Central Lake Ontario Conservation

2012

Terrestrial Watershed Monitoring Report

What we do on the land is mirrored in the water

Working In Partnership:

DURHAM REGION

Conservation ONTARIO
Natural Champions

Report No.: 2013-02MR

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EXECUTIVE SUMMARY

The Terrestrial Watershed Monitoring program is designed to monitor the ecological integrity of the watershed, focusing on Forests, Wetlands and Non-forested communities. In 2012 ten plots were established throughout the Oshawa Creek watershed; five forest, three wetland, and two non-forested plots. One of the ecological parameters measured is native species richness. Percent of native species richness for Forest, Non-forested and Wetland communities in the Oshawa Creek Watershed was 69%, 35% and 78% respectively. Dog-strangling vine (*Cynanchum rossicum*) is the most frequently occurring invasive species throughout the sites, the next is Common Buckthorn (*Rhamnus cathartica*) being observed at five and four sites respectively.

CLOCA staff also participated in three special monitoring projects within 2012 which are more refined in scope and provide data and insight for future management programs.

1) CLOCA continued to monitor the success of transplanting over 200 regionally rare plant species in 2010; Fringe-tip closed gentian (*Gentiana andrewsii*), Fringed gentian (*Gentianopsis crinite*), Slender-leaved gerardia (*Gerardia tenuifolia*) and Large yellow lady's slipper (*Cypripedium calceolus* var. *pubescens*). Each of these plants have varying flowering times, and two of the four species (both Gentian's) flower biennially. In 2012 over 840 plants were observed, primarily Fringed-gentian.

2) Surficial groundwater levels and ground vegetation are being monitored at Heber Down Conservation Area at the Heber Down Provincially Significant Wetland complex to assess long-term changes. This is a long term monitoring program and it is too early to discern any results.

3) To gain more information on the natural features present within the NHS, CLOCA staff implemented the Natural Heritage System Inventory Pilot Project. Staff visited several private landowners within the Lynde Creek watershed to ground-truth the functional Natural Heritage System, inventorying 70ha of the NHS. The ground-truthing further refined the desk-top mapping exercise conducted for the development of the NHS, and provided more detailed information on the natural areas within CLOCA's NHS, and will be continued again in 2013.

In addition to these special projects, CLOCA continues to implement their Invasive Species Management Strategy. The strategy focuses on prevention, education & outreach, best management practices and collaborating with a broad professional network that works on invasive species related issues. CLOCA staff had the opportunity to implement several of the Invasive Species pilot projects developed in preceding years. Some of the working groups' other accomplishments for 2012 include:

- Restoration initiatives
- Outreach initiatives at CLOCA's CA's and local events
- Survey of goldfish at 20 of Oshawa's storm water management ponds
- Contributing to the development of Provincial BMP's
- Contributing to regional working groups
- Implementation of invasive species management pilot programs

1.0 INTRODUCTION

The Terrestrial Watershed Monitoring Program (TWMP) was developed to help monitor and determine the changes of the ecological integrity of terrestrial natural areas within the Central Lake Ontario Conservation Authority's jurisdiction. CLOCA has used the Parks Canada Agency's Panel (1998) definition of Ecological Integrity, "an ecosystem has integrity when it is deemed characteristic for its natural region, including the composition and abundance of native species and biological communities, rates of changes and supporting processes. In plain language, ecosystems have integrity when they have their native components (plants, animals and other organisms) and processes (such as growth and reproductions) intact."

CLOCA monitors specific ecological indicators within a select group of systems that cover the landscape of CLOCA's jurisdiction. The systems monitored and indicators measured are grouped according to Ecological Land Classification (ELC) categories and are described in Table 1**.**

Table 1: ELC Classification with corresponding system and ecological indicator

ECOSYSTEM TYPE	ELC COMMUNITY SERIES INCLUDED	ECOLOGICAL INDICATOR
Forested Systems	Cultural Woodlots (CUW), Cultural Plantations (CUP), Deciduous Forests (FOD), Mixed Forests (FOM), Coniferous Forests (FOC)	Tree Health; Regeneration; Ground Vegetation; Biodiversity
Non-Coastal Wetland Systems	Deciduous Swamp (SWD), Mixed Swamp (SWM), Coniferous Swamp (SWC)	Tree Health; Regeneration; Ground Vegetation; Biodiversity
Non-Forested Systems	Cultural Thicket (CUT), Cultural Meadow (CUM)	Ground Vegetation; Biodiversity

In November of 2010, CLOCA's board of directors endorsed CLOCA's Invasive Species Management Strategy. Staff have been working to implement key activities of the strategy, ranging from on the ground invasive species management, to public outreach and communication to collaborating with municipal and provincial partners.

In addition to this, special projects are taken on as required. 2012 saw the continuation of two projects, the monitoring of rare and uncommon transplants and surficial groundwater monitoring at Heber Down Provincially Significant Wetland. A new Natural Heritage System Inventory Pilot Project was implemented to gain more detailed information on the natural features present within CLOCA's Lynde Creek Watershed functional Natural Heritage System.

2.0 TERRESTRIAL WATERSHED MONITORING

In 2012 the Terrestrial Watershed Monitoring program was implemented within the Oshawa Creek watershed (). The Oshawa Creek watershed is approximately 119km^2 in size, spanning all three major physiographic regions and four municipalities; the Town of Whitby to the west, the Township of Scugog to the north, the entire length of the City of Oshawa and the Municipality of Clarington to the east. The headwaters originate in the Oak Ridges Moraine, with the resulting tributaries traveling south through the old glacial Lake Iroquois beach towards the Lake Iroquois Lacustrine Plain, draining into Lake Ontario through the Oshawa Creek Provincially Significant Coastal Wetland Complex and Oshawa Harbour.

Oshawa Creek watershed lies in the centre of CLOCA's jurisdiction and has a total natural vegetated cover of approximately 23.3%, which equates to 27.7km^2. The natural cover is fairly well distributed across the northern and central portions of the watershed. Moving south, much of the natural cover is confined to the valley lands as a result of the urbanized landscape. This urbanization is steadily creeping north with population growth and the future extension of Highway 407 East. The representation of Oshawa Creek watershed's natural vegetation cover is summarized in Table 2.

