes but does not at this point monopolize them. There appears to be enough variability in topography and water level to allow for other species to coexist.

4.5 Fauna Species Findings for Upper Petticoat Creek

4.5.1 Fauna Species Representation

The TRCA fauna roadside surveys at the Upper Petticoat Creek Study Area in 2014 documented a total of 40 bird species, 5 mammals, and 7 herpetofauna species, bringing the total number of possible breeding vertebrate fauna species identified by the TRCA in 2014 to 52. Four additional bird species can be added from additional observations made during the previous 10 years: brown thrasher (*Toxostoma rufum*) reported from Block A in 2009; great horned owl (*Bubo virginianus*), reported from Block A in 2013 (nesting in the small heronry); and eastern phoebe (*Sayornis phoebe*) and wood duck (*Aix sponsa*) from the 2010 survey of the Markham East Woodlot, bringing the terrestrial vertebrate fauna species total for the study area to 56 species. Three additional species were recorded in 2004 prior to the current 10 year period: American woodcock (*Scolopax minor*), and least flycatcher (*Empidonax minimus*) reported from Block B; and bobolink (*Dolichonyx oryzivorus*) reported from both Blocks A and B.

This total is a little lower than those from several other study areas in the same urban-rural interface zone. For example, the fauna list for the Altona Forest study area (64 ha), surveyed in 2012, is 58 species; Toogood Pond (37.4 ha) has a list of 60 vertebrate fauna species. This is perhaps to be expected given that the 2014 Upper Petticoat surveys were conducted at road-side, positioning the surveyor up to as much as 600 m from points within the habitat patches – a distance over which bird song would not be audible. Refer to Appendix 3 for a list of the fauna species and their corresponding L-ranks.

4.5.2 Fauna Species of Concern

Fauna species, like vegetation communities and flora species are considered of regional conservation concern if they rank L1 to L3 based on their scores for the seven criteria mentioned in Section 3.2. Since the subject site is situated close to the urban zone this report also considers those species ranked as L4, i.e. those species that are of concern in urban landscapes. As with flora, this is a proactive, preventive approach, identifying where conservation efforts need to be made before a species becomes rare.

Fauna surveys at the Upper Petticoat Creek Study Area in 2014 reported four bird species of regional concern (L1 – L3: great blue heron, *Ardea herodias*; American redstart, *Setophaga ruticilla*; vesper sparrow, *Pooecetes gramineus*; and wood thrush, *Hylocichla mustelina*), and 14 of urban concern (L4). In addition, there were 7 herpetofauna and 3 mammal species of regional and urban concern, including three L2 species (wood frog, *Lithobates sylvatica;* spring peeper, *Pseudacris crucifer*; and grey treefrog, *Hyla versicolor*). One L3 ranked bird species (brown thrasher) and two further L4 species (great horned owl and wood duck) can be added from the incidental observations over the past decade bringing the total number of fauna species of regional or urban concern to 32 (Table 5). Locations of these breeding fauna are depicted on Map 13.

Table 5. Summary of Fauna Species of Regional and Urban Concern, Upper Petticoat Creek Study Area.

Fauna	Number of Species	Number of Species of Regional and Urban Concern (L1 to L4 rank)
birds	44	22
herps	7	7
mammals	5	3
TOTALS	56	32

Figure 2: A small heronry established in Block A in 2009, growing to nine nests by 2014 (photo by Paul Prior, May 2014)

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 10 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).

Fauna surveys at the study area documented two fauna species considered regionally rare: great blue heron and hairy-tailed mole (*Parascalops breweri*). Great blue herons have been nesting in the treed swamp in Block A every year since at least 2009 when there were five nests reported and this figure had been constant until 2014 when the heronry increased to nine nests. This heronry is located 4 km to the north west of the "Cherrywood Swamp" heronry (Altona Road and Taunton Road), a large heronry that currently appears to be in decline, suggesting that this new heronry may be recruiting birds that are abandoning the larger site. The regional status of hairy-tailed mole is poorly understood and, as is often the case with both regional mole species (and

many other small mammals), the record from the 2014 inventory was of a dead individual found on the gravel track in Block A. It is likely that the species is more widespread than TRCA records indicate.

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, *Sciuridae*; raccoons, *Procyon lotor*; and house cats, *Felis catus*); 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 3 or more points (out of a possible 5) for this criterion. At the study area many of the species that are ranked L1 to L4 receive this score (26 of the 32 species) and are therefore considered sensitive to one or more of the impacts associated with development (Map 8).

The surrounding landscape is almost entirely agricultural and thus many of the negative impacts associated with an urban or suburban matrix are missing. In more urban landscapes such matrix impacts can be the dominant factors influencing the presence or absence of sensitive ground-nesting birds. Of the 20 sensitive bird species recorded in the study area, only 5 species are ground-nesters, with 2 of these (swamp sparrow, *Melospiza georgiana*; and common yellowthroat, *Geothlypis trichas*) associated with wetland habitats which tend to be less effected by ground-borne disturbances. The remaining three species are either open country or edge species; there were no forest ground-nesters – e.g. ovenbird (*Seiurus aurocapilla*) – recorded in any of the forest patches. However, these same forest patches accommodated small populations of sensitive frog species (spring peepers and wood frogs) which spend much of their annual life-cycle foraging on the forest floor. This suggests that some factor other than ground-borne disturbance from hikers and dogs (disturbances typically associated with forest patches adjacent to residential areas) is limiting the presence of ground-nesting bird species. It is unlikely that any of the patches within the study area are much visited by people other than perhaps the most southerly forest block which is adjacent to a small group of homes.

Ground-nesting birds 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. Many of the negative influences associated with urbanization can be transferred deep within an otherwise intact natural matrix by extensive trail networks used by large numbers of people originating from quite distant urban and suburban centres. 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. 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). Similarly, clearing of forest understory to accommodate trails displaces sensitive low-nesting species. There is no evidence that such activities are occurring across the majority of the study area.

Forest-nesting birds that score as sensitive to development are represented at the site by eastern wood-pewee (*Contopus virens*, 7 territories), red-eyed vireo (*Vireo olivaceus*, 4 territories), and wood thrush (3 territories). It should be noted that the majority of these territories, together with the majority of the American redstart territories (a forest edge species), were located in the Markham East Woodlot, surveyed in 2010. As canopy nesters these species are less effected by ground-borne disturbances but yet, again, the number of individuals – away from the Markham East Woodlot - is really rather low (particularly for the vireo). Such species are still susceptible to artificially high densities of predators subsidized by backyard feeders and poor garbage management but again this hardly seems likely to be a considerable impact in this more rural landscape. It should be noted that the TRCA fauna inventory assesses the presence of species, i.e. the number of territories of each species at the site, but does not give any indication of the success of nesting attempts.

Away from the forest habitat the fauna are largely associated with wet field edge habitats (swamp sparrows and common yellowthroats) and open habitats. Results suggest an apparent decline of two particularly sensitive open country species, bobolink and vesper sparrow, but since the main focus of the 2014 inventory was the forest habitat within the study area, it is possible that these birds were overlooked during the inventory, especially given that the 2014 inventory was conducted almost exclusively from the 11th Concession road (except in Block A). The 2014 inventory reported just one territorial vesper sparrow whereas this species was represented by four territories in 2004 when there were also two bobolink territories.

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 ≥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).

Twelve of the fauna species of regional and urban concern that were identified at the study area are considered area sensitive; all of these species – nine birds and three frogs - require at least 10 ha of habitat. Again, the majority of the area sensitive birds were located in 2010 in the Markham East Woodlot (11 ha) but otherwise the bulk of the remainder of these species were recorded from the largest forest/treed swamp patch (circa 15 ha) at the centre of the study area. Although it is possible that numbers of observed fauna are somewhat reduced due to having had to conduct the 2014 surveys from roads along the edges of habitat patches, the higher rate of occurrence of sensitive species within the largest forest block suggests that patch size has had considerable influence on the presence of species of urban and rural concern. It should be noted that if Markham East Woodlot is excluded the number of area sensitive species is comparable to that found at the more urban site at TooGood pond.

The three area sensitive frog species (wood frog, spring peeper and grey treefrog) are all species that have been effectively extirpated from the urban portion of the Toronto region. All three species have a requirement for both forest and wetland elements in order to complete their life-cycles - wetlands for breeding and forest habitat for foraging and over-wintering - a requirement which is more likely to be satisfied across larger habitat blocks. Currently, even though the forest blocks are much reduced in size, these same forest blocks contain or are close to vernal wetlands and therefore the three frog species are able to persist even in such a highly fragmented landscape.

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. Such a variety of habitat needs are more likely satisfied within a larger extent of natural cover.

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 road-kill). 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.

All seven herp species and the three mammal species of regional or urban concern are considered highly sensitive to patch isolation. Typically, birds are considerably less affected by this criterion. The main obstruction to movement across the landscape within the study area is the presence of Hwy 407 which creates a major barrier to north-south movement for terrestrial species such as frogs and snakes. Other than the obvious impact of Hwy 407, the main barrier to the movement of herps and mammals across the landscape is the north-south 11th Concession. There were several road-kill specimens found along this route during the roadside surveys conducted by the TRCA in the spring of 2014, particularly where this road bisects the larger forest patch in Block C.

Fauna species that score greater than three points under the ***habitat dependence*** criterion are considered habitat specialists (Map 14). These species exhibit a combination of very specific habitat requirements that range from the 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. Only two fauna species that occur in the study area are considered habitat specialists: spring peeper and wood frog. Both of these species score as highly habitat dependent primarily due to their requirement for two distinct habitat types: wetland and upland forest. The lack of habitat dependent species perhaps reflects the rather low quality of the forest, wetland and meadow habitats on site.

A site's species list presents only the species' richness, i.e. it indicates only the presence or absence of species at a site but indicates neither the breeding success nor the population stability of each species at the site. A healthy functioning system will accommodate a whole suite of species that are adapted to the habitat types at the site, and will allow those particular species to thrive and breed successfully. As the quality of the habitat patch improves so will the representation of flora and fauna species associated with that habitat. In this way, representation biodiversity is an excellent measure of the health of a natural system. Degraded forest habitats in urban landscapes often accommodate only generalist species with the more sensitive forest-dependent species entirely absent. The results of the inventory at the Upper Petticoat Creek Study Area suggest that small forest patches within an agricultural landscape are likewise depauperate. However, it should certainly be borne in mind that the effectiveness of the 2014 fauna inventory was possibly somewhat compromised by the inability to access the full extent of the natural habitats.

5.0 Summary and Recommendations

The recommendations for the Upper Petticoat Creek 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 study area within the regional context, followed by specific recommendations.

5.1 Site Summary

1. The site is located in the upper reaches of the Petticoat watershed, north of Steeles Avenue. Its natural cover fills an important function in helping to maintain a viable connection across the rural landscape between the Oak Ridges Moraine to the north and important staging areas for migrant birds located in the lower reaches of the Rouge River and the Lake Ontario shoreline. It also provides linking habitat between the Rouge River and Duffins Creek.

2. Being located within the protected Rouge Park lands, the site is secure from urban intrusion. Disturbance is largely agricultural in nature, and its land-use designation allows for more flexibility in improving natural heritage and contributing to the local and regional terrestrial natural heritage targets.

3. Fifty vegetation types were observed, ranging from mature deciduous forest to deciduous swamp to shallow marsh and aquatic communities. The site includes 19 forest, 12 wetland, 3 aquatic, 5 successional and 1 meadow vegetation community types. This is a rather high community diversity given the size of the site (34 ha) and reflects the presence of pre-existing fragments of older vegetation types, more recent plantings and natural regeneration, and especially, streams and ponds.

4. The small but growing heronry established in the mature swamp forest remnant in Block A is significant from a regional perspective, especially given the increasing pressures imposed on heronries elsewhere in the region.

5. Despite the fragmented configuration of the natural habitat across this agricultural landscape, six species of frogs and toads (including three L2 species) are persisting. The remnant forest patches contain vernal wetland elements and therefore enable such populations of wood frog, grey treefrog and spring peeper to maintain small populations on the landscape.

6. Four hundred and twelve flora species were observed (excluding planted specimens) including 20 plants considered flora species of regional concern (one L2 species and 19 L3 species), plus an additional 78 species of intermediate concern (L4). These species are associated with the forest, wetland and successional vegetation communities. Total species richness is moderate to high for the size of the site but it includes a large component of exotic species (L+) that reflect a history of intensive agricultural use and habitat fragmentation.

7. There is good representation of species typical of shaded swamp and upland forest such as marsh cinquefoil and moonseed. The wetland species persist as relicts in a highly altered and drained agricultural landscape.

8. There are at least seven species of native hawthorn associated with hedgerows and successional areas. They are an interesting and complex group of small trees and shrubs associated with past and present agricultural use.

9. Emerald ash borer is a threat to many of the forests and wetlands where red ash is a dominant or co-dominant species.

10. The 56 species of vertebrate fauna observed is lower than expected in this non-urban landscape. This is either a result of the highly fragmented forest patches, or (perhaps more likely) the compromised inventory process in 2014, whereby all fauna was assessed from roadside locations. A proper inventory, in line with other TRCA inventories conducted throughout the region, requires full access to all natural habitat within the study area.

11. Other than at the Markham East Woodlot, forest canopy in the remnant forest patches apparently supports very few pairs of forest-dependent bird species: six pairs of eastern wood-pewees and just one pair of red-eyed vireo. Again, a full inventory may reveal more appropriate populations of such species (especially the latter).

12. Despite the low richness and representation in the breeding bird population, the site is potentially important for migrating songbirds moving to and from migrant staging areas on the Lake Ontario shoreline.

13. Given the site's location within the Rouge National Urban Park there is considerable potential to use the natural habitats in the Upper Petticoat Creek Study Area as interpretive and educational opportunities in this growing urban community.

5.2 Site Recommendations

The recommendations primarily address objectives of protecting regional biodiversity in the TRCA jurisdiction. In order to maintain or enhance the current level of biodiversity at the Upper Petticoat Creek Study Area, the overall integrity of the natural heritage system that includes the site must be protected. Therefore, at the landscape scale, in keeping with the TNHSS, connections to other natural habitat patches in the landscape need to be created and maintained. Furthermore, the recommendations highlight the issues that may occur with any increased public use of the Study Area as the urban landscape continues to expand. Local community stewardship needs to address this potential increase in negative matrix influence and ensure that effective mitigation is included as part of any future management of the site. This includes strategic placement of any interpretive signage, managing public use, allowing healthy dynamic natural processes to proceed, and controlling invasive species.

The following recommendations address the above natural heritage concerns, with an emphasis upon bolstering the existing natural features on site. Thus, we recommend overall that 1) existing habitats and features be protected and enhanced; 2) that public use be managed; and 3) that invasive species be controlled.