Overall, close to 40% of the entire natural cover of the watershed is represented by forests, while 22% of the total natural cover is made up of deciduous, mixed and coniferous swamps (forested wetlands). Non-forested wetlands, which is comprised of cultural thickets and cultural meadows, makes up 5% of the watersheds natural cover. The remaining 9.8% of the watershed natural cover consists of cultural savannah's, cultural hedgerows, thicket swamps, open water, shallow, submerged and meadow marshes, as well as shrub bluffs and beach bars. These are not included in this monitoring program, as many of these natural features are monitored through the Durham Region Coastal Wetland Monitoring Program, and overall they comprise a very small part (2%) of the entire Oshawa Creek watershed land cover.

Table 2: Natural Cover by ELC Community Class

MONITORING SYSTEM	ELC CLASSIFICATION	COVER (HA)	COVER AS % OF TOTAL NATURAL AREA	% COVER AS LAND AREA IN WATERSHED
Forested Systems	FOD, FOC, FOM, CUP, CUW	1106.84	40%	9%
Non-Coastal Wetland Systems	SWM, SWD, SWC	621.66	22%	5%
Non-Forested Systems	CUT, CUM	771.07	28%	7%
Not included in monitoring program	BBO, BLS, CUH, CUS, MAM, MAS, OAO, SAS, SWT	270.57	10%	2%
Total		**2770.13**	**100%**	**23.3%**

(forest cover within this document is different than CLOCA's Watershed Plans because in the WSPs Forests and Wetlands are calculated together as one value)

A total of 10 plots were installed within the Oshawa Creek Watershed (

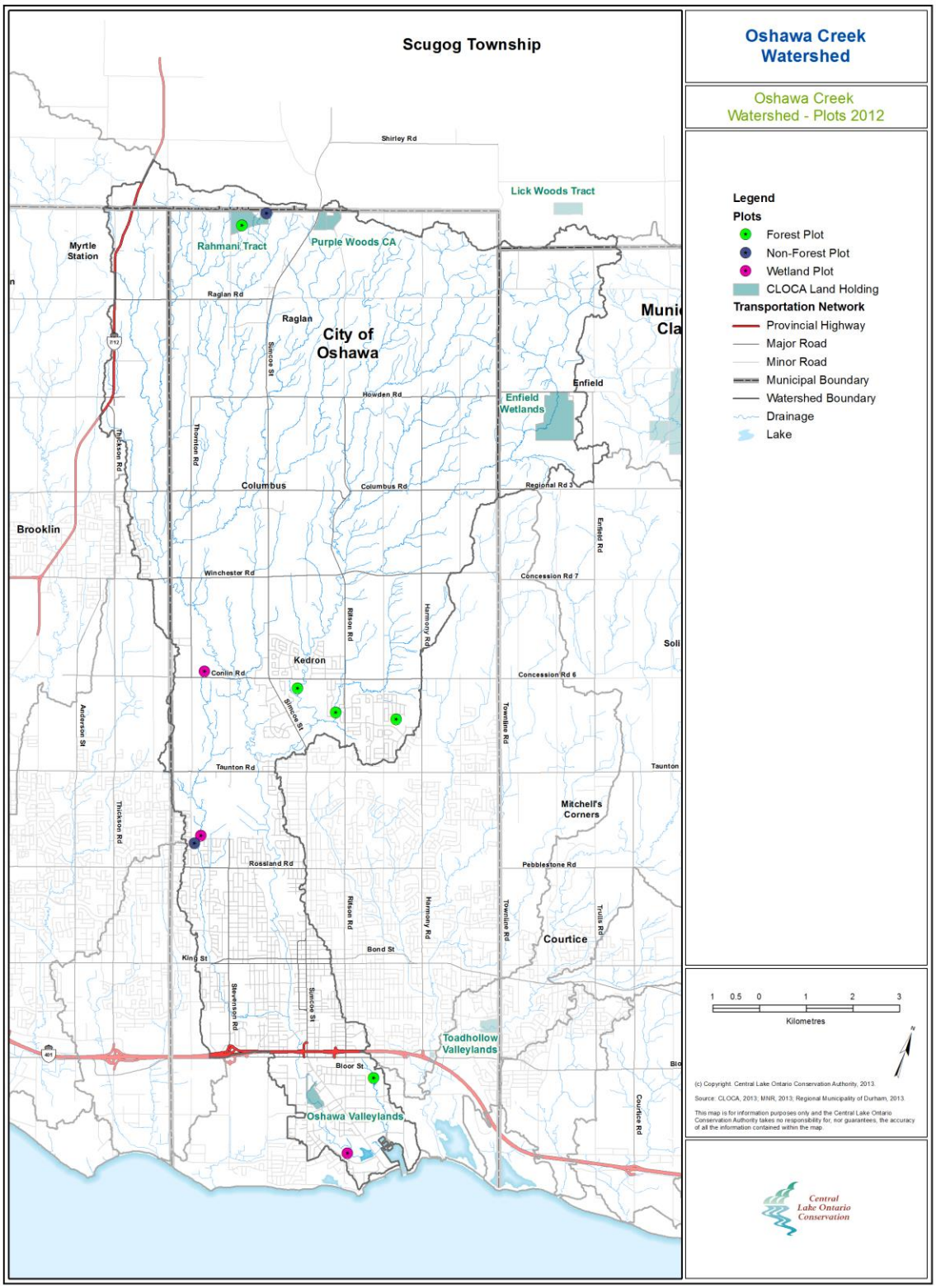

Figure 2), five in Forested Systems, three in Wetland Systems and two in Non-forested systems. All of the plots were installed either within public municipal lands or CLOCA owned lands.

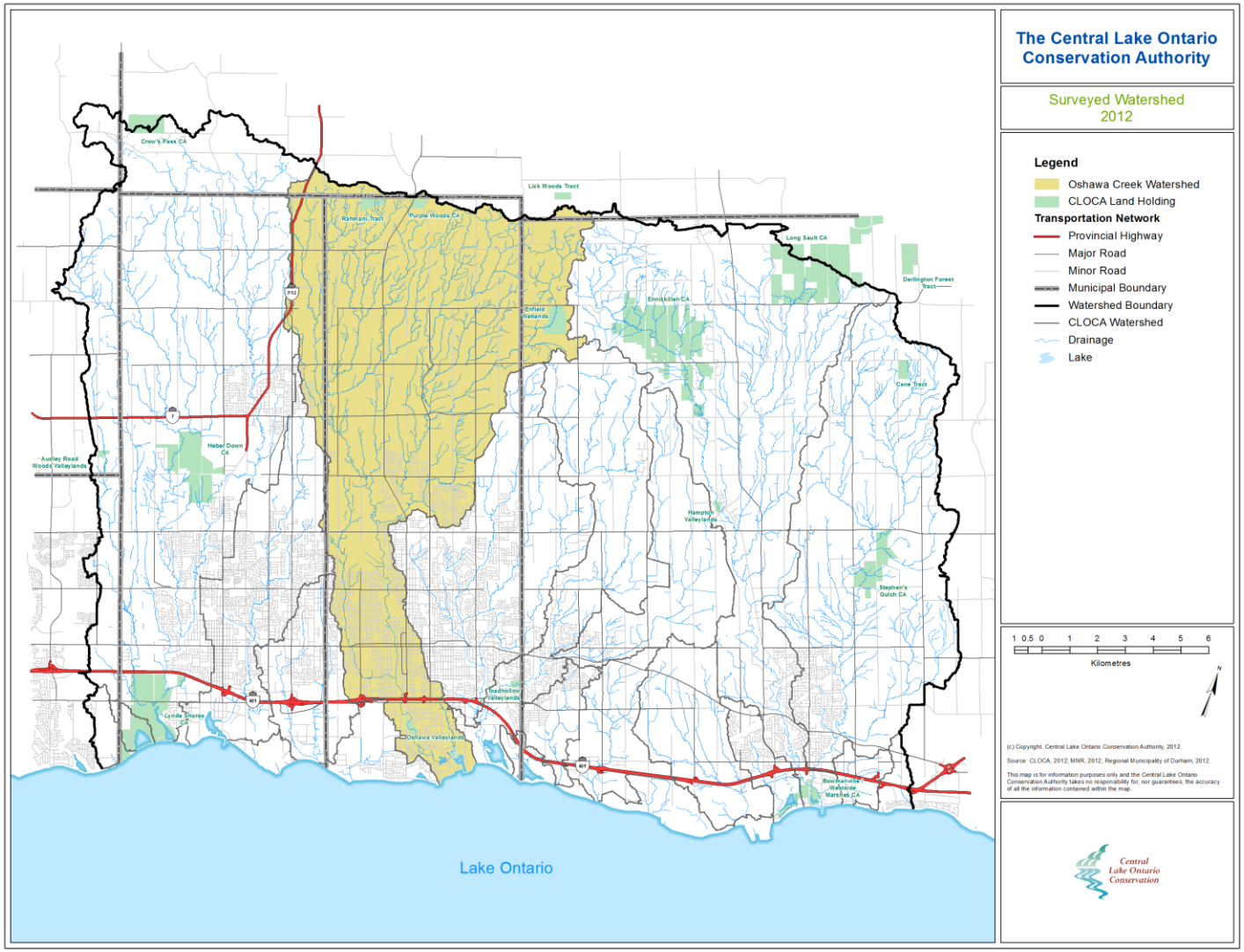

Figure 1: Oshawa Creek Watershed

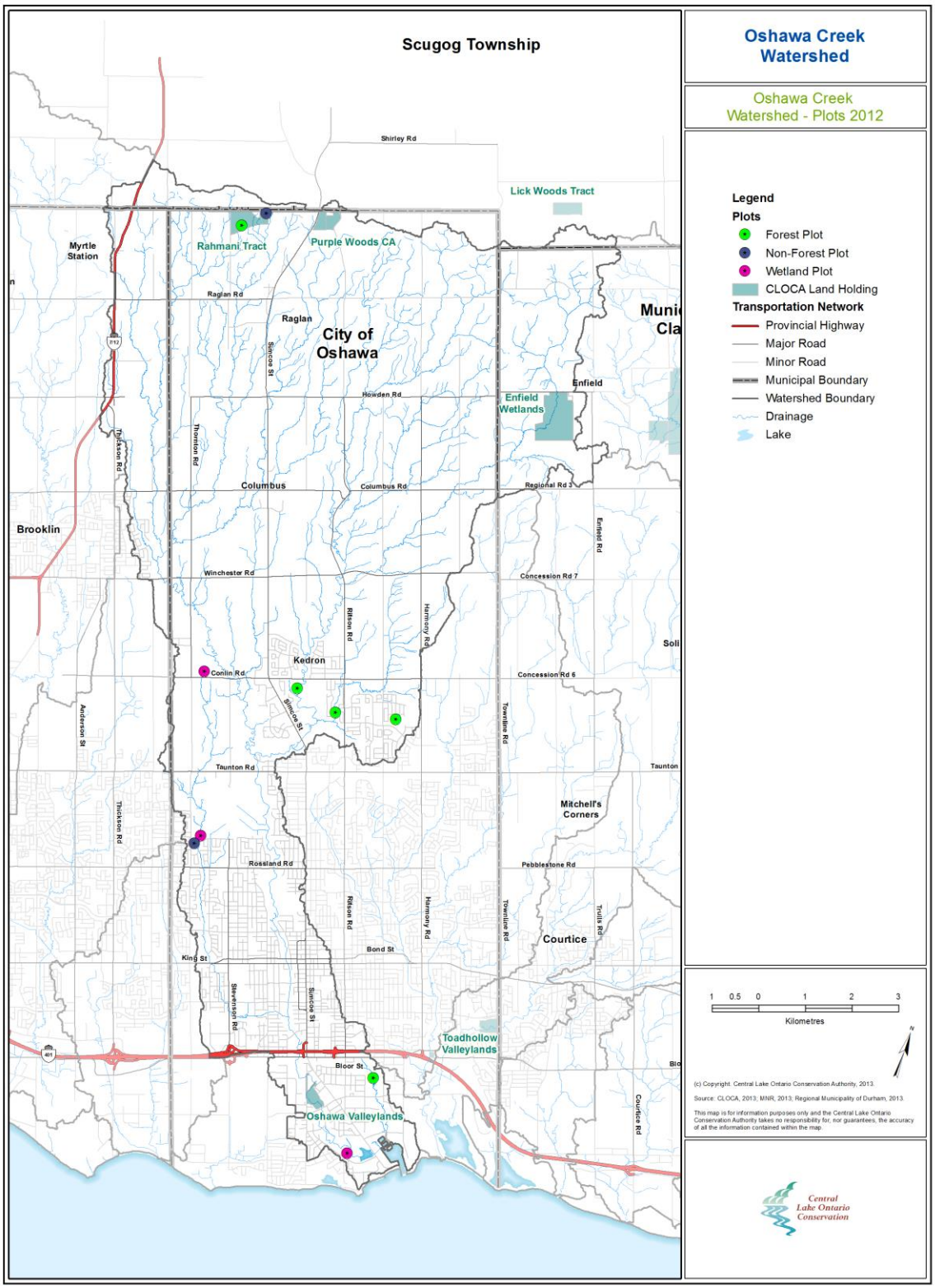

Figure 2: Oshawa Creek Watershed Monitoring Locations

2.1 Forested Systems

According to Environment Canada's "How Much Habitat is Enough?" forest cover within a watershed should be greater than 30%. Through CLOCA's Natural Heritage System and watershed plans, CLOCA strives to achieve a minimum of 30% natural cover within each watershed throughout its jurisdiction. Oshawa Creek watersheds forests account for only 9% of the land cover. Deciduous forests are more prominent, representing 11% of the watersheds cover, while coniferous and mixed forests each represent 6% of the watersheds natural cover.

Forest monitoring plots were established at five locations within the Oshawa Creek watershed. All plots are 20mx20m; the ability to establish plots is dependent on accessibility to natural areas. CLOCA has limited property within the Oshawa Creek watershed, and worked with its partners, the City of Oshawa and Camp Samac, to establish plots representatively throughout the watershed. Many of these forested areas are home to a variety of flora and fauna, and it is vital to ensure the integrity of their habitat is maintained. For this reason, tree health, regeneration, ground vegetation and invasive species are observed.

2.1.1 Tree Health

Tree size and disturbance history can help in understanding how the forest structure is changing, and when regularly monitored, can often help identify both short-term and long-term stresses on the system. These short-term stresses may include extreme weather, insect defoliation and many other factors. While long-term stresses may be more difficult to isolate and can result from surrounding land use changes, recreational uses, climate change, and an array of other factors.

The now retired Canadian Forest Service (Sajan, 2006) states that the average annual mortality rates of 1% to 3% are considered normal, but a red flag should be raised at 5% morality rates. This threshold will be used when monitoring and analyzing data. If mortality rates exceed this rate recommendations for management will be made. To utilize this threshold, a baseline must be established to measure from and be compared against. At all forest plots, tree health is assessed by observing the species, dbh (diameter at breast height), tree status (dead/alive), stem defects, and crown vigor (amount of defoliation).

While high mortality rates can raise alarm, dying, decaying and dead trees play an integral role in forest ecosystems. Decomposing material can provide habitat and food sources for a variety of animals, including cavity nesters and salamanders, the latter of which are sensitive indicator species; decomposing material is also an important component in nutrient cycling.

Table 3 below shows the percent mortality rate at each site, keeping in mind that the data represented in the table shows the baseline data. The recommended thresholds will not be applied to this year's data.