1. Protect and Enhance Existing Features

   The first priority should be to focus on ***maintaining conditions that allow existing communities or species of conservation concern to thrive***. This is especially true of the wetland and forest habitats throughout the site.

   a. Pursue opportunities to expand natural cover across the site. Upper Petticoat Creek, because of its protected designation, provides opportunities for expanding locally to meet the regional terrestrial natural heritage target system. Furthermore, the entire headwater zone of this creek lies outside any areas slated for urban expansion, and it is one of the few areas of protected land on the South Slope physiographic region.

   b. In choosing areas for natural restoration, focus on north-south natural cover linkages along the watercourse and east-west linkages along hedgerows or where there are smaller gaps between natural areas, especially joining the Little Rouge Creek to the West Duffins Creek. For example, there is a potential corridor running southwest from the Markham East Woodlot to Little Rouge Creek (TRCA 2011).

   c. The northern part of the study area (i.e. Block A and the Markham East Woodlot area) is something of a critical nexus at the regional scale. Firstly it forms a narrowing of the broad north-south greenbelt corridor between Markham and the developing Seaton lands. Secondly, it is bisected by major road barriers (Hwys 407 and 7); and thirdly, it has existing habitat features (e.g. the heronry and Markham East Woodlot). This may be a good place to target for natural cover expansion and connectivity improvements.

   d. Fauna inventory results suggest that patch size is the major factor limiting use of the study area by nesting forest dependent birds. All agricultural lands adjacent to forest patches within the study area have the potential for enhancing and increasing forest cover, thereby introducing areas of forest interior where species such as wood thrush might be recruited as nesting species.

   e. Open habitats should also be maintained in places. Native meadow communities can provide foraging opportunities for migrating monarch butterflies (*Danaus plexippus*) and migrant songbirds in the fall (primarily sparrows). In addition, hawthorn diversity and health can be maintained by removing invasive species such as buckthorn and perhaps by retaining some level of livestock grazing.

f. Areas selected for restoration should have soil and moisture assessments conducted in order to help determine suitable lists of species for planting. If soil conditions are suitable, consideration should be given to adding vernal pool features to accommodate local wood frog and spring peeper populations.

g. Ensure effective and adequate passage (e.g. tunnels and culverts) for frogs, snakes and mammals across or under roads, especially Hwys 7 and 407; and York-Durham Townline. This is essential to maintain corridor function, especially in the light of increasing commuter traffic.

h. Hydrology should be restored, especially in and around Petticoat Creek and associated swamp communities. Measures that would help toward this end would be the disconnection of old tile drains and blocking any drains or ditches that might convey water away from deciduous swamps (e.g. near 14th Avenue and 11th Concession).

2. Manage Public Use

Visitor pressure is likely to increase in the future, and it is important that this increase in use does not impact sensitive habitat features such as the wetlands. On the other hand, the Upper Petticoat Creek subwatershed seems to be somewhat less sensitive and diverse than the larger part of Rouge Park south of Steeles Avenue which has experienced documented declines in fauna and flora (TRCA 2012, TRCA 2014).

a. Because of the somewhat less sensitive character of this area, it may be possible to place some public uses here, diverting them from the more sensitive areas of Rouge Park south of Steeles. These could be placed within designated restoration lands on the site (not near to existing sensitive natural heritage features such as swamps or the heronry).

b. Some areas should be left without public access as pure refuges for flora and fauna. (e.g. the location of the heronry in Block A). Because the land is not currently used by the public, it is possible to do so proactively instead of trying to manage existing uses.

c. Hikers and dog-walkers are currently having little impact on the site. However, if there is any intention to encourage greater public use of the natural habitats within the study area it is important to establish very definite rules on the presence of dogs. Wherever dog-walkers have access, it follows that there will be an expectation that animals will be allowed to roam off-leash – despite local by-laws to the contrary. If such a use is allowed to embed itself at the site, there is a considerable risk that the more terrestrial frog populations will suffer; furthermore,

any benefits gained by increasing forest patch sizes will be off-set by the increased impact of such use on low and ground-nesting bird species.

d. Involve all the different governments and agencies in planning and restoring Upper Petticoat Creek (federal, provincial and municipal governments; TRCA, and environmental NGOs).

e. Involving the local community in any restoration efforts will enhance feelings of good stewardship, which in turn will result in more ecologically positive behaviour, e.g. sustainable farming practices including the use of organic methods and the provision of adequate natural cover buffers and corridors along water courses. Proper disposal of yard waste; diminished use of salt on paved surfaces in close proximity to the site; responsible dog-ownership.

3. Control Invasive Species

Several invasive plant species are threats to the native biodiversity in the Upper Petticoat Creek Study Area. ***It is essential that well-planned and realistic measures be undertaken to control invasive species***. Management for invasive species will need to be tailored to the individual species in question, depending on how wide-spread and established they are.

a. Take a proactive approach. For example, where there is a lot of red ash that will die, focus on invasive removal and underplanting with native species before the invasive species are released.

b. Proactive management of invasive species can also occur along any planned trail corridors as well as to any other areas targeted for restoration planting. This would include local removal of dog-strangling vine, buckthorn, common reed, and other species that are widespread across the site as a whole.

c. Since most of the invasive species at the site have large and/or diffuse populations, the best approach is to control disturbance that would aid their further spread rather than eradication efforts. For example, trailside plantings of competitive native ground covers such as bloodroot (*Sanguinaria canadensis*) and discouraging dumping would reduce the disturbance that encourages garlic mustard.

d. Japanese knotweed, periwinkle, and possibly common reed might be realistic candidates for eradication efforts. These species are currently present in discrete populations but have a high potential for spread. Their removal would thus be both feasible and have a highly protective effect on biodiversity.

e. Emerald ash borer cannot be controlled. However, selected red, white, and black ash trees that are still healthy should be treated with TreeAzin® or similar agent to protect them. In the long term, these trees may be able to serve as a seed source for recolonizing the area.

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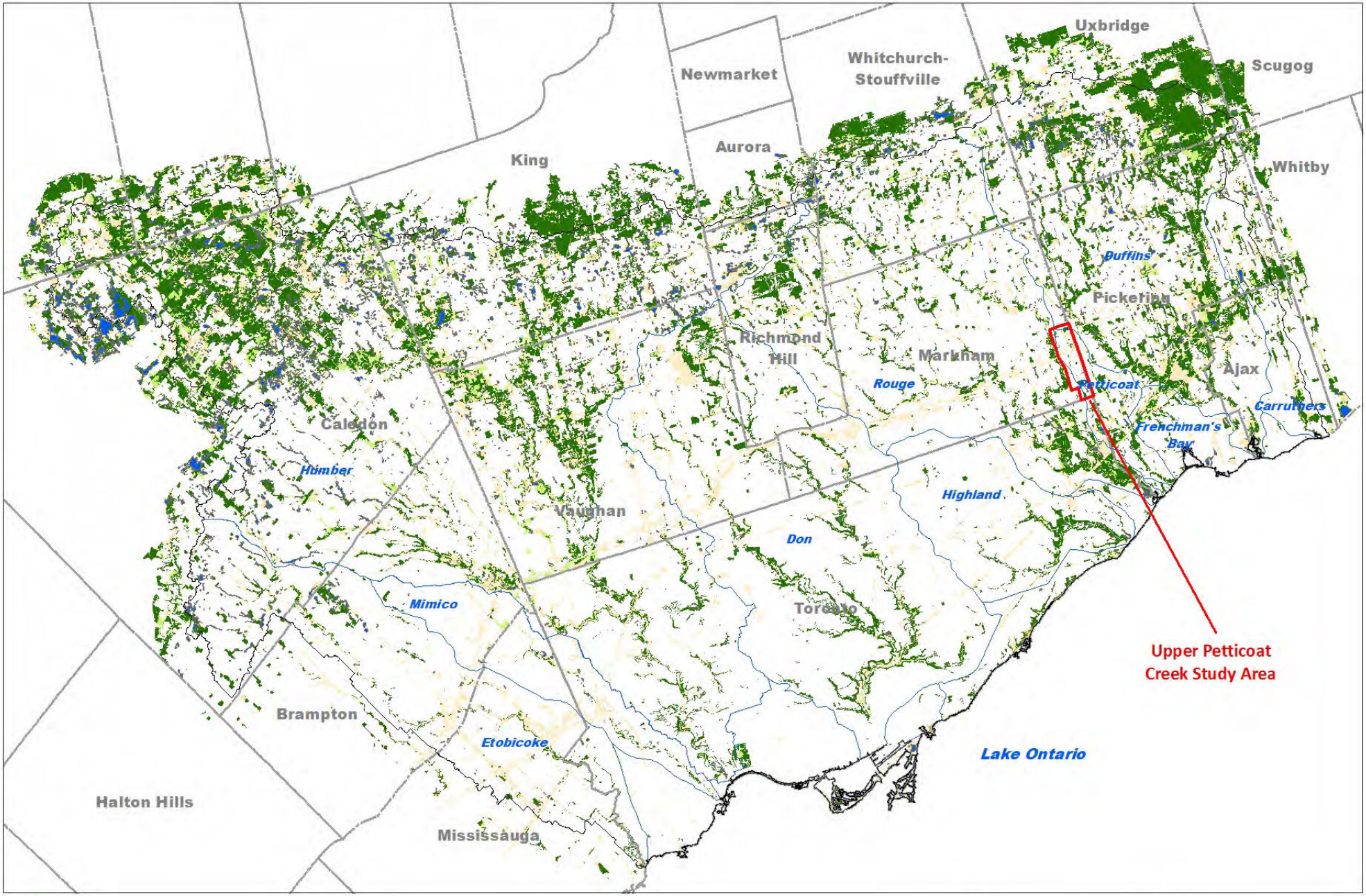

Toronto and Region Conservation
for The Living City

N

0 2.5 5 10 15 20 Kilometers

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec
* Landscape analysis based on 20072008 Orthophotography

Map 1:
Upper Petticoat Creek Study Area in the Context of Regional Natural Cover

Natural Cover *
- Forest
- Successional
- Meadow
- Wetland
- Beach/Bluff

Legend
- Upper Petticoat Creek Study Area Boundary
- TRCA Jurisdiction
- Watershed
- Municipal Boundary

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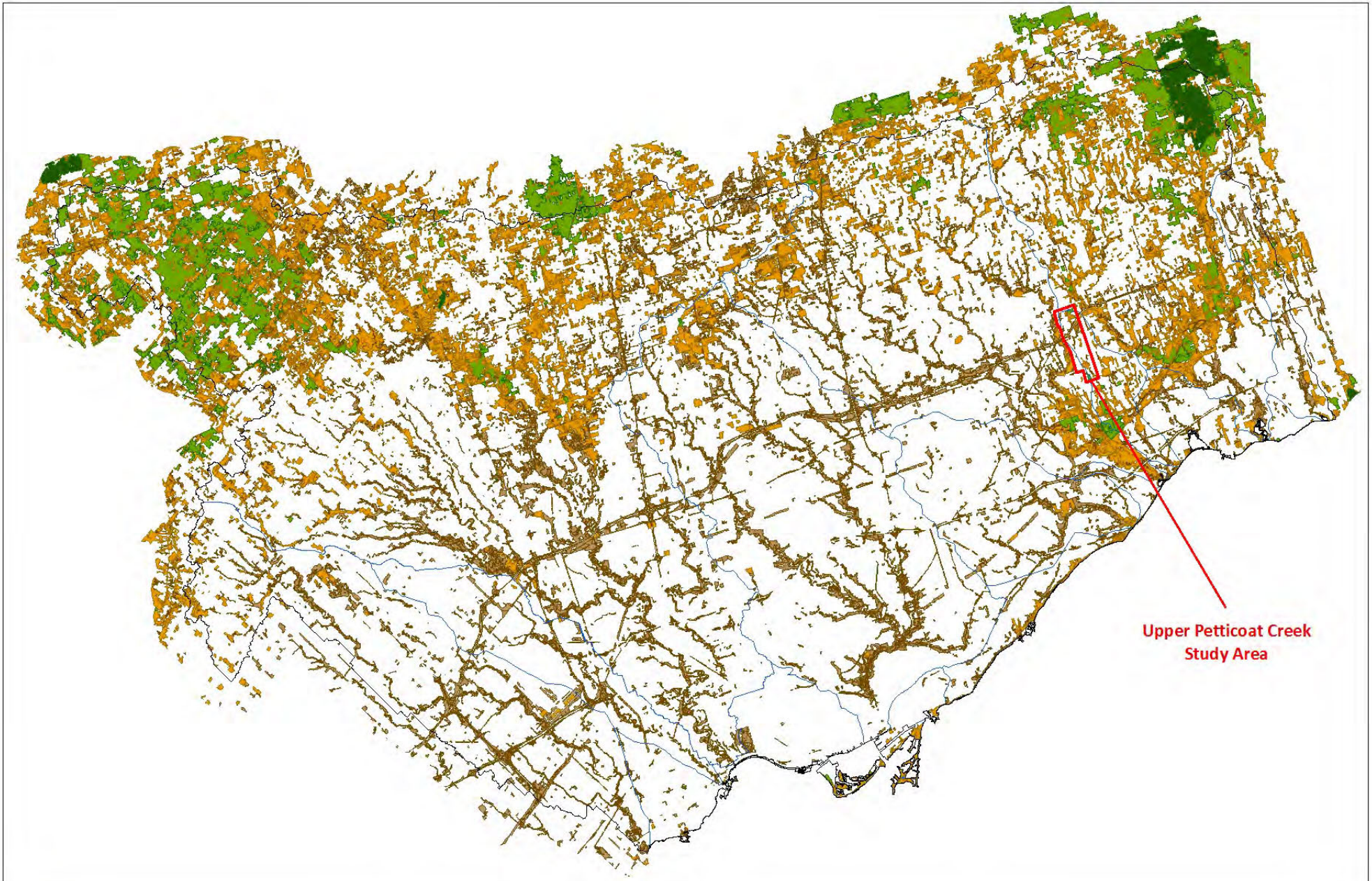
0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 2: Upper Petticoat Creek Study Area