Table 3: Forested Plots Tree Health Summary

Site Name	Mortality of Trees (%)
OSHF01	0%
OSHF02	4%
OSHF03	0%
RTCAF01	0%
SAMACF01	8%
Overall	**3%**

Table 4 shows the species composition and the percent of non-native species by site number. Two of the sites don't appear to have any non-native tree species, while the remaining three range from 17% to 60% non-native species. Table 5 shows the tree species found in all eight sites according to importance value. Among the top five trees for importance value are two non-native invasive species: Scot's Pine and Crack Willow. Scot's Pine is a tree from Europe and was brought over by seed collected by early settlers for planting in North America. They grow rapidly with abundant seed production, but is subject to many pests and diseases (Farrar, 2006). Crack willow, found in the more urbanized southerly part of the watershed, is native to Europe and often reaches sizes of 100cm in diameter. It has brittle branches that break off in storms and can easily re-root themselves, as they have a high strike rate (Farrar, 2006). Importance value is "an index made up of Relative Density, Relative Dominance and Relative Frequency that profiles the structural role of a species in a stand." (Roberts-Pichette, *et al*., 1999). As a result, importance values are highly dependent on the quantity of tree species within the plots, as well as their size and basal area. Tree health will be observed every five years as the plots are monitored

Table 4: Forested Plot Tree Species Composition by Site

Site Code	Species Richness	Native	Non-Native	% Non-Native
OSHF01	1	1	0	0%
OSHF02	4	4	0	0%
OSHF03	5	2	3	60%
RTCAF01	5	4	1	20%
SAMACF01	6	5	1	17%

Table 5: Forested Plot Tree Species by Importance Value

Tree Species		Importance Value
Latin Name	Common Name	
Thuja occidentalis	Easter White Cedar	57.45
Acer saccharum ssp. Saccharum	Sugar Maple	42.73
*Pinus sylvestris**	Scot's Pine	32.87
Pinus strobus	White Pine	32.57
*Salix fragilis**	Crack Willow	32.15
Ulmus Americana	American Elm	13.66
Fraxinus pennsylvanica	Green Ash	13.37
*Acer negundo**	Manitoba Maple	12.52
Acer x freeman	Freeman's Maple	10.79
*Rhamnus cathartica**	Common Buckthorn	10.32
Prunus serotina	Black Cherry	8.04
Fraxinus Americana	White Ash	7.23

Tree Species		Importance Value
Latin Name	Common Name	
Acer rubrum	Red Maple	6.91
Quercus rubra	Red Oak	6.81
Juglans cinerea	Butternut	6.75
*Acer platanoides**	Norway Maple	5.85

*indicates non-native species

2.1.2 Regeneration

Monitoring the regeneration of saplings is another important feature used to understand the structure and observe the success of the forest. All tree species and heights are recorded for saplings within 16cm to 200cm in height that lie within the subplot boundaries. Specimens less than 16cm are not recorded as the success rate is too unpredictable and they may not survive the growing season.

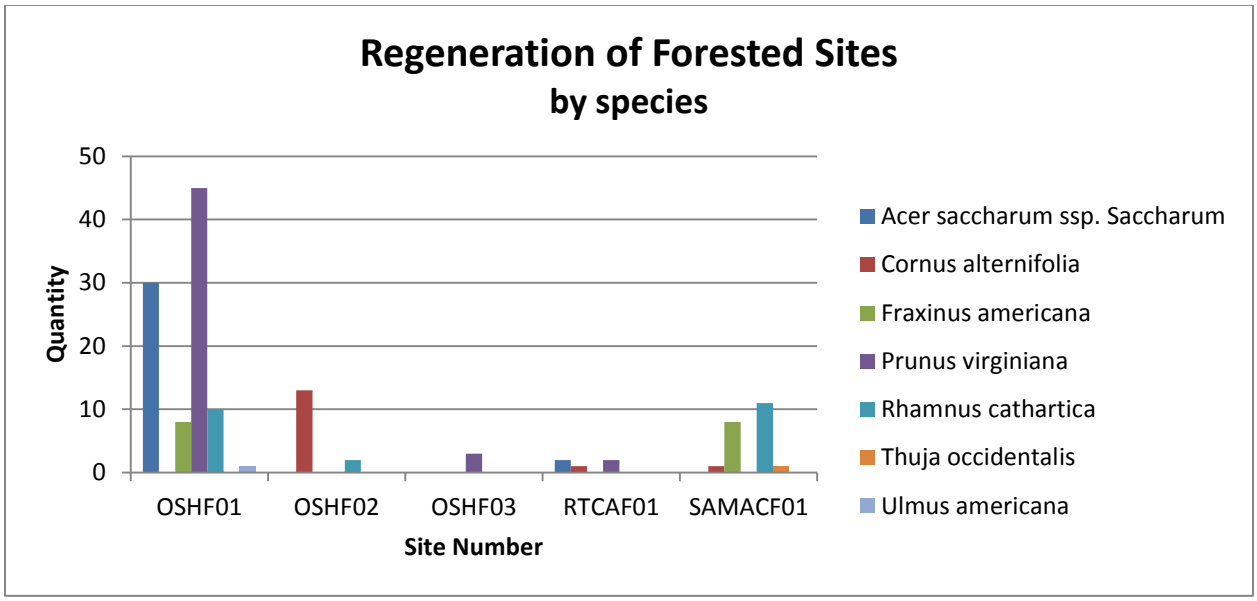

Figure 3: Regeneration of Forested Sites by Species

All the sites had a fair diversity of regenerating saplings (Figure 3), with OSHF01 having the greatest amount. Chokecherry, a small tree or tall shrub reaching heights of up to 9m and 15cm in diameter (Farrar, 2006), was the most abundant sapling, with Sugar Maple being the next most abundant sapling. Both of these are native species and provide valuable resources for wildlife. The next most abundant regenerating species is Common Buckthorn, an invasive shrub species that is a prolific fruit producer, and can easily displace native plant material, both woody and herbaceous. While OSHF01 has a high number of regenerating Sugar Maple and Chokecherry, there is a high number of Common Buckthorn in the surrounding areas. The woodlot that OSHF01 is found in is adjacent to a new subdivision and will begin to see increasing pressures due to increased public use. It is recommended that the City of Oshawa work with the community members to help preserve the native natural features which this forest still possesses.

Table 6: Regeneration by height classification for Forested Plots

Tree Species	Seedling Height Class (cm)						Total by Species
	16-35	36-55	56-75	76-95	96-200	200+	
Acer saccharum ssp saccharum	24	4	2	0	1	1	32
Cornus atlernifolia	7	0	0	0	4	4	15
Fraxinus americana	10	3	0	0	1	0	16
Prunus virginiana	15	11	12	5	6	1	50
Rhamnus cathartica	10	5	3	2	3	2	23
Thuja occidentalis	0	1	0	0	0	0	1
Ulmus americana	0	0	0	0	0	1	1
Total by height class	**66**	**24**	**17**	**7**	**15**	**9**	**138**

Table 6 shows the height category by species; the majority of regenerating species fall within the 16cm-35cm category and due to their size are still quite vulnerable. Sugar Maple and Choke Cherry are the most abundant regenerating saplings in this size category. Sugar Maple is much less abundant in the larger height classes, while Choke Cherry maintains its abundance through the larger categories. White Ash is the fourth greatest regenerating species, and is found mostly in the shortest height category. With Emerald Ash Borer on the rise, many of these Ash trees may help to regenerate the potentially decimated Ash population in years to come.

2.1.3 Ground Vegetation

Monitoring ground vegetation within a forested system can provide information regarding the phenology (timing of biological events, such as flowering, in relation to changes in season and climate) of the plant; the change in composition and species vulnerability to disturbed landscapes; as well as provide information on the quality of habitat. Ground vegetation is defined as all herbaceous material and ground layer vegetation, including lichens, mosses, fungi and small trailing and rosette plants. It also encompasses woody stemmed material that is less than 1m in height. Ground vegetation can vary depending on many factors, including forest canopy cover, soil substrate, moisture variation and time of year.

Table 7: Ground Vegetation data for Forested Plots

Site Name	Species Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
OSHF01	18	15	3	17%
OSHF02	18	10	8	44%
OSFH03	14	4	10	71%
RTCAF01	15	13	2	13%
SAMACF01	12	6	6	50%
Overall*	**48**	**33**	**15**	**31%**

*Overall species richness counts only unique occurrences; totals have been adjusted for this duplication

Table 7 shows the species composition of the ground vegetation layer for each site and breaks it up between native, non-native and overall species richness. Total species richness is relatively similar across all five sites, however the native species richness varies considerably. The five sites vary in their levels of disturbance and historical and present day adjacent land uses. OSHF01 has the greatest % non-

native species, and as mentioned before it is adjacent to a newly unfinished subdivision in north Oshawa. While this site will likely experience more disturbance in the near future, it has not been as impacted as other sites such as OSHF03 which is found in south Oshawa within the Oshawa Creek floodplain and is heavily infested with a number of highly invasive species.