Legend

Upper Petticoat Creek Study Area Boundary



Toronto and Region Conservation
for The Living City

N

0 2.5 5 10 15 20
Kilometers

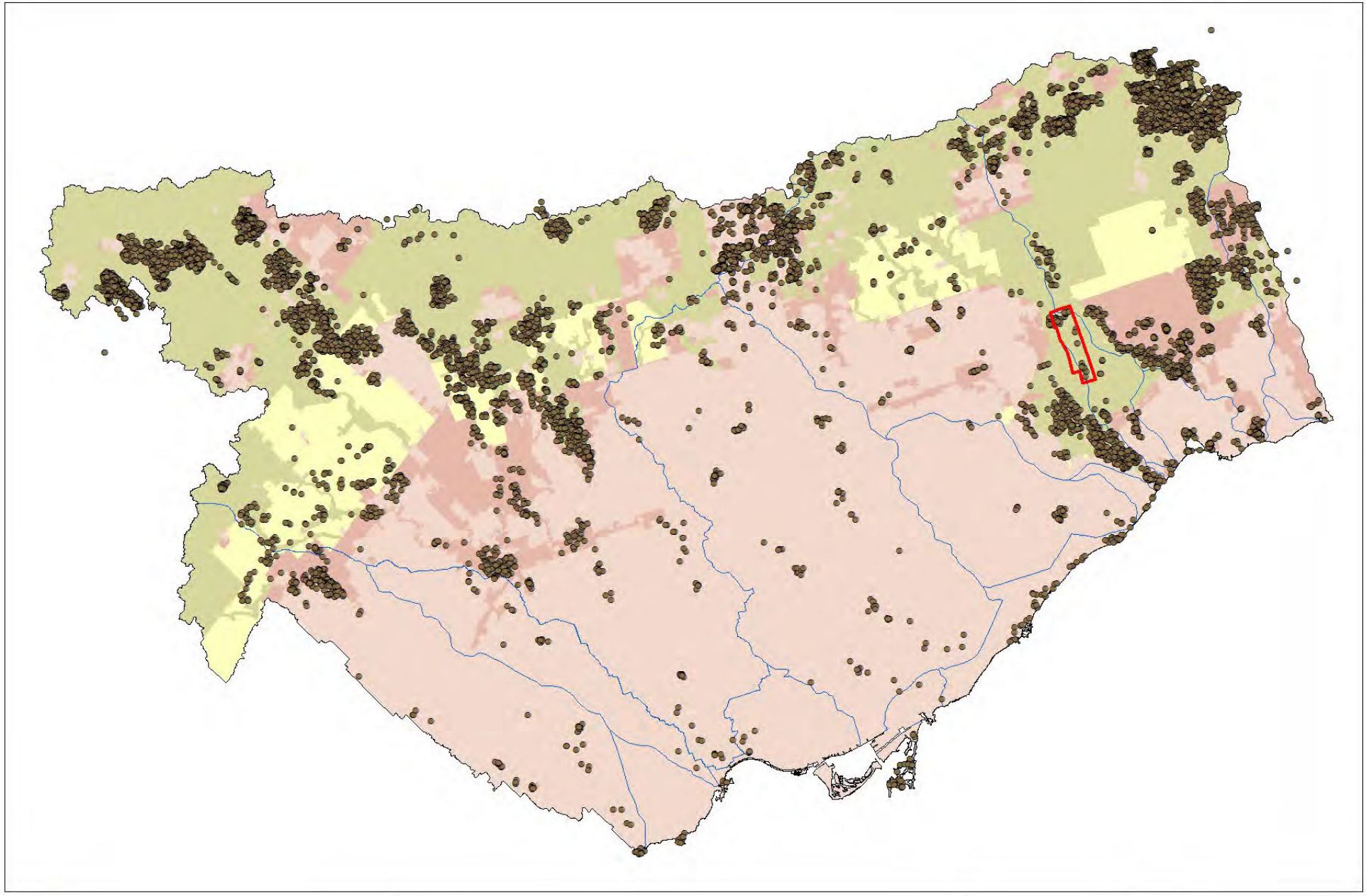
Date: January 2015
* Landscape analysis based on 20072008 Orthophotography

Map 3:
Regional Natural System
Habitat Patch Quality

Legend

Habitat Patch Quality *
- L1 - Excellent
- L2 - Good
- L3 - Fair
- L4 - Poor
- L5 - Very Poor

- Upper Petticoat Creek Study Area Boundary
- TRCA Jurisdiction
- Watershed



Toronto and Region Conservation
for The Living City

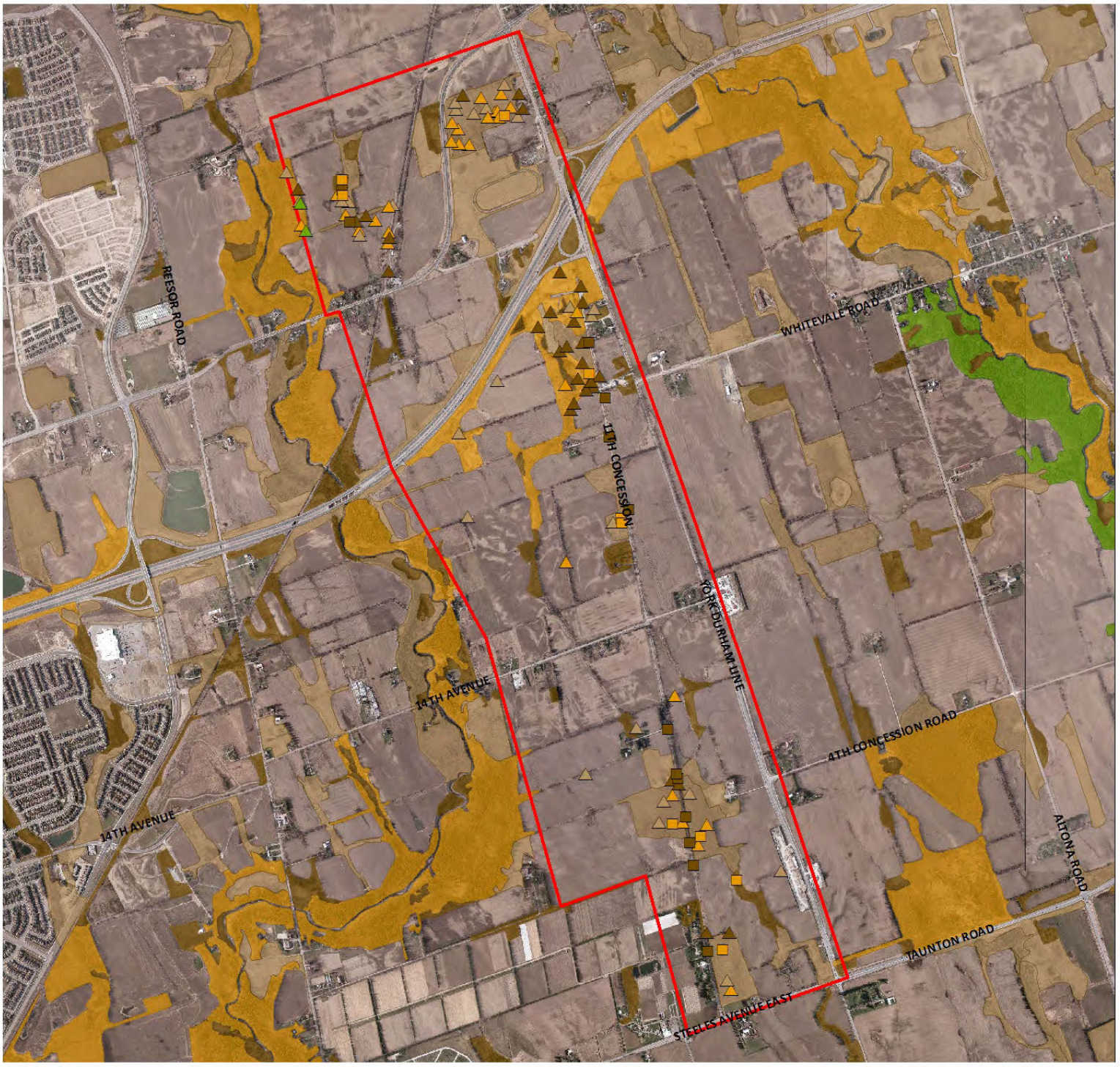
0 2.5 5 10 15 20 Kilometers

Date: January 2015

Map 4:
Distribution of Fauna
Regional Species of Concern

Legend

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



Fauna Area Sensitivity Scores

- 5 - >100ha
- 4 - >20ha
- 3 - > 5ha
- 2 - > 1ha
- 1 - < 1ha

- Fauna Species
- Frog Species

Habitat Patch Size Scores *

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor

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0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec
* Landscape analysis based on 20072008 Orthophotography

Map 5: Habitat Patch Size Scores with Fauna Area Sensitivity Scores

Legend

Upper Petticoat Creek Study Area Boundary

NOTE: All fauna species with their associated scores for area sensitivity can be found in Appendix #3.

Toronto and Region Conservation
for The Living City

N
W E
S

0 125 250 500 750 1,000
Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec
* Landscape analysis based on 20072008 Orthophotography

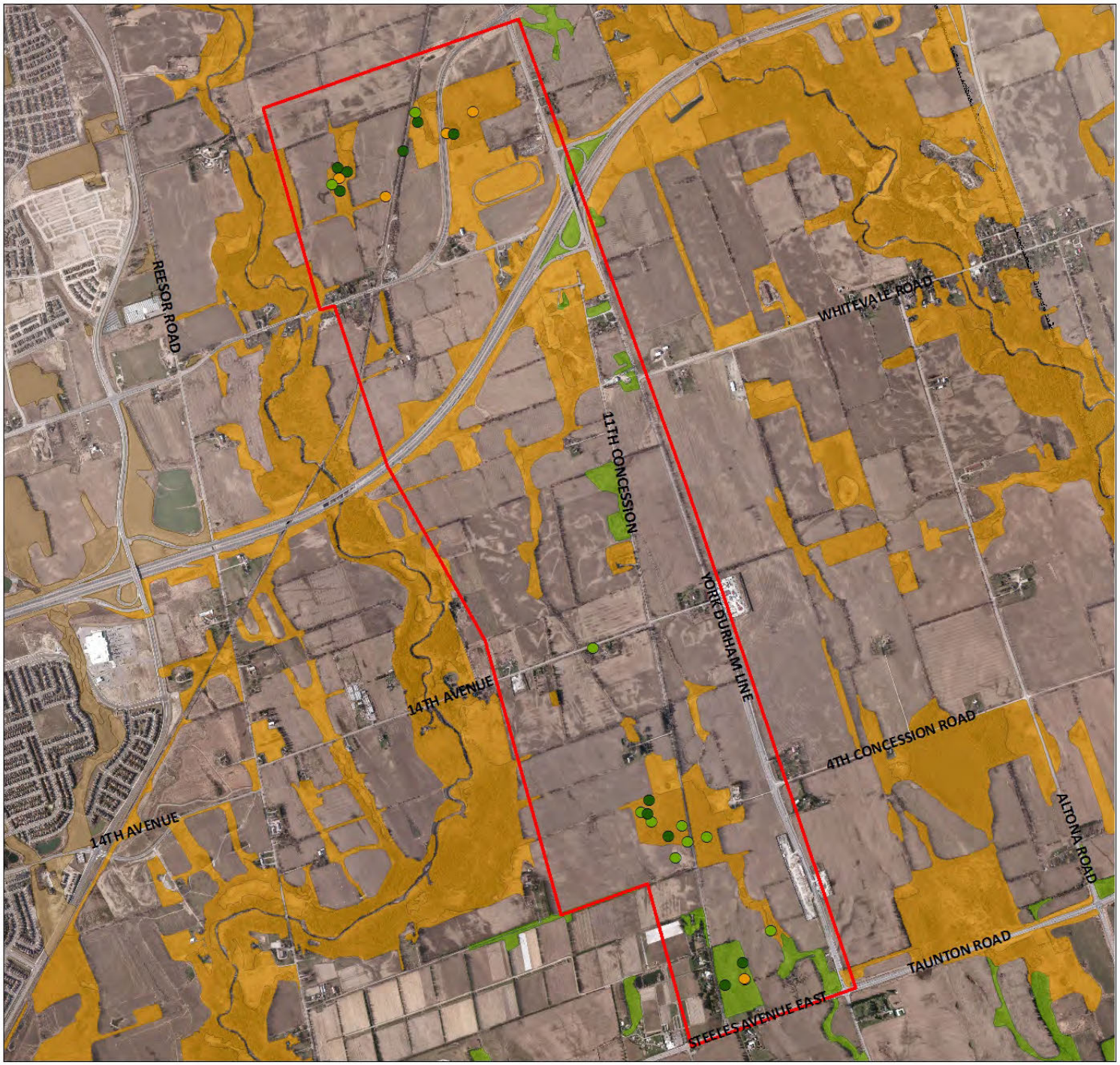
Map 6:
Interior Forest
at Upper Petticoat Creek

Legend

- Upper Petticoat Creek Study Area Boundary
- Forest

Forest Interior

- 100m-200m
- 200m-300m
- 300m-400m
- 400m-500m
- 500m-600m
- 600m-700m



Flora Sensitivity to Development Scores

- 5 - Species receives severe negative impact from development-related disturbances
- 4 - Species receives moderately severe negative impact from development-related disturbances
- 3 - Species receives significant negative impact from development-related disturbances
- 2 - Species receives slight negative impact from development-related disturbances
- 1 - Species experiences no overall benefit or detriment from development-related disturbances (neutral)
- 0 - Species benefits significantly from development-related disturbances

NOTE: All flora species with their associated scores for sensitivity to development can be found in Appendix #2.

○ Flora Species

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N

0 125 250 500 750 1,000 Meters

Date: January 2013
Orthophoto: Spring 2011, First Base Solutions Inc.
* Landscape analysis based on 2007/2008 Orthophotography

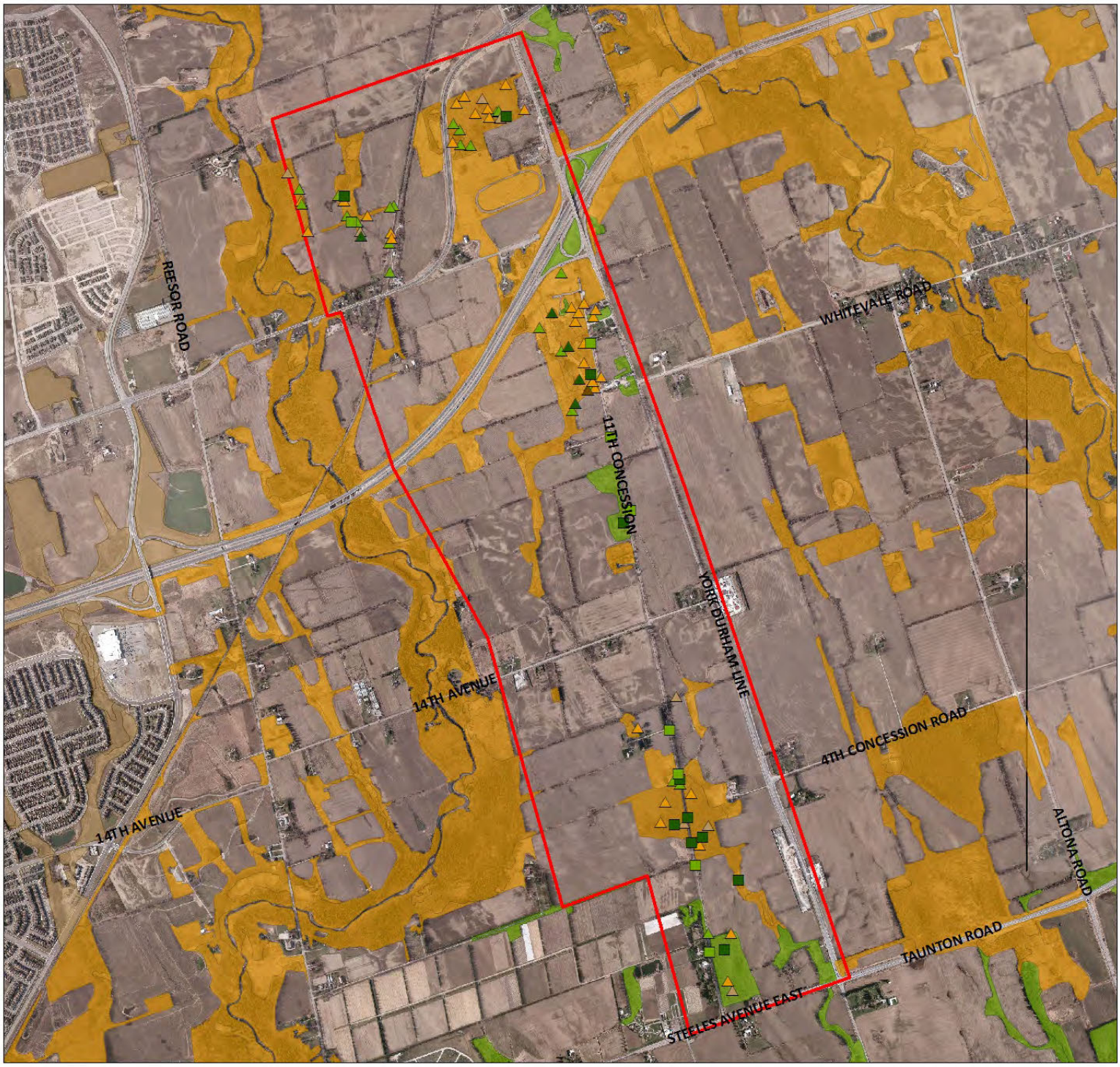
Map 7:
Scores for Matrix Influence and Flora Sensitivity to Development

Legend

Habitat Matrix Influence Scores *

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor

Upper Petticoat Creek Study Area Boundary



Fauna Sensitivity to Development Scores

- ▲ ■ 5 - Species receives severe negative impact from development-related disturbances
- ▲ ■ 4 - Species receives moderately severe negative impact from development-related disturbances
- ▲ ■ 3 - Species receives significant negative impact from development-related disturbances
- ▲ ■ 2 - Species receives slight negative impact from development-related disturbances
- ▲ ■ 1 - Species experiences no overall benefit or detriment from development-related disturbances (neutral)
- ▲ ■ 0 - Species benefits significantly from development-related disturbances

NOTE: All fauna species with their associated scores for sensitivity to development can be found in Appendix #3.

△ Fauna Species

□ Frog Species

Toronto and Region Conservation for The Living City

N

0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec
* Landscape analysis based on 20072008 Orthophotography

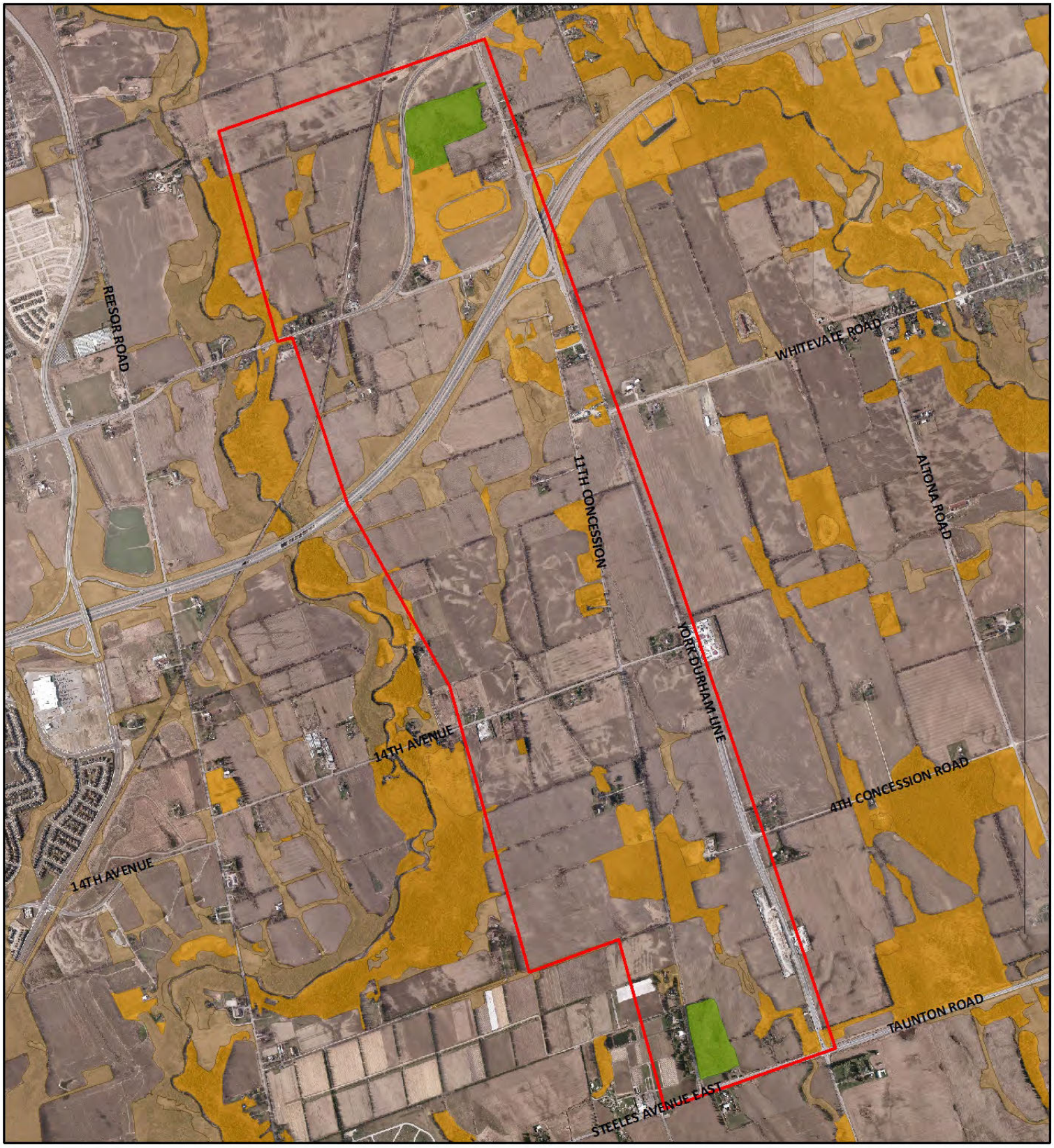
Map 8:
Scores for Matrix Influence and Fauna Sensitivity to Development

Legend

Habitat Matrix Influence Scores *

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor

Upper Petticoat Creek Study Area Boundary



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N

0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec
* Landscape analysis based on 20072008 Orthophotography

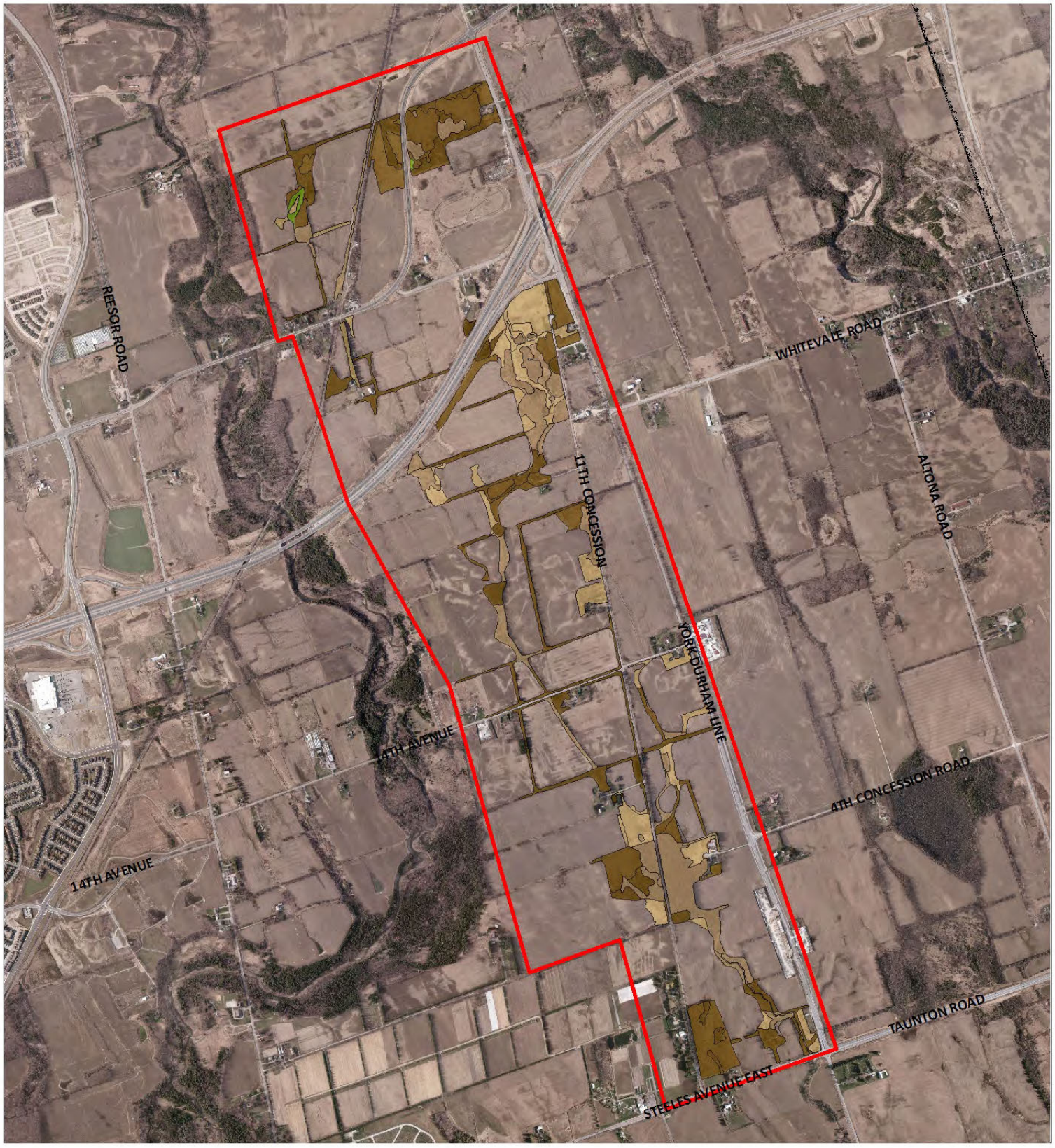
Map 9: Habitat Patch Quality

Legend

Habitat Patch Quality *

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

Upper Petticoat Creek Study Area Boundary



Toronto and Region Conservation *for* The Living City

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0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 10: Vegetation Communities with their Associated Local Ranks

Legend

Vegetation Community Ranks

- L1
- L2
- L3
- L4
- L5
- L+

Upper Petticoat Creek Study Area Boundary

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

Toronto and Region Conservation for The Living City

N

0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 11: Location of Flora Species of Concern

Legend

Flora Species of Concern (L1-L4)

- L1
- L2
- L3

Upper Petticoat Creek Study Area Boundary

Flora Habitat Dependence Scores

- 5 - Extreme habitat specialist
- 4 - Strong habitat specialist
- 3 - Moderate habitat specialist
- 2 - Moderate habitat generalist
- 1 - Strong habitat generalist
- 0 - Extreme habitat generalist

○ Flora Species

NOTE: All flora species with their associated scores for habitat dependence can be found in Appendix #2.

Toronto and Region Conservation for The Living City

N

0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 12: Flora Species Habitat Dependence Scores

Legend

Upper Petticoat Creek Study Area Boundary

Toronto and Region Conservation *for* The Living City

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0 125 250 500 750 1,000 Meters

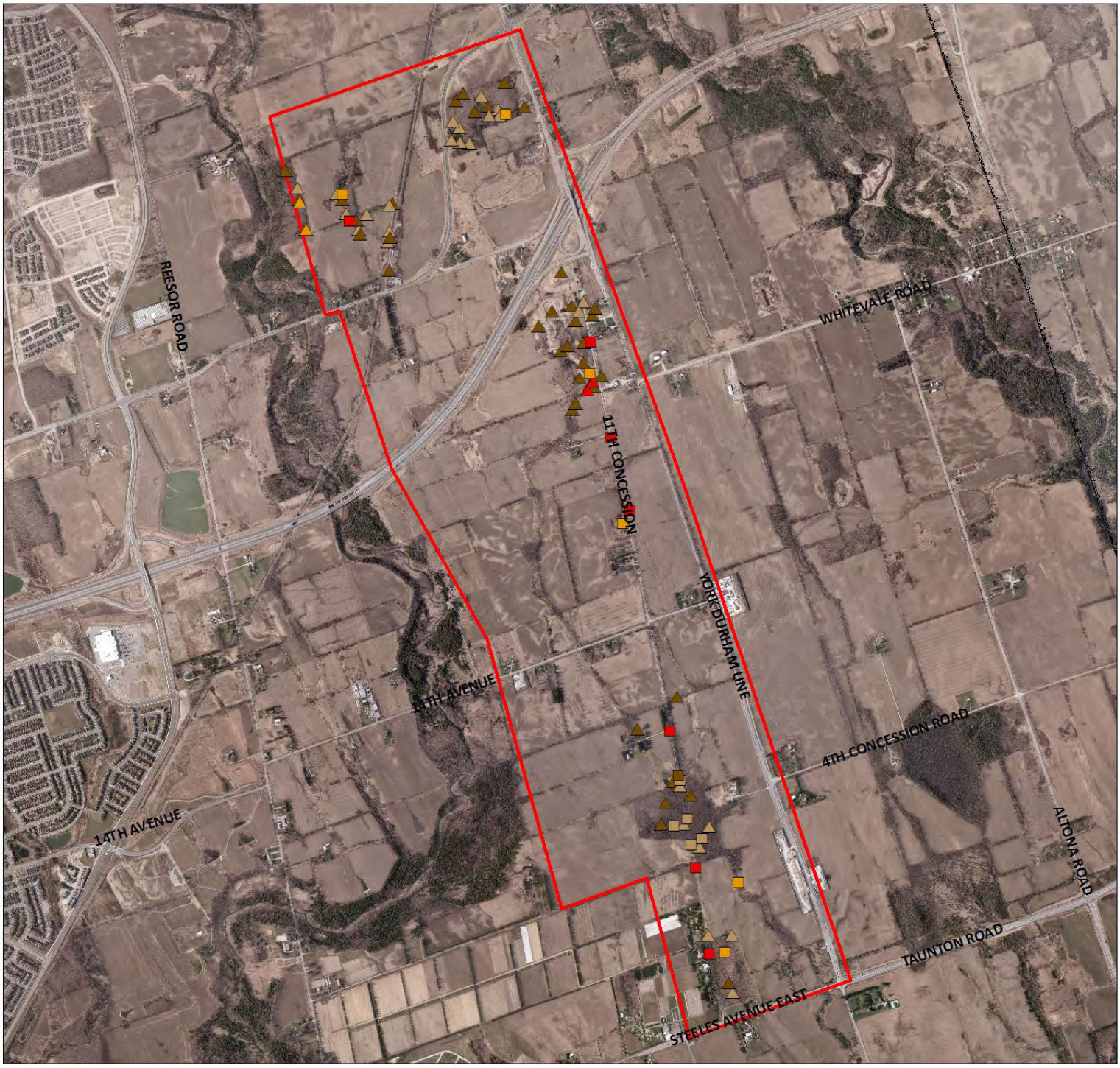
Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 13: Locations of Fauna Species of Concern

Legend

Fauna Species of Concern				Frog Species of Concern			
L1	L2	L3	L4	L1	L2	L3	L4

Upper Petticoat Creek Study Area Boundary



Fauna Habitat Dependence Scores

- 5 - Extreme habitat specialist
- 4 - Strong habitat specialist
- 3 - Moderate habitat specialist
- 2 - Moderate habitat generalist
- 1 - Strong habitat generalist
- 0 - Extreme habitat generalist

NOTE: All fauna species with their associated scores for habitat dependence can be found in Appendix #3.