Table 8: Non-Native Species list for Forested Plots

Latin Name	Common Name	Rank
Alliaria petiolata	Garlic Mustard	1
Arctium minus	Common Burdock	-
Chelidonium majus	Celandine Poppy	5
Conium maculatum	Poison Hemlock	-
Cynanchum rossicum	Dog-Strangling Vine	1
Epipactis helleborine	Helleborine	-
Geranium robertianum	Herb Robert	-
Hesperis matronalis	Dame's Rocket	1
Impatiens glandulifera	Himalayan Balsam	1
Ranunculus acris	Tall Buttercup	-
Rhamnus cathartica	Common Buckthorn	1
Ribes x rubrum	Garden Currant	-
Solanum dulcamara	Bittersweet Nightshade	3
Taraxacum officinale	Common Dandelion	-
Urtica dioica ssp. Dioica	European Stinging Nettle	3

Table 8 shows the non-native species categories and their ranking of invasiveness (CLOCA, 2010-01MP). Of the fifteen non-native species present (Table 9), five are ranked as "…aggressive invasive exotic species that can alter and dominate sites and exclude native species. …" (CLOCA, 2010-01MP). These include Garlic Mustard, Dog-strangling Vine, Dame's Rocket, Himalayan Balsam, and Common Buckthorn. The three remaining species ranked include Bittersweet Nightshade and European Stinging Nettle, which are considered "moderately invasive … but can become locally dominant when the proper conditions exist…" and Celandine Poppy which is ranked in the fifth category and has "the potential to become [an] invasive exotic in Ontario …" (CLOCA, 2010-01MP).

Table 9: CLOCA's Invasive Species Ranking Criteria (as adapted by Urban Forested Associates, Inc. 2004)

Category Rank	Category Criteria
1	This category contains aggressive invasive exotic species that can alter or dominate sites and exclude native species. These organisms are a threat to natural areas, as they disperse widely, through transport by animals and/or natural means (water, wind, etc). These species are top priority, however control may be difficult.
2	Species that are highly invasive but tend to only dominate certain niches or do not spread rapidly from major concentrations. They spread by vegetative means or by seeds that drop close to the parent. They may persist in dense populations for long periods. Control where necessary and limit their spread to other areas.
3	Moderately invasive species, but can become locally dominant when the proper conditions

Category Rank	Category Criteria
	exist. Control where necessary and limit their spread to other areas.
4	Species that do not pose a serious threat to natural areas unless they are competing directly with more desirable vegetation. These plants are sometimes substituted for native plants, but may not reproduce aggressively once established.
5	Some of these species have the potential to become invasive exotics in Ontario. They can reproduce aggressively on occasion but have not been shown to be a serious threat to natural areas in Ontario. Some are very similar to indigenous species and could simply have been overlooked.

2.2 Non Forested Systems

Non-forested systems include cultural meadows (CUM) and cultural thickets (CUT) which accounts for 28% of the Oshawa Creek watersheds natural cover or 6.5% of the entire watersheds land cover. Two non-forested plots were established in 2012 within the Oshawa Creek watershed, one within the Rhamani Tract Conservation Area and another on public lands owned by the City of Oshawa. Each site has six 1mx1m monitoring plots established and were observed twice during the field season, once in early June and again in late August.

2.2.1 Ground Vegetation

Table 10 shows the overall species composition of the two sites. A total of 21 species were observed, more than half of which were non-native. Even though both sites contained a high number of non-native species, not all of these non-native species pose a threat. Cultural meadows and cultural thickets often have a higher presence of non-native species, due to the anthropogenic influences affecting the site, and many non-native species have become naturalized and do not out-compete the surrounding native vegetation. Table 11 shows all the non-native species present and their potential invasiveness according to the categorized criteria (Table 9).

Table 10: Ground Vegetation data for Non-Forested Sites

Site Name	Species Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
OSHNF01	16	10	6	63%
RTCANF01	13	4	9	69%
Overall*	**21**	**8**	**13**	**62%**

*Overall species richness counts only unique occurrences; totals have been adjusted for this duplication

Table 11: Non-Native Species list of Non-Forested Sites

Latin Name	Common Name	Rank
Chrysanthemum leucanthemum	Ox-Eye Daisy	-
Cirsium arvense	Canada Thistle	1
Coronill varia	Crown Vetch	1
Cynanchum rossicum	Dog-Strangling Vine	1
Daucus carota	Queen Anne's Lace	-
Galium mollugo	White Bedstraw	2
Linaria vulgaris	Butter-and-Eggs	4

LATIN NAME	COMMON NAME	RANK
Lotus corniculata	Bird-Foot Trefoil	2
Medicago lupulina	Black Medick	4
Phleum pratense	Timothy Grass	-
Rumex crispus	Curly Dock	-
Taraxacum officinale	Common Dandelion	-
Vicia cracca	Cow Vetch	2

Within the two sites three species are ranked within the first category, Canada Thistle, Crown Vetch and Dog-Strangling Vine. Canada Thistle is a noxious weed in Ontario, as it can negatively impact agricultural lands. Dog-Strangling Vine creates a monoculture in meadows and can quickly invade forests, climbing up trees and shading them from the nutrients they require. Crown Vetch, while categorized as highly invasive, has a tendency to invade mostly meadows and successional lands.

Species found within category two are characterized as "species that are highly invasive but tend to only dominate certain niches or do not spread rapidly from major concentrations … may persist in dense populations for long periods." (CLOCA, 2010-01MP). Three of the species found within the non-forested plots fall in this category and are more commonly found in cultural meadows and thickets.

The remaining species are grouped within category four and are often found in cultural meadows and while they may become dominant, they do not often transform the ecosystem, especially in this case where the sites are cultural as a result of historical land practices. These sites are described as "open communities originating from, or maintained by, anthropogenic or culturally based disturbances; often having a large proportion of introduced species."

2.3 Wetlands

Wetlands play an integral part in the function and health of a watershed, as they act as natural filters, recharge groundwater, and provide habitat for wildlife. The wetlands monitored within the Terrestrial Watershed Monitoring Program consist of forested wetlands, including deciduous, mixed and coniferous swamps (SWD, SWM, SWC). Within the Oshawa Creek watershed, these wetlands make up 22% of the natural cover and 5% of the entire land cover. Coastal wetlands within the CLOCA jurisdiction are monitored through the Durham Region Coastal Wetland Monitoring Program (DRCWMP), and as a result are not monitored through this program. According to Environment Canada, wetland cover within a watershed should be at least 10%, and at least 6% for a subwatershed. Three wetland plots were established within the Oshawa Creek watershed; one in the southern more urbanized area, the second in an urbanized location and the third plot is located in the central portion of the watershed in a rural, less urbanized area (Figure 1). Varying adjacent land uses and anthropogenic influences can have an effect on the integrity of wetland systems.

2.3.1 Tree Health

Tree health was assessed using the same methodology as the Forested Monitoring Plots. Please refer to Section 2.1.1 for more information on the process.

Table 12 shows the percent mortality at each of the three sites; keeping in mind that the data presented will be used as baseline data and the recommended threshold will not be applied to this year's data.

Table 12: Tree Health Summary for Wetland Sites

Site Name	Mortality of Trees (%)
DURW01	5%
OSHW01	0%
OSHW02	0%
Overall	**2%**

The overall mortality for the three sites is at 2%; which is relatively low. Mortality rates will continue to be monitored on a five year cycle. Table 13 shows the species composition of native and non-native tree species observed. Both DURW01 and OSHW02 have limited if any non-native tree species present. OSHW01 is located in a valley and highly urbanized part of the Oshawa Creek watershed and consists of entirely non-native trees, including Crack Willow and Manitoba Maple. The latter is native to central Canada, but is frequently planted as an ornamental and has spread beyond its natural range (Farrar, 2006). Crack Willow is native to Europe and was also introduced as an ornamental species and is often associated with low moist areas (Farrar, 2006).

Table 13: Wetland Plot Tree Species Composition

Site Name	Species Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
DURW01	7	7	0	0%
OSHW01	2	0	2	100%
OSHW02	5	4	1	20%

Table 14: Wetland Plot Tree Species by Importance Values

Tree Species		Importance Value
Latin Name	Common Name	
Thuja occidentalis	Eastern White Cedar	106.09
Fraxinus pennsylvanica	Green Ash	42.11
*Salix fragilis**	Crack Willow	31.74
Populus tremuloides	Trembling Aspen	29.81
*Acer negundo**	Manitoba Maple	27.17
Pinus resinosa	Red Pine	16.14
Rhamnus cathartica	Common Buckthorn	10.95
Tsuga canadensis	Eastern Hemlock	10.20
Prunus serotina	Black Cherry	9.28
Ostrya virginiana	Ironwood	8.74
Ulmus americana	American Elm	7.32

*indicates non-native species

Table 14 lists the tree species present in the three plots according to importance value; both the non-native species are among the top five for importance value. Manitoba Maple and Crack Willow also rank in categories 1 and 2 respectively on the invasive species ranking list (CLOCA, 2010-01MP).

2.3.2 Regeneration

Regeneration is assessed using the same methodology as the Forested Monitoring Plots; please refer to Section 2.1.2 for more information on the process.

Two of the three sites surveyed had regenerating species; the highly urbanized OSHW01 had no regenerating saplings within the plot. OSHW02 only had one species regenerating, Common Buckthorn, which is a highly invasive shrub and has the ability to suppress understory vegetation with its domination of light, soil and nutrients. DURW01 had the greatest species richness with five species regenerating. Figure 4 shows the regeneration of wetland sites according to species and Table 15 shows regeneration by height categories. Species regeneration is relatively similar across all height categories, except for the largest (200+cm). Ash species (both green and black) were found to be regenerating in many of the height classes, including the higher categories. While no evidence of Emerald Ash Borer (EAB) was found at any of these sites, EAB has been discovered in both the northern and southern reaches of Oshawa.

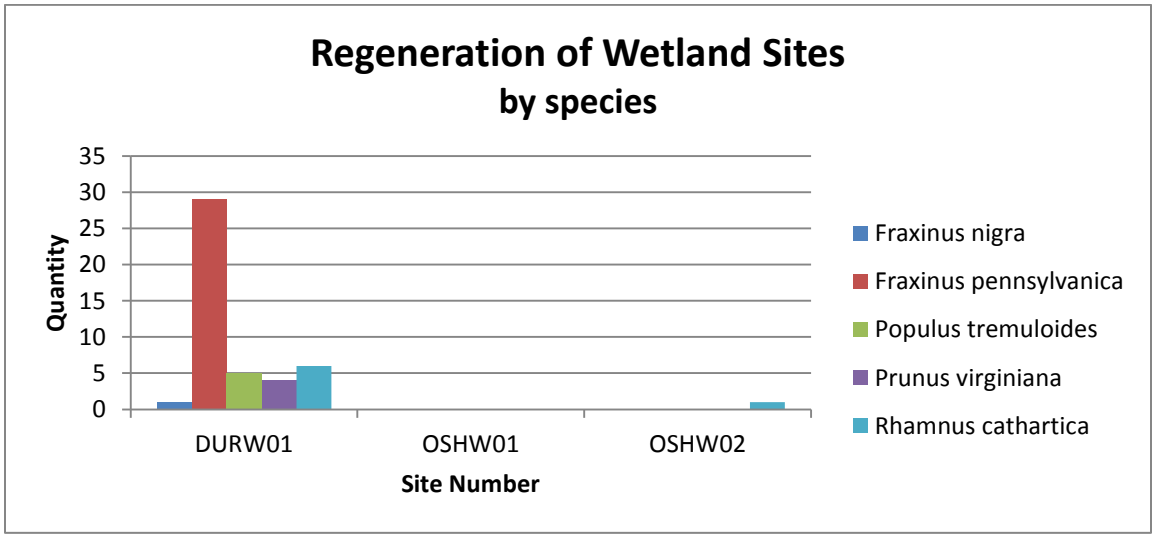

Figure 4: Regeneration of Wetland Sites by Species

Table 15: Regeneration by height classification for Wetland Plots

Tree Species	Seedling Height Class (cm)						Total by Species
	16-35	36-55	56-75	76-95	96-200	200+	
Fraxinus nigra	0	0	0	0	0	1	1
Fraxinus pennsylvanica	5	5	5	6	5	3	29
Populus tremuloides	0	0	3	2	0	0	5
Prunus virginiana	4	0	0	0	0	0	4
Rhamnus cathartica	1	2	0	2	2	0	7
Total by height class	**10**	7	8	10	7	4	46

2.3.3 Ground Vegetation

Ground vegetation was assessed using the same methodology as the Forested Monitoring Plots; please refer to section 2.1.3 for more information on the process.