Toronto and Region Conservation for The Living City

N

0 125 250 500 750 1,000 Meters

Date: January 2015
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 14: Fauna Species Habitat Dependence Scores

Legend

- Upper Petticoat Creek Study Area Boundary
- Fauna Species
- Frog Species

Appendix 1: Vegetation Communities in Upper Petticoat Creek (2004-14)

ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank Nov-14
			Local Occur.	Geophy. Requir.	Total Score	
	Forest					
FOD5-1	Dry-Fresh Sugar Maple Deciduous Forest	4.7	1.5	0.0	1.5	L5
FOD5-2	Dry-Fresh Sugar Maple - Beech Deciduous Forest	4.8	1.5	0.0	1.5	L5
FOD5-6	Dry-Fresh Sugar Maple - Basswood Deciduous Forest	0.8	2.5	0.0	2.5	L5
FOD5-8	Dry-Fresh Sugar Maple - White Ash Deciduous Forest	0.5	1.5	0.0	1.5	L5
FOD6-1	Fresh-Moist Sugar Maple - Ash Deciduous Forest	1.1	2.0	0.0	2.0	L5
FOD6-5	Fresh-Moist Sugar Maple - Hardwood Deciduous Forest	6.7	1.5	0.0	1.5	L5
FOD7-1	Fresh-Moist White Elm Lowland Deciduous Forest	4.8	2.0	1.0	3.0	L4
FOD7-2	Fresh-Moist Ash Deciduous Forest	6.6	2.0	1.0	3.0	L5
FOD7-4	Fresh-Moist Black Walnut Lowland Deciduous Forest	1.4	2.5	1.0	3.5	L4
FOD7-a	Fresh-Moist Manitoba Maple Lowland Deciduous Forest	0.5	1.5	0.0	1.5	L5
FOD7-F	Fresh-Moist Basswood Lowland Deciduous Forest	0.7	3.0	1.0	4.0	L4
FOD8-1	Fresh-Moist Poplar Deciduous Forest	0.3	1.0	0.0	1.0	L5
FOD9-3	Fresh-Moist Bur Oak Deciduous Forest	0.1	3.0	1.0	4.0	L4
CUP1-3	Black Walnut Deciduous Plantation	0.3	3.0	0.0	3.0	L5
CUP1-7	Red (Green) Ash Deciduous Plantation	1.8	3.0	0.0	3.0	L5
CUP1-A	Restoration Deciduous Plantation	1.4	2.0	0.0	2.0	L5
CUP3-1	Red Pine Coniferous Plantation	0.3	1.5	0.0	1.5	L5
CUP3-C	White Spruce Coniferous Plantation	0.3	2.0	0.0	2.0	L5
CUP3-e	Norway Spruce Coniferous Plantation	0.9	2.0	0.0	2.0	L+
CUP3-H	Mixed Conifer Coniferous Plantation	0.4	1.5	0.0	1.5	L5
	Successional					
CUT1-1	Sumac Deciduous Thicket	6.5	2.0	0.0	2.0	L5
CUH1-A	Treed Hedgerow	14.9	1.5	0.0	1.5	L5
CUH1-B	Native Shrub - Sapling Hedgerow	1.3	3.0	0.0	3.0	L4
CUH1-c	Buckthorn Hedgerow	0.9	2.5	0.0	2.5	L+
CUS1-A1	Native Deciduous Successional Savannah	0.7	1.5	0.0	1.5	L5
CUS1-b	Exotic Successional Savannah	3.1	2.0	0.0	2.0	L+
CUW1-A3	Native Deciduous Successional Woodland	3.3	1.0	0.0	1.0	L5
CUW1-b	Exotic Successional Woodland	1.2	1.5	0.0	1.5	L+
CUW1-D	Hawthorn Successional Woodland	0.4	2.5	0.0	2.5	L5

Appendix 1: Vegetation Communities in Upper Petticoat Creek (2004-14)

ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank Nov-14
			Local Occur.	Geophy. Requir.	Total Score	
	Wetland					
SWD2-2	Red (Green) Ash Mineral Deciduous Swamp	13.4	2.5	2.0	4.5	L4
SWD3-2	Silver Maple Mineral Deciduous Swamp	1.7	2.5	2.0	4.5	L4
SWD4-2	White Elm Mineral Deciduous Swamp	0.9	3.0	2.0	5.0	L4
SWD4-3	Paper Birch - Poplar Mineral Deciduous Swamp	0.9	2.0	2.0	4.0	L4
SWD6-2	Silver Maple Organic Deciduous Swamp	1.2	3.5	3.0	6.5	L2
SWT2-2	Willow Mineral Thicket Swamp	1.7	2.0	2.0	4.0	L4
SWT2-5	Red-osier Mineral Thicket Swamp	0.4	2.0	2.0	4.0	L4
MAM5-1	Mineral Fen Meadow Marsh	0.1	3.5	3.0	6.5	L2
MAM2-2	Reed Canary Grass Mineral Meadow Marsh	18.3	1.0	1.0	2.0	L+
MAM2-9	Jewelweed Mineral Meadow Marsh	0.05	2.5	1.0	3.5	L4
MAM2-10	Forb Mineral Meadow Marsh	0.5	2.0	1.0	3.0	L5
MAS2-1b	Narrow-Leaved Cattail Mineral Shallow Marsh	2.2	2.0	0.0	2.0	L+
MAS2-a	Common Reed Mineral Shallow Marsh	2.5	3.0	0.0	3.0	L+
MAS3-1b	Narrow-leaved Cattail Organic Shallow Marsh	2.1	3.0	1.0	4.0	L+
	Aquatic					
SAS1-3	Stonewort Submerged Shallow Aquatic	0.2	2.5	1.0	3.5	L4
SAF1-3	Duckweed Floating-leaved Shallow Aquatic	0.3	2.5	1.0	3.5	L4
OAO1	Open Aquatic (deep or riverine unvegetated)	0.1	2.0	0.0	2.0	L5
OAO1-T	Turbid Open Aquatic (disturbed unvegetated)	0.1	2.0	0.0	2.0	L+
	Meadow					
CUM1-A	Native Forb Meadow	15.4	1.5	0.0	1.5	L5
CUM1-b	Exotic Cool-season Grass Graminoid Meadow	2.7	1.0	0.0	1.0	L+
CUM1-c	Exotic Forb Meadow	0.3	1.5	0.0	1.5	L+

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Caryophyllaceae	*Silene antirrhina*	sleepy catchfly	4	4	4	5	17	L2
Cyperaceae	*Carex laxiculmis* var. *laxiculmis*	spreading wood sedge	3	3	3	3	12	L3
Cyperaceae	*Carex tuckermanii*	Tuckerman's sedge	2	4	4	4	14	L3
Celastraceae	*Celastrus scandens*	American bittersweet	2	4	3	5	14	L3
Plantaginaceae	*Chelone glabra*	turtlehead	2	3	4	5	14	L3
Rosaceae	*Comarum palustre*	marsh cinquefoil	3	4	4	5	16	L3
Rosaceae	*Crataegus* cf. *coccinea* var. *fulleriana*	Fuller's hawthorn	3	3	5	3	14	L3
Rosaceae	*Crataegus* cf. *flabellata*	fan-leaved hawthorn	5	2	4	3	14	L3
Rosaceae	*Crataegus coccinea* var. *pringlei*	Pringle's hawthorn	3	3	3	3	12	L3
Dryopteridaceae	*Dryopteris clintoniana*	Clinton's wood fern	2	4	5	4	15	L3
Juglandaceae	*Juglans* cf. *cinerea*	butternut	1	5	4	4	14	L3
Araceae	*Lemna trisulca*	star duckweed	2	4	5	3	14	L3
Campanulaceae	*Lobelia inflata*	Indian tobacco	2	4	4	4	14	L3
Menispermaceae	*Menispermum canadense*	moonseed	2	4	4	4	14	L3
Asteraceae	*Nabalus albus*	white wood lettuce	3	4	4	3	14	L3
Grossulariaceae	*Ribes triste*	swamp red currant	2	4	4	5	15	L3
Cyperaceae	*Scirpus pendulus*	drooping bulrush	3	4	5	4	16	L3
Colchicaceae	*Streptopus lanceolatus* var. *lanceolatus*	rose twisted-stalk	2	4	4	5	15	L3
Taxaceae	*Taxus canadensis*	Canada yew	1	4	4	5	14	L3
Colchicaceae	*Uvularia grandiflora*	large-flowered bellwort	1	4	5	5	15	L3
Sapindaceae	*Acer saccharinum*	silver maple	1	2	5	3	11	L4
Sapindaceae	*Acer saccharum* ssp. *nigrum*	black maple	2	3	4	2	11	L4
Ranunculaceae	*Actaea pachypoda*	white baneberry	1	3	4	3	11	L4
Amaryllidaceae	*Allium tricoccum*	wild leek	1	3	4	4	12	L4
Rosaceae	*Amelanchier laevis*	smooth serviceberry	2	2	4	3	11	L4
Fabaceae	*Apios americana*	ground-nut	3	4	3	3	13	L4
Aristolochiaceae	*Asarum canadense*	wild ginger	2	3	4	3	12	L4
Apocynaceae	*Asclepias incarnata* ssp. *incarnata*	swamp milkweed	1	3	4	4	12	L4
Betulaceae	*Betula alleghaniensis*	yellow birch	1	4	3	5	13	L4
Betulaceae	*Betula papyrifera*	paper birch	1	4	2	4	11	L4
Asteraceae	*Bidens vulgata*	tall beggar's-ticks	2	2	3	4	11	L4
Urticaceae	*Boehmeria cylindrica*	false nettle	2	4	4	3	13	L4
Ranunculaceae	*Caltha palustris*	marsh marigold	1	4	3	4	12	L4
Brassicaceae	*Cardamine diphylla*	broad-leaved toothwort	1	3	3	4	11	L4
Brassicaceae	*Cardamine pensylvanica*	bitter cress	2	2	4	4	12	L4
Cyperaceae	*Carex aurea*	golden-fruited sedge	2	2	4	4	12	L4
Cyperaceae	*Carex cephalophora*	oval-headed sedge	2	3	3	4	12	L4
Cyperaceae	*Carex communis*	fibrous-rooted sedge	2	4	3	3	12	L4
Cyperaceae	*Carex deweyana*	Dewey's sedge	1	4	3	3	11	L4
Cyperaceae	*Carex hirtifolia*	hairy wood sedge	2	3	4	3	12	L4
Cyperaceae	*Carex hitchcockiana*	Hitchcock's sedge	2	3	5	3	13	L4
Cyperaceae	*Carex intumescens*	bladder sedge	2	4	4	2	12	L4

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Cyperaceae	*Carex lupulina*	hop sedge	1	4	4	4	13	L4
Cyperaceae	*Carex peckii*	Peck's sedge	2	3	3	3	11	L4
Cyperaceae	*Carex pensylvanica*	Pennsylvania sedge	1	4	3	4	12	L4
Cyperaceae	*Carex pseudocyperus*	pseudocyperus sedge	1	3	3	4	11	L4
Cyperaceae	*Carex retrorsa*	retrorse sedge	1	3	3	4	11	L4
Cyperaceae	*Carex tenera* var. *echinodes*	marsh straw sedge	3	3	2	3	11	L4
Betulaceae	*Carpinus caroliniana* ssp. *virginiana*	blue beech	1	3	4	3	11	L4
Juglandaceae	*Carya cordiformis*	bitternut hickory	1	4	4	2	11	L4
Berberidaceae	*Caulophyllum giganteum*	long-styled blue cohosh	1	3	4	4	12	L4
Betulaceae	*Corylus cornuta*	beaked hazel	2	4	3	4	13	L4
Rosaceae	*Crataegus holmesiana*	Holmes' hawthorn	3	3	4	3	13	L4
Rosaceae	*Crataegus macracantha*	long-spined hawthorn	2	2	4	3	11	L4
Rosaceae	*Crataegus submollis*	Emerson's hawthorn	2	3	4	3	12	L4
Woodsiaceae	*Cystopteris bulbifera*	bulblet fern	1	3	4	4	12	L4
Poaceae	*Danthonia spicata*	poverty oat grass	2	3	3	4	12	L4
Poaceae	*Dichanthelium acuminatum* ssp. *acuminatum*	hairy panic grass	2	3	3	3	11	L4
Dryopteridaceae	*Dryopteris cristata*	crested wood fern	1	4	4	4	13	L4
Dryopteridaceae	*Dryopteris intermedia*	evergreen wood fern	1	4	4	3	12	L4
Orobanchaceae	*Epifagus virginiana*	beech-drops	2	3	5	2	12	L4
Asteraceae	*Eupatorium perfoliatum*	boneset	1	3	3	3	10	L4
Fagaceae	*Fagus grandifolia*	American beech	1	4	3	4	12	L4
Oleaceae	*Fraxinus nigra*	black ash	1	4	4	3	12	L4
Rosaceae	*Geum fragarioides*	barren strawberry	2	4	4	3	13	L4
Juncaceae	*Juncus torreyi*	Torrey's rush	2	3	4	2	11	L4
Cupressaceae	*Juniperus virginiana*	red cedar	2	2	4	3	11	L4
Asteraceae	*Lactuca biennis*	tall blue lettuce	2	4	2	4	12	L4
Araceae	*Lemna turionifera*	turion duckweed	5	2	3	3	13	L4
Liliaceae	*Lilium michiganense*	Michigan lily	1	4	3	5	13	L4
Lamiaceae	*Lycopus americanus*	cut-leaved water-horehound	1	4	3	3	11	L4
Asparagaceae	*Maianthemum canadense*	Canada May-flower	1	4	1	5	11	L4
Pinaceae	*Pinus strobus*	white pine	1	4	3	4	12	L4
Dryopteridaceae	*Polystichum acrostichoides*	Christmas fern	1	3	5	4	13	L4
Salicaceae	*Populus grandidentata*	large-toothed aspen	1	3	4	3	11	L4
Potamogetonaceae	*Potamogeton foliosus*	leafy pondweed	1	3	5	4	13	L4
Fagaceae	*Quercus macrocarpa*	bur oak	1	4	3	3	11	L4
Fagaceae	*Quercus rubra*	red oak	1	4	2	4	11	L4
Brassicaceae	*Rorippa palustris* ssp. *hispida*	hispid marsh cress	3	2	4	2	11	L4
Rosaceae	*Rubus pubescens*	dwarf raspberry	2	3	3	5	13	L4
Salicaceae	*Salix amygdaloides*	peach-leaved willow	1	2	5	3	11	L4
Salicaceae	*Salix bebbiana*	Bebb's willow	1	3	3	4	11	L4
Salicaceae	*Salix discolor*	pussy willow	1	3	4	3	11	L4
Salicaceae	*Salix petiolaris*	slender willow	2	3	5	3	13	L4

	Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)							
			Local	Popn.	Hab.	Sens.	Total	Rank
			Occur.	Trend	Dep.	Dev.	Score	TRCA
Family	Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	Apr-14
Cyperaceae	*Schoenoplectus tabernaemontani*	soft-stemmed bulrush	1	2	5	3	11	L4
Iridaceae	*Sisyrinchium montanum*	blue-eyed grass	1	3	3	5	12	L4
Apiaceae	*Sium suave*	water-parsnip	2	2	4	4	12	L4
Araceae	*Spirodela polyrhiza*	greater duckweed	1	4	5	3	13	L4
Potamogetonaceae	*Stuckenia pectinata*	sago pondweed	2	2	5	3	12	L4
Thelypteridaceae	*Thelypteris palustris* var. *pubescens*	marsh fern	1	4	2	4	11	L4
Cupressaceae	*Thuja occidentalis*	white cedar	1	4	1	5	11	L4
Saxifragaceae	*Tiarella cordifolia*	foam-flower	1	3	3	4	11	L4
Melanthiaceae	*Trillium erectum*	red trillium	1	4	3	5	13	L4
Melanthiaceae	*Trillium grandiflorum*	white trillium	1	3	4	5	13	L4
Pinaceae	*Tsuga canadensis*	eastern hemlock	1	4	3	5	13	L4
Typhaceae	*Typha latifolia*	broad-leaved cattail	1	4	4	4	13	L4
Violaceae	*Viola sororia* var. *affinis*	Le Conte's violet	2	4	4	3	13	L4
Araceae	*Wolffia columbiana*	Columbia water-meal	2	4	5	2	13	L4
Euphorbiaceae	*Acalypha rhomboidea*	three-seeded mercury	2	1	2	0	5	L5
Sapindaceae	*Acer saccharum* ssp. *saccharum*	sugar maple	1	3	0	2	6	L5
Asteraceae	*Achillea millefolium* ssp. *lanulosa*	woolly yarrow	1	2	0	1	4	L5
Ranunculaceae	*Actaea rubra* ssp. *rubra*	red baneberry	1	3	1	3	8	L5
Asteraceae	*Ageratina altissima* var. *altissima*	white snakeroot	1	2	2	1	6	L5
Rosaceae	*Agrimonia gryposepala*	agrimony	1	2	0	2	5	L5
Alismataceae	*Alisma triviale*	water-plantain						L5
Asteraceae	*Ambrosia artemisiifolia*	common ragweed	1	1	3	0	5	L5
Fabaceae	*Amphicarpaea bracteata*	hog-peanut	2	2	2	2	8	L5
Ranunculaceae	*Anemone canadensis*	Canada anemone	1	2	2	2	7	L5
Apocynaceae	*Apocynum androsaemifolium*	spreading dogbane	1	3	2	4	10	L5
Apocynaceae	*Apocynum cannabinum* var. *cannabinum*	hemp dogbane	3	2	2	2	9	L5
Araliaceae	*Aralia nudicaulis*	wild sarsaparilla	1	3	1	4	9	L5
Araceae	*Arisaema triphyllum*	Jack-in-the-pulpit	1	3	2	3	9	L5
Apocynaceae	*Asclepias syriaca*	common milkweed	1	2	0	2	5	L5
Woodsiaceae	*Athyrium filix-femina* var. *angustum*	northeastern lady fern	1	3	1	3	8	L5
Asteraceae	*Bidens cernua*	nodding bur-marigold	1	2	3	3	9	L5
Asteraceae	*Bidens frondosa*	common beggar's-ticks	1	1	4	0	6	L5
Asteraceae	*Bidens tripartita*	three-parted beggar's-ticks	2	2	4	2	10	L5
Cyperaceae	*Carex arctata*	nodding wood sedge	1	4	2	3	10	L5
Cyperaceae	*Carex bebbii*	Bebb's sedge	1	2	3	3	9	L5
Cyperaceae	*Carex blanda*	common wood sedge	1	2	1	2	6	L5
Cyperaceae	*Carex cristatella*	crested sedge	1	2	4	1	8	L5
Cyperaceae	*Carex gracillima*	graceful sedge	1	3	4	2	10	L5
Cyperaceae	*Carex granularis*	meadow sedge	1	2	2	3	8	L5
Cyperaceae	*Carex pedunculata*	early-flowering sedge	1	3	3	3	10	L5
Cyperaceae	*Carex radiata*	straight-styled sedge	1	2	2	2	7	L5
Cyperaceae	*Carex rosea*	curly-styled sedge	1	2	3	2	8	L5

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Cyperaceae	*Carex stipata*	awl-fruited sedge	2	3	2	3	10	L5
Cyperaceae	*Carex vulpinoidea*	fox sedge	1	2	4	1	8	L5
Apiaceae	*Cicuta maculata*	spotted water-hemlock	1	2	2	2	7	L5
Onagraceae	*Circaea canadensis* ssp. *canadensis*	enchanter's nightshade	1	1	1	1	4	L5
Cornaceae	*Cornus alternifolia*	alternate-leaved dogwood	1	2	1	2	6	L5
Cornaceae	*Cornus stolonifera*	red osier dogwood	1	2	0	3	6	L5
Rosaceae	*Crataegus punctata*	dotted hawthorn	1	2	3	3	9	L5
Dryopteridaceae	*Dryopteris carthusiana*	spinulose wood fern	1	3	2	2	8	L5
Cucurbitaceae	*Echinocystis lobata*	wild cucumber	1	2	3	1	7	L5
Cyperaceae	*Eleocharis erythropoda*	creeping spike-rush	1	2	4	1	8	L5
Onagraceae	*Epilobium ciliatum* ssp. *ciliatum*	sticky willow-herb	1	2	2	2	7	L5
Onagraceae	*Epilobium coloratum*	purple-leaved willow-herb	1	3	4	2	10	L5
Equisetaceae	*Equisetum arvense*	field horsetail	1	2	1	1	5	L5
Equisetaceae	*Equisetum hyemale* ssp. *affine*	scouring-rush	2	2	2	2	8	L5
Asteraceae	*Erigeron annuus*	daisy fleabane	1	2	0	1	4	L5
Asteraceae	*Erigeron canadensis*	horse-weed	2	1	2	0	5	L5
Asteraceae	*Erigeron philadelphicus* var. *philadelphicus*	Philadelphia fleabane	1	2	0	1	4	L5
Liliaceae	*Erythronium americanum* ssp. *americanum*	yellow trout-lily	1	3	3	2	9	L5
Asteraceae	*Eurybia macrophylla*	big-leaved aster	1	3	2	4	10	L5
Asteraceae	*Euthamia graminifolia*	grass-leaved goldenrod	1	1	4	1	7	L5
Asteraceae	*Eutrochium maculatum* var. *maculatum*	spotted Joe-Pye weed	1	2	3	3	9	L5
Rosaceae	*Fragaria vesca* ssp. *americana*	woodland strawberry	2	2	2	2	8	L5
Rosaceae	*Fragaria virginiana* ssp. *virginiana*	common wild strawberry	2	2	0	2	6	L5
Oleaceae	*Fraxinus americana*	white ash	1	2	0	3	6	L5
Oleaceae	*Fraxinus pennsylvanica*	red ash	1	2	0	3	6	L5
Rubiaceae	*Galium palustre*	marsh bedstraw	1	2	3	3	9	L5
Rosaceae	*Geum aleppicum*	yellow avens	1	3	3	2	9	L5
Rosaceae	*Geum canadense*	white avens	1	2	1	2	6	L5
Poaceae	*Glyceria grandis*	tall manna grass	1	3	4	2	10	L5
Poaceae	*Glyceria striata*	fowl manna grass	1	2	1	2	6	L5
Boraginaceae	*Hackelia virginiana*	Virginia stickseed	1	2	0	2	5	L5
Boraginaceae	*Hydrophyllum virginianum*	Virginia waterleaf	1	2	1	2	6	L5
Balsaminaceae	*Impatiens capensis*	orange touch-me-not	1	2	0	2	5	L5
Juglandaceae	*Juglans nigra*	black walnut	1	1	2	1	5	L5
Juncaceae	*Juncus articulatus*	jointed rush	1	2	4	2	9	L5
Juncaceae	*Juncus bufonius*	toad rush	3	1	4	1	9	L5
Juncaceae	*Juncus dudleyi*	Dudley's rush	1	2	3	1	7	L5
Juncaceae	*Juncus tenuis*	path rush	1	2	1	1	5	L5
Urticaceae	*Laportea canadensis*	wood nettle	1	3	2	2	8	L5
Poaceae	*Leersia oryzoides*	rice cut grass	1	2	3	2	8	L5
Araceae	*Lemna* cf. *minor*	common duckweed	1	2	4	2	9	L5
Lamiaceae	*Lycopus uniflorus*	northern water-horehound	1	3	3	3	10	L5

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Primulaceae	*Lysimachia ciliata*	fringed loosestrife	1	2	2	2	7	L5
Asparagaceae	*Maianthemum racemosum* ssp. *racemosum*	false Solomon's seal	1	3	2	3	9	L5
Asparagaceae	*Maianthemum stellatum*	starry false Solomon's seal	1	2	1	3	7	L5
Onocleaceae	*Matteuccia struthiopteris* var. *pensylvanica*	ostrich fern	1	2	2	2	7	L5
Lamiaceae	*Mentha arvensis* ssp. *borealis*	wild mint	1	2	3	2	8	L5
Poaceae	*Muhlenbergia mexicana* var. *filiformis*	slender muhly grass	4	2	0	2	8	L5
Asteraceae	*Nabalus altissimus*	tall wood lettuce	1	3	2	2	8	L5
Onagraceae	*Oenothera biennis*	common evening-primrose	1	1	1	1	4	L5
Onocleaceae	*Onoclea sensibilis*	sensitive fern	1	3	1	3	8	L5
Betulaceae	*Ostrya virginiana*	ironwood	1	3	2	2	8	L5
Oxalidaceae	*Oxalis stricta*	common yellow wood-sorrel	1	1	1	1	4	L5
Poaceae	*Panicum capillare*	panic grass	2	1	4	1	8	L5
Vitaceae	*Parthenocissus inserta*	thicket creeper	1	2	0	1	4	L5
Polygonaceae	*Persicaria lapathifolia*	pale smartweed	2	1	4	0	7	L5
Urticaceae	*Pilea pumila*	dwarf clearweed	1	2	1	1	5	L5
Plantaginaceae	*Plantago rugelii*	red-stemmed plantain	1	2	0	1	4	L5
Poaceae	*Poa palustris*	fowl meadow-grass	1	2	3	2	8	L5
Berberidaceae	*Podophyllum peltatum*	May-apple	1	3	3	2	9	L5
Salicaceae	*Populus balsamifera*	balsam poplar	1	2	3	2	8	L5
Salicaceae	*Populus deltoides*	cottonwood	1	1	4	1	7	L5
Salicaceae	*Populus tremuloides*	trembling aspen	1	3	1	3	8	L5
Lamiaceae	*Prunella vulgaris* ssp. *lanceolata*	heal-all (native)	1	2	3	2	8	L5
Rosaceae	*Prunus serotina*	black cherry	1	2	0	2	5	L5
Rosaceae	*Prunus virginiana* var. *virginiana*	choke cherry	1	2	0	1	4	L5
Ranunculaceae	*Ranunculus abortivus*	kidney-leaved buttercup	1	3	1	2	7	L5
Ranunculaceae	*Ranunculus recurvatus* var. *recurvatus*	hooked buttercup	1	3	2	3	9	L5
Ranunculaceae	*Ranunculus sceleratus*	cursed crowfoot	2	2	3	2	9	L5
Anacardiaceae	*Rhus typhina*	staghorn sumach	1	1	2	2	6	L5
Grossulariaceae	*Ribes americanum*	wild black currant	1	3	2	2	8	L5
Grossulariaceae	*Ribes cynosbati*	prickly gooseberry	1	3	2	2	8	L5
Rosaceae	*Rubus allegheniensis*	common blackberry	1	3	0	1	5	L5
Rosaceae	*Rubus idaeus* ssp. *strigosus*	wild red raspberry	1	1	0	1	3	L5
Rosaceae	*Rubus occidentalis*	wild black raspberry	1	1	0	1	3	L5
Rosaceae	*Rubus odoratus*	purple-flowering raspberry	2	2	2	2	8	L5
Salicaceae	*Salix eriocephala*	narrow heart-leaved willow	1	1	3	1	6	L5
Salicaceae	*Salix interior*	sandbar willow	1	1	5	2	9	L5
Adoxaceae	*Sambucus canadensis*	common elderberry	1	3	2	2	8	L5
Adoxaceae	*Sambucus racemosa* ssp. *pubens*	red-berried elder	1	3	2	2	8	L5
Papaveraceae	*Sanguinaria canadensis*	bloodroot	1	3	0	3	7	L5
Cyperaceae	*Scirpus atrovirens*	black-fruited bulrush	1	2	4	2	9	L5
Lamiaceae	*Scutellaria lateriflora*	mad-dog skullcap	2	2	3	3	10	L5
Smilacaceae	*Smilax herbacea*	carrion-flower	2	3	2	2	9	L5

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Solanaceae	*Solanum ptychanthum*	American black nightshade	3	1	4	0	8	L5
Asteraceae	*Solidago altissima*	tall goldenrod	1	2	0	0	3	L5
Asteraceae	*Solidago caesia*	blue-stemmed goldenrod	1	2	4	2	9	L5
Asteraceae	*Solidago canadensis* var. *canadensis*	Canada goldenrod	1	2	0	1	4	L5
Asteraceae	*Solidago flexicaulis*	zig-zag goldenrod	1	1	3	2	7	L5
Asteraceae	*Solidago gigantea*	late goldenrod	1	1	1	1	4	L5
Asteraceae	*Solidago nemoralis* ssp. *nemoralis*	grey goldenrod	2	2	2	2	8	L5
Asteraceae	*Symphyotrichum cordifolium*	heart-leaved aster	1	1	0	2	4	L5
Asteraceae	*Symphyotrichum ericoides* var. *ericoides*	heath aster	1	1	2	1	5	L5
Asteraceae	*Symphyotrichum lanceolatum* var. *lanceolatum*	panicled aster	1	2	3	1	7	L5
Asteraceae	*Symphyotrichum lateriflorum* var. *lateriflorum*	calico aster	1	2	3	2	8	L5
Asteraceae	*Symphyotrichum novae-angliae*	New England aster	1	2	2	1	6	L5
Asteraceae	*Symphyotrichum puniceum* var. *puniceum*	swamp aster	1	2	2	2	7	L5
Ranunculaceae	*Thalictrum dioicum*	early meadow rue	1	3	3	2	9	L5
Ranunculaceae	*Thalictrum pubescens*	tall meadow rue	1	3	2	2	8	L5
Malvaceae	*Tilia americana*	basswood	1	3	2	3	9	L5
Anacardiaceae	*Toxicodendron radicans* var. *radicans*	poison ivy (vine form)	2	2	4	2	10	L5
Anacardiaceae	*Toxicodendron radicans* var. *rydbergii*	poison ivy (shrub form)	1	2	0	2	5	L5
Ulmaceae	*Ulmus americana*	white elm	1	4	0	2	7	L5
Urticaceae	*Urtica dioica* ssp. *gracilis*	American stinging nettle	1	3	2	2	8	L5
Verbenaceae	*Verbena hastata*	blue vervain	1	2	4	2	9	L5
Verbenaceae	*Verbena urticifolia*	white vervain	1	2	2	2	7	L5
Adoxaceae	*Viburnum lentago*	nannyberry	1	3	1	2	7	L5
Violaceae	*Viola labradorica*	dog violet	1	2	0	2	5	L5
Violaceae	*Viola pubescens* var. *scabriuscula*	smooth yellow violet	3	4	1	2	10	L5
Violaceae	*Viola sororia* var. *sororia*	common blue violet	1	2	0	2	5	L5
Vitaceae	*Vitis riparia*	riverbank grape	1	1	0	0	2	L5
Asteraceae	*Xanthium strumarium*	clotbur	2	1	4	0	7	L5
Malvaceae	*Abutilon theophrasti*	velvet-leaf	3	0	0	2	5	L+
Sapindaceae	*Acer platanoides*	Norway maple	2	0	0	0	2	L+
Poaceae	*Agrostis gigantea*	redtop	2	0	0	0	2	L+
Brassicaceae	*Alliaria petiolata*	garlic mustard	1	0	0	0	1	L+
Brassicaceae	*Alyssum alyssoides*	yellow alyssum	5	0	0	0	5	L+
Amaranthaceae	*Amaranthus retroflexus*	red-root pigweed	2	0	0	0	2	L+
Primulaceae	*Anagallis arvensis*	scarlet pimpernel	2	0	0	0	2	L+
Asteraceae	*Anthemis cotula*	stinking mayweed	4	0	0	0	4	L+
Asteraceae	*Arctium lappa*	great burdock	1	0	0	0	1	L+
Asteraceae	*Arctium minus*	common burdock	1	0	0	0	1	L+
Asteraceae	*Artemisia biennis*	biennial wormwood	3	0	0	0	3	L+
Asteraceae	*Artemisia vulgaris*	common mugwort	3	0	0	0	3	L+
Asparagaceae	*Asparagus officinalis*	asparagus	2	0	0	0	2	L+
Brassicaceae	*Barbarea vulgaris*	winter cress	1	0	0	0	1	L+

	Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)							
			Local	Popn.	Hab.	Sens.	Total	Rank
			Occur.	Trend	Dep.	Dev.	Score	TRCA
Family	Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	Apr-14
Berberidaceae	*Berberis thunbergii*	Japanese barberry	2	0	0	0	2	L+
Poaceae	*Bromus hordeaceus* ssp. *hordeaceus*	soft brome	5	0	0	0	5	L+
Poaceae	*Bromus inermis*	smooth brome grass	1	0	0	0	1	L+
Campanulaceae	*Campanula rapunculoides*	creeping bellflower	2	0	0	0	2	L+
Bignoniaceae	*Campsis radicans*	trumpet creeper						L+
Cyperaceae	*Carex spicata*	spiked sedge	2	0	0	0	2	L+
Celastraceae	*Celastrus orbiculatus*	oriental bittersweet	2	0	0	0	2	L+
Caryophyllaceae	*Cerastium fontanum*	mouse-ear chickweed	2	0	0	0	2	L+
Plantaginaceae	*Chaenorhinum minus* ssp. *minus*	dwarf snapdragon	3	0	0	0	3	L+
Papaveraceae	*Chelidonium majus*	celandine	2	0	0	0	2	L+
Amaranthaceae	*Chenopodium album*	lamb's quarters	2	0	0	0	2	L+
Amaranthaceae	*Chenopodium glaucum*	oak-leaved goosefoot	3	0	0	0	3	L+
Asteraceae	*Cichorium intybus*	chicory	1	0	0	0	1	L+
Asteraceae	*Cirsium arvense*	creeping thistle	1	0	0	0	1	L+
Asteraceae	*Cirsium vulgare*	bull thistle	1	0	0	0	1	L+
Asparagaceae	*Convallaria majalis*	lily-of-the-valley	1	0	0	0	1	L+
Convolvulaceae	*Convolvulus arvensis*	field bindweed	2	0	0	0	2	L+
Rosaceae	*Crataegus monogyna*	English hawthorn	1	1	4	0	6	L+
Apocynaceae	*Cynanchum rossicum*	dog-strangling vine	1	0	0	0	1	L+
Boraginaceae	*Cynoglossum officinale*	hound's tongue	2	0	0	0	2	L+
Poaceae	*Dactylis glomerata*	orchard grass	1	0	0	0	1	L+
Apiaceae	*Daucus carota*	Queen Anne's lace	1	0	0	0	1	L+
Poaceae	*Digitaria ischaemum*	smooth crab grass	3	0	0	0	3	L+
Poaceae	*Digitaria sanguinalis*	hairy crab grass	3	0	0	0	3	L+
Caprifoliaceae	*Dipsacus fullonum*	teasel	2	0	0	0	2	L+
Poaceae	*Echinochloa crus-galli*	barnyard grass	2	0	0	0	2	L+
Boraginaceae	*Echium vulgare*	viper's bugloss	2	0	0	0	2	L+
Poaceae	*Elymus repens*	quack grass	2	0	0	0	2	L+
Onagraceae	*Epilobium hirsutum*	European willow-herb	2	0	0	0	2	L+
Onagraceae	*Epilobium parviflorum*	small-flowered willow-herb	1	0	0	0	1	L+
Orchidaceae	*Epipactis helleborine*	helleborine	1	0	0	0	1	L+
Brassicaceae	*Erysimum cheiranthoides*	wormseed mustard	2	0	0	0	2	L+
Celastraceae	*Euonymus fortunei*	wintercreeper euonymus	3	0	0	0	3	L+
Polygonaceae	*Fallopia convolvulus*	black bindweed	2	0	0	0	2	L+
Polygonaceae	*Fallopia japonica* var. *japonica*	Japanese knotweed	2	0	0	0	2	L+
Poaceae	*Festuca rubra* ssp. *rubra*	red fescue	2	0	0	0	2	L+
Poaceae	*Festuca trachyphylla*	hard fescue	3	0	0	0	3	L+
Oleaceae	*Fraxinus excelsior*	European ash	3	0	0	0	3	L+
Asteraceae	*Galinsoga quadriradiata*	hairy galinsoga	4	0	0	0	4	L+
Rubiaceae	*Galium mollugo*	white bedstraw	2	0	0	0	2	L+
Rubiaceae	*Galium verum*	yellow bedstraw	3	0	0	0	3	L+
Rosaceae	*Geum urbanum*	urban avens	1	0	0	0	1	L+

	Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)							
			Local	Popn.	Hab.	Sens.	Total	Rank
			Occur.	Trend	Dep.	Dev.	Score	TRCA
Family	Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	Apr-14
Lamiaceae	*Glechoma hederacea*	creeping Charlie	1	0	0	0	1	L+
Asteraceae	*Gnaphalium uliginosum*	low cudweed	5	0	0	0	5	L+
Xanthorrhoeaceae	*Hemerocallis fulva*	orange day-lily	2	0	0	0	2	L+
Brassicaceae	*Hesperis matronalis*	dame's rocket	1	0	0	0	1	L+
Asteraceae	*Hieracium vulgatum*	blotched hawkweed	3	0	0	0	3	L+
Poaceae	*Hordeum jubatum* ssp. *jubatum*	squirrel-tail barley	3	0	0	0	3	L+
Hypericaceae	*Hypericum perforatum*	common St. John's-wort	1	0	0	0	1	L+
Asteraceae	*Inula helenium*	elecampane	2	0	0	0	2	L+
Iridaceae	*Iris pseudacorus*	yellow flag	2	0	0	0	2	L+
Cupressaceae	*Juniperus* cf. *chinensis*	Chinese juniper	3	0	5	0	8	L+
Asteraceae	*Lactuca serriola*	prickly lettuce	2	0	0	0	2	L+
Asteraceae	*Lapsana communis*	nipplewort	2	0	0	0	2	L+
Fabaceae	*Lathyrus tuberosus*	tuberous vetchling	4	0	0	0	4	L+
Lamiaceae	*Leonurus cardiaca* ssp. *cardiaca*	motherwort	2	0	0	0	2	L+
Asteraceae	*Leucanthemum vulgare*	ox-eye daisy	1	0	0	0	1	L+
Oleaceae	*Ligustrum vulgare*	privet	2	0	0	0	2	L+
Plantaginaceae	*Linaria vulgaris*	butter-and-eggs	2	0	0	0	2	L+
Poaceae	*Lolium perenne*	perennial rye	2	0	0	0	2	L+
Caprifoliaceae	*Lonicera morrowii*	Morrow's honeysuckle	2	0	0	0	2	L+
Caprifoliaceae	*Lonicera tatarica*	Tartarian honeysuckle	2	0	0	0	2	L+
Caprifoliaceae	*Lonicera x bella*	shrub honeysuckle	1	0	0	0	1	L+
Fabaceae	*Lotus corniculatus*	bird's foot trefoil	1	0	0	0	1	L+
Lamiaceae	*Lycopus europaeus*	European water-horehound	2	0	0	0	2	L+
Primulaceae	*Lysimachia nummularia*	moneywort	2	0	0	0	2	L+
Lythraceae	*Lythrum salicaria*	purple loosestrife	2	0	0	0	2	L+
Rosaceae	*Malus pumila*	apple	1	0	0	0	1	L+
Malvaceae	*Malva moschata*	musk mallow	4	0	0	0	4	L+
Malvaceae	*Malva neglecta*	common mallow	3	0	0	0	3	L+
Fabaceae	*Medicago lupulina*	black medick	1	0	0	0	1	L+
Fabaceae	*Medicago sativa* ssp. *sativa*	alfalfa	2	0	0	0	2	L+
Fabaceae	*Melilotus albus*	white sweet clover	1	0	0	0	1	L+
Fabaceae	*Melilotus officinalis*	yellow sweet clover	2	0	0	0	2	L+
Moraceae	*Morus alba*	white mulberry	2	0	0	0	2	L+
Boraginaceae	*Myosotis scorpioides*	true forget-me-not	1	0	0	0	1	L+
Caryophyllaceae	*Myosoton aquaticum*	giant chickweed	3	0	0	0	3	L+
Brassicaceae	*Nasturtium microphyllum*	small-leaved watercress	2	0	0	0	2	L+
Lamiaceae	*Nepeta cataria*	catnip	2	0	0	0	2	L+
Poaceae	*Panicum dichotomiflorum*	fall panic grass	3	0	0	0	3	L+
Polygonaceae	*Persicaria maculosa*	lady's thumb	2	0	0	0	2	L+
Poaceae	*Phleum pratense*	Timothy grass	1	0	0	0	1	L+
Poaceae	*Phragmites australis* ssp. *australis*	common reed	1	0	5	0	6	L+
Asteraceae	*Pilosella caespitosa*	yellow hawkweed	2	0	0	0	2	L+

Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)

Family	Scientific Name	Common Name	Local Occur. 1-5	Popn. Trend 1-5	Hab. Dep. 0-5	Sens. Dev. 0-5	Total Score 2-20	Rank TRCA Apr-14
Asteraceae	*Pilosella piloselloides*	smooth yellow hawkweed	2	0	0	0	2	L+
Pinaceae	*Pinus sylvestris*	Scots pine	2	0	0	0	2	L+
Plantaginaceae	*Plantago major*	common plantain	1	0	0	0	1	L+
Poaceae	*Poa compressa*	flat-stemmed blue grass	1	0	0	0	1	L+
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky blue grass	1	0	0	0	1	L+
Asparagaceae	*Polygonatum multiflorum*	European Solomon's seal	4	0	0	0	4	L+
Polygonaceae	*Polygonum achoreum*	striate knotweed	3	0	0	0	3	L+
Polygonaceae	*Polygonum aviculare* ssp. *aviculare*	prostrate knotweed	2	0	0	0	2	L+
Salicaceae	*Populus alba*	white poplar	2	0	0	0	2	L+
Portulacaceae	*Portulaca oleracea*	purslane	3	0	0	0	3	L+
Rosaceae	*Potentilla recta*	sulphur cinquefoil	1	0	0	0	1	L+
Rosaceae	*Prunus avium*	mazzard cherry	3	0	0	0	3	L+
Poaceae	*Puccinellia distans*	alkali grass	3	0	0	0	3	L+
Rosaceae	*Pyrus communis*	pear	2	0	0	0	2	L+
Ranunculaceae	*Ranunculus acris*	tall buttercup	1	0	0	0	1	L+
Rhamnaceae	*Rhamnus cathartica*	common buckthorn	1	0	0	0	1	L+
Grossulariaceae	*Ribes rubrum*	garden red currant	1	0	0	0	1	L+
Grossulariaceae	*Ribes uva-crispa*	European gooseberry	5	ns	ns	ns	5	L+
Fabaceae	*Robinia pseudoacacia*	black locust	1	0	0	0	1	L+
Rosaceae	*Rosa multiflora*	multiflora rose	1	0	0	0	1	L+
Polygonaceae	*Rumex crispus*	curly dock	1	0	0	0	1	L+
Salicaceae	*Salix alba*	white willow	2	0	0	0	2	L+
Salicaceae	*Salix purpurea*	purple-osier willow	3	0	0	0	3	L+
Salicaceae	*Salix* x *fragilis*	crack willow	1	0	0	0	1	L+
Salicaceae	*Salix* x *sepulcralis*	weeping willow	2	0	0	0	2	L+
Poaceae	*Schedonorus arundinaceus*	tall fescue	3	0	0	0	3	L+
Poaceae	*Schedonorus pratensis*	meadow fescue	1	0	0	0	1	L+
Asparagaceae	*Scilla siberica*	Siberian squill	3	0	0	0	3	L+
Fabaceae	*Securigera varia*	crown vetch	1	0	0	0	1	L+
Poaceae	*Setaria faberi*	giant foxtail	4	0	0	0	4	L+
Poaceae	*Setaria pumila* ssp. *pumila*	yellow foxtail	3	0	0	0	3	L+
Poaceae	*Setaria verticillata*	bristly foxtail	4	0	0	0	4	L+
Poaceae	*Setaria viridis*	green foxtail	2	0	0	0	2	L+
Brassicaceae	*Sinapis arvensis*	charlock	2	0	0	0	2	L+
Solanaceae	*Solanum dulcamara*	bittersweet nightshade	1	0	0	0	1	L+
Asteraceae	*Sonchus arvensis* ssp. *arvensis*	glandular perennial sow-thistle	2	0	0	0	2	L+
Asteraceae	*Sonchus arvensis* ssp. *uliginosus*	smooth perennial sow-thistle	5	0	0	0	5	L+
Asteraceae	*Sonchus asper*	spiny sow-thistle	2	0	0	0	2	L+
Asteraceae	*Sonchus oleraceus*	annual sow-thistle	2	0	0	0	2	L+
Rosaceae	*Sorbus aucuparia*	European mountain-ash	1	0	0	0	1	L+
Boraginaceae	*Symphytum officinale*	common comfrey	3	0	0	0	3	L+
Oleaceae	*Syringa vulgaris*	common lilac	2	0	0	0	2	L+

	Appendix 2: Upper Petticoat Creek Flora (2004 - 2014)							
			Local	Popn.	Hab.	Sens.	Total	Rank
			Occur.	Trend	Dep.	Dev.	Score	TRCA
Family	Scientific Name	Common Name	1-5	1-5	0-5	0-5	2-20	Apr-14
Asteraceae	*Taraxacum officinale*	dandelion	1	0	0	0	1	L+
Taxaceae	*Taxus cuspidata*	Japanese yew	3	0	0	0	3	L+
Brassicaceae	*Thlaspi arvense*	penny-cress	2	0	0	0	2	L+
Fabaceae	*Trifolium hybridum*	alsike clover	2	0	0	0	2	L+
Fabaceae	*Trifolium pratense*	red clover	1	0	0	0	1	L+
Fabaceae	*Trifolium repens*	white clover	1	0	0	0	1	L+
Asteraceae	*Tripleurospermum inodorum*	scentless chamomile	2	0	0	0	2	L+
Asteraceae	*Tussilago farfara*	coltsfoot	1	0	0	0	1	L+
Typhaceae	*Typha angustifolia*	narrow-leaved cattail	1	0	0	0	1	L+
Typhaceae	*Typha* x *glauca*	hybrid cattail	1	0	0	0	1	L+
Ulmaceae	*Ulmus glabra*	Scotch elm	3	0	0	0	3	L+
Ulmaceae	*Ulmus pumila*	Siberian elm	2	0	0	0	2	L+
Urticaceae	*Urtica dioica* ssp. *dioica*	European stinging nettle	2	0	0	0	2	L+
Caprifoliaceae	*Valeriana officinalis*	common valerian	3	0	0	0	3	L+
Scrophulariaceae	*Verbascum thapsus*	common mullein	2	0	0	0	2	L+
Plantaginaceae	*Veronica arvensis*	corn speedwell	3	0	0	0	3	L+
Plantaginaceae	*Veronica officinalis*	common speedwell	2	0	0	0	2	L+
Plantaginaceae	*Veronica serpyllifolia* ssp. *serpyllifolia*	thyme-leaved speedwell	2	0	0	0	2	L+
Adoxaceae	*Viburnum lantana*	wayfaring tree	2	0	0	0	2	L+
Adoxaceae	*Viburnum opulus* ssp. *opulus*	European highbush cranberry	1	0	0	0	1	L+
Fabaceae	*Vicia cracca*	cow vetch	1	0	0	0	1	L+
Apocynaceae	*Vinca minor*	periwinkle	2	0	0	0	2	L+
Sapindaceae	*Acer negundo*	Manitoba maple	1	0	0	2	3	L+?
Poaceae	*Agrostis stolonifera*	creeping bent grass	2	0	0	0	2	L+?
Amaranthaceae	*Atriplex patula*	halberd-leaved orache	3	0	0	0	3	L+?
Amaranthaceae	*Atriplex prostrata*	spreading orache	3	0	0	0	3	L+?
Amaranthaceae	*Chenopodium pratericola*	meadow goosefoot						L+?
Cyperaceae	*Cyperus esculentus*	yellow nut-sedge	3	0	4	1	8	L+?
Euphorbiaceae	*Euphorbia maculata*	spotted spurge	3	0	0	0	3	L+?
Geraniaceae	*Geranium robertianum*	herb Robert	1	0	0	0	1	L+?
Polygonaceae	*Persicaria hydropiper*	water-pepper	2	0	0	0	2	L+?
Poaceae	*Phalaris arundinacea*	reed canary grass	1	0	0	0	1	L+?
Rosaceae	*Potentilla norvegica*	rough cinquefoil	2	0	0	0	2	L+?
Poaceae	*Sporobolus* cf. *vaginiflorus*	ensheathed dropseed	4	0	0	0	4	L+?
Pinaceae	*Pinus resinosa*	red pine	2	5	5	5	17	pL2
Juglandaceae	*Carya ovata*	shagbark hickory	2	4	4	4	14	pL3
Pinaceae	*Larix laricina*	tamarack	2	4	4	4	14	pL3
Pinaceae	*Larixcf. decidua*	European larch	3	0	0	0	3	pL+
Pinaceae	*Pinus nigra*	Austrian pine	5	0	0	0	5	pL+
Salicaceae	*Populus* x *canadensis*	Carolina poplar	3	0	0	0	3	pL+
Pinaceae	*Picea glauca*	white spruce	1	5	4	4	14	prL3
Pinaceae	*Picea abies*	Norway spruce	3	0	0	0	3	prL+

Appendix 3: Upper Petticoat Creek Study Area Fauna Observations from 2005 to 2014.

													Blocks		
Common Name	**Scientific Name**	**Code**	**LO**	**PTn**	**PTt**	**AS**	**PIS**	**StD**	**HD**	**+**	**TS**	**L-Rank**	**A**	**B**	**C**
Survey Species: species for which the TRCA protocol effectively surveys.															
Birds															
bobolink	*Dolichonyx oryzivorus*	BOBO	1	4	4	3	1	5	1	1	20	**L2**	1(2004)	1(2004)	
American redstart	*Setophaga ruticilla*	AMRE	0	3	2	3	1	4	2	0	15	**L3**	6		
American woodcock	*Scolopax minor*	AMWO	0	2	2	3	2	4	2	0	15	**L3**		1(2004)	
brown thrasher	*Toxostoma rufum*	BRTH	0	4	3	2	2	4	1	0	16	**L3**	1(2009)		
great blue heron	*Ardea herodias*	GBHE	3	2	2	3	1	4	2	0	17	**L3**	9n		
least flycatcher	*Empidonax minimus*	LEFL	1	4	3	2	1	3	1	0	15	**L3**		2(2004)	
vesper sparrow	*Pooecetes gramineus*	VESP	1	3	2	2	2	5	1	1	17	**L3**	1	2(2004)	2(2004)
wood thrush	*Hylocichla mustelina*	WOTH	0	4	2	3	2	4	2	0	17	**L3**	3		1(2004)
common yellowthroat	*Geothlypis trichas*	COYE	0	3	2	1	2	4	1	0	13	**L4**		4	1
eastern kingbird	*Tyrannus tyrannus*	EAKI	0	4	2	2	1	3	1	0	13	**L4**		1	
eastern wood-pewee	*Contopus virens*	EAWP	0	4	2	2	1	3	1	0	13	**L4**	1	1	5
great-crested flycatcher	*Myiarchus crinitus*	GCFL	0	2	2	3	1	2	2	0	12	**L4**	2		2
great-horned owl	*Bubo virginianus*	GHOW	0	2	2	2	2	2	1	0	11	**L4**	1(2013)		
grey catbird	*Dumetella carolinensis*	GRCA	0	3	2	1	1	3	1	0	11	**L4**	3	5	
hairy woodpecker	*Picoides villosus*	HAWO	0	2	2	3	1	2	2	0	12	**L4**			1
indigo bunting	*Passerina cyanea*	INBU	0	3	2	1	1	4	2	0	13	**L4**			2
northern flicker	*Colaptes auratus*	NOFL	0	4	2	1	1	3	2	0	13	**L4**	1	1	1
red-breasted nuthatch	*Sitta canadensis*	RBNU	0	1	2	3	1	2	1	0	10	**L4**			1
red-eyed vireo	*Vireo olivaceus*	REVI	0	1	2	2	1	3	1	0	10	**L4**	4		
rose-breasted grosbeak	*Pheucticus ludovicianus*	RBGR	0	3	2	3	1	3	2	0	14	**L4**	3	1	1
savannah sparrow	*Passerculus sandwichensis*	SAVS	0	4	2	1	1	4	1	0	13	**L4**		1	
spotted sandpiper	*Actitis macularia*	SPSA	0	3	2	1	2	4	1	0	13	**L4**	1		
swamp sparrow	*Melospiza georgiana*	SWSP	0	1	2	1	2	5	1	1	13	**L4**		4	
white-breasted nuthatch	*Sitta carolinensis*	WBNU	0	2	2	3	1	2	2	0	12	**L4**	1		
wood duck	*Aix sponsa*	WODU	0	2	1	3	2	4	2	0	14	**L4**	1(2010)		
American Crow	*Corvus brachyrhynchos*	AMCR	0	1	2	1	1	0	0	0	5	**L5**	x	x	x
American goldfinch	*Carduelis tristis*	AMGO	0	3	2	1	1	1	0	0	8	**L5**	x	x	x
American robin	*Turdus migratorius*	AMRO	0	1	2	1	1	1	0	0	6	**L5**	x	x	x
Baltimore oriole	*Icterus galbula*	BAOR	0	4	2	1	1	1	0	0	9	**L5**	x	x	x
black-capped chickadee	*Parus atricapillus*	BCCH	0	1	2	1	1	1	0	0	6	**L5**	x	x	x
blue jay	*Cyanocitta cristata*	BLJA	0	3	2	1	1	1	0	0	8	**L5**	x	x	x
brown-headed cowbird	*Molothrus ater*	BHCO	0	3	2	1	1	1	0	0	8	**L5**	x	x	

Appendix 3: Upper Petticoat Creek Study Area Fauna Observations from 2005 to 2014.

													Blocks		
Common Name	**Scientific Name**	**Code**	**LO**	**PTn**	**PTt**	**AS**	**PIS**	**StD**	**HD**	**+**	**TS**	**L-Rank**	**A**	**B**	**C**
cedar waxwing	*Bombycilla cedrorum*	CEDW	0	1	2	1	1	1	0	0	6	**L5**	x	x	x
common grackle	*Quiscalus quiscula*	COGR	0	4	2	1	1	1	0	0	9	**L5**		x	x
downy woodpecker	*Picoides pubescens*	DOWO	0	1	2	1	1	1	1	0	7	**L5**	x		x
eastern phoebe	*Sayornis phoebe*	EAPH	0	1	2	1	1	1	2	0	8	**L5**	1(2010)		
house wren	*Troglodytes aedon*	HOWR	0	1	2	1	2	1	1	0	8	**L5**	x		x
killdeer	*Charadrius vociferus*	KILL	0	2	2	1	2	2	0	0	9	**L5**	x		
mallard	*Anas platyrhynchos*	MALL	0	1	2	1	2	1	0	0	7	**L5**		x	
mourning dove	*Zenaida macroura*	MODO	0	3	2	1	1	0	0	0	7	**L5**		x	x
northern cardinal	*Cardinalis cardinalis*	NOCA	0	1	2	1	1	2	1	0	8	**L5**	x	x	x
orchard oriole	*Icterus spurius*	OROR	0	3	1	1	1	1	0	0	7	**L5**		1	
red-winged blackbird	*Agelaius phoeniceus*	RWBL	0	3	2	1	1	2	0	0	9	**L5**	x	x	x
song sparrow	*Melospiza melodia*	SOSP	0	3	2	1	1	2	0	0	9	**L5**	x	x	x
warbling vireo	*Vireo gilvus*	WAVI	0	1	2	1	1	2	1	0	8	**L5**	x	x	
yellow warbler	*Setophaga petechia*	YWAR	0	3	2	1	1	2	0	0	9	**L5**	x	x	
European starling	*Sturnus vulgaris*	EUST		4								**L+**	x		
Herpetofauna															
grey treefrog	*Hyla versicolor*	TGTF	1	3	2	3	4	5	2	1	21	**L2**	1(2004)		2
spring peeper	*Pseudacris crucifer crucifer*	SPPE	1	2	2	3	4	5	3	1	21	**L2**	1		
wood frog	*Lithobates sylvatica*	WOFR	0	2	2	3	4	5	3	1	20	**L2**	1	1	2
northern leopard frog	*Lithobates pipiens*	LEFR	0	3	2	1	4	5	2	1	18	**L3**	1(2004)		3
American toad	*Anaxyrus americanus*	AMTO	0	3	2	1	4	4	0	0	14	**L4**	1	3	3
green frog	*Lithobates clamitans*	GRFR	0	2	2	1	3	4	1	0	13	**L4**			1
Incidental Species: **species that are reported on as incidental to the TRCA protocol.**															
Mammals															
hairy-tailed mole	*Parascalops breweri*	HTMO	3	2	2	1	4	4	1	0	17	**L3**	1		
eastern chipmunk	*Tamias striatus*	EACH	0	2	2	2	3	3	1	0	13	**L4**		1	
coyote	*Canis latrans*	COYO	1	2	2	1	3	1	0	0	10	**L4**		1	
grey squirrel	*Sciurus carolinensis*	GRSQ	0	2	2	1	3	0	0	0	8	**L5**	x	x	x
raccoon	*Procyon lotor*	RACC	0	2	2	1	3	0	1	0	9	**L5**			x

Appendix 3: Upper Petticoat Creek Study Area Fauna Observations from 2005 to 2014.

													Blocks		
Common Name	**Scientific Name**	**Code**	**LO**	**PTn**	**PTt**	**AS**	**PIS**	**StD**	**HD**	**+**	**TS**	**L-Rank**	**A**	**B**	**C**
Herpetofauna															
eastern gartersnake	*Thamnophis sirtalis sirtalis*	EAGA	0	2	2	1	3	3	0	0	11	**L4**		1	
LEGEND															
LO = local occurrence		AS = area sensitivity									TS = total score				
PTn = Continental population trend		PIS = Patch Isolation Sensitivity									L-rank = TRCA Rank, October, 2008				
PTt = TRCA population trend		STD = sensitivity to development													
HD = habitat dependence		+ = additional points													