Table 16 shows the species richness at the three wetland plots within Oshawa Creek watershed. Overall the non-native species richness was 21%. As mentioned previously, the sites are very different in regards to anthropogenic influences, and this is evident through the species richness at each site. The site is found in a more northern part of the watershed that is juxtaposed by agricultural lands and natural areas has a native species richness of 89%, and has the greatest number of species observed at the site with 35 species found in total. OSHW01, which experiences the greatest anthropogenic influences has the greatest amount of non-native species present, with 44%. Table 17 shows the non-native species observed and their invasiveness ranking from 1 to 5; category one being "aggressive exotic species" while category five "have the potential to become invasive exotics". Table 9 provides a full list of the five categories and their associated criteria.

Table 16: Ground Vegetation data for Wetland Sites

Site Name	Species Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
DURW01	35	31	4	11%
OSHW01	16	9	7	44%
OSHW02	15	14	1	7%
Overall*	**53**	**42**	**11**	**21%**

*Overall species richness counts only unique occurrences; totals have been adjusted for this duplication

Table 17: Non-Native Species List for Wetland Sites

Latin Name	Common Name	Rank
Alliaria petiolata	Garlic Mustard	1
Glechoma hederacea	Ground Ivy	4
Hesperis matronalis	Dame's Rocket	1
Impatiens glandulifera	Himalayan Balsam	1
Myosotis scirpoides	True Forget-me-not	4
Ranunculus acris	Tall Buttercup	-
Rhamnus cathartica	Common Buckthorn	1
Solanum dulcamara	Bittersweet Nightshade	3
Taraxacum officinale	Common Dandelion	-

LATIN NAME	COMMON NAME	RANK
Tussilago farfara	Sweet Coltsfoot	4
Urtica dioica ssp. Dioica	European Stinging Nettle	3

Nine of the eleven non-native species are ranked with some degree of invasiveness, with four of the species ranking in the first category. Garlic Mustard, Dame's Rocket, Himalayan Balsam and Common Buckthorn are some of the provinces worst offenders when it comes to invasive species. The first three are often found in similar environments, low-lying moist grounds and varying degrees of sunlight. Garlic Mustard is allelopathic, which means it exudes chemicals into the soil that prevents other plants from growing. Himalayan Balsam has very shallow roots and when found near tributaries and banks can result in erosion during winter and spring months. All of these top invasive species have the ability to transform entire ecosystems.

3.0 Special Projects

3.1 Transplant Monitoring

In 2010, approximately 200 regionally rare plants comprising of 4 species were transplanted by the developer's environmental consultant from a proposed development site. The four plant species included Fringed gentian (*Gentianopsis crinita*), Fringed-tip closed gentian (*Gentiana andrewsii*), Large yellow lady's slipper (*Cypripedium calceolus* var. *pubescens*) and Gerardia (*Agalinis spp*). 2012 was the second year of monitoring the transplant of these uncommon and regionally rare plant species. In 2011 only 35 plants were observed, but this year's field observations found over 840 plants, primarily comprised of Fringed Gentians. These two Gentian species flower biennially resulting in the variation in the number of plants observed over the 2 years of monitoring. While habitat is appropriate for these species, neither Gentian species have been recorded at Heber Down Conservation Area before, and their present population is a result of this successful transplant.

Figure 5 shows a number of the plants that were observed flowering during the 2012 field season, and Table 18 depicts the number of plants observed in 2011 and 2012. This project has provided CLOCA Natural Heritage staff with information regarding the potential success of transplanting these types of species to naturalized and protected areas and future monitoring and recording of the transplant response at this site is not required.

Table 18: Number of Plants observed in 2011 and 2012

Transplanted Species		2011	2012
Latin Name	Common Name		
Gentianopsis crinita	Fringed Gentian	13	831
Gentiana andrewsii	Fringe-tip Closed Gentian	10	3
Cypripedium calceolus var. pubescens	Large Yellow Lady's Slipper	0	0
Agalinis tenuifoilia	Slender-leaved Gerardia	6	7

Figure 5: Gentian spp and Gerardia Spp observed in 2012

3.2 Groundwater Levels at Heber Down CA

Since 2009 CLOCA has been monitoring groundwater levels in conjunction with wetland specific plants at four locations within the Heber Down Provincially Significant Wetland Complex at Heber Down Conservation Area. The wetland is situated on the former Lake Iroquois Shoreline and is 85.3ha in size with 96% of the wetland consisting of swamp and the remaining 4% marsh. Only 2% of the wetland complex is privately owned, the remaining 98% is owned by CLOCA.

Water levels are recorded on a monthly basis at the four locations using piezometers; vegetation inventories are also conducted at these sites along 4 transects which each contain 12 1mx1m plots. At each site the species composition is observed (Table 19), in addition to the overall wetness index. The wetness index categorizes plants based on the probability for them to be found in a wetland or upland area. Table 20 shows the average wetness for each transect, the maximum wetness value, minimum wetness value and the mode. The maximum wetness value represents the most upland plant within the transect, while the minimum value represents the most wetland plant within the transect. While the wetness index may classify a plant as an obligate wetland plant or obligate upland plant, they may not always be found in those specific areas; many invasive plants often don't follow these 'rules', and due to their prolific nature to spread and adaptability, they are found quite readily in a variety of environments.

Table 19: Ground Vegetation Data by Transect

Site Name	Species Richness	Native Species Richness	Non-native Species Richness	% Non-native Species
Transect 1	27	23	4	15%
Transect 2	17	14	3	18%
Transect 3	28	24	4	14%
Transect 4	31	29	2	6%
Overall	**45**	**39**	**6**	**13%**

Table 20: Wetness index by Transect

Site Name	Mean Wetness Index	Maximum Wetness Value	Minimum Wetness Value	Mode Wetness Value
Transect 1	-1.29	5	-5	0
Transect 2	0.31	5	-4	-2
Transect 3	-0.8	5	-5	0
Transect 4	-0.25	5	-5	5
Overall	**-0.53**	**5**	**-5**	**-5**

Piezometers measure surficial groundwater and have been installed to a maximum depth of 6ft. Without the use of drills and augers it was not possible to get the piezometers any deeper, and the roots of many herbaceous wetland plants reach approximately 2m (~6ft) (Canadell, *et al.*, 1996).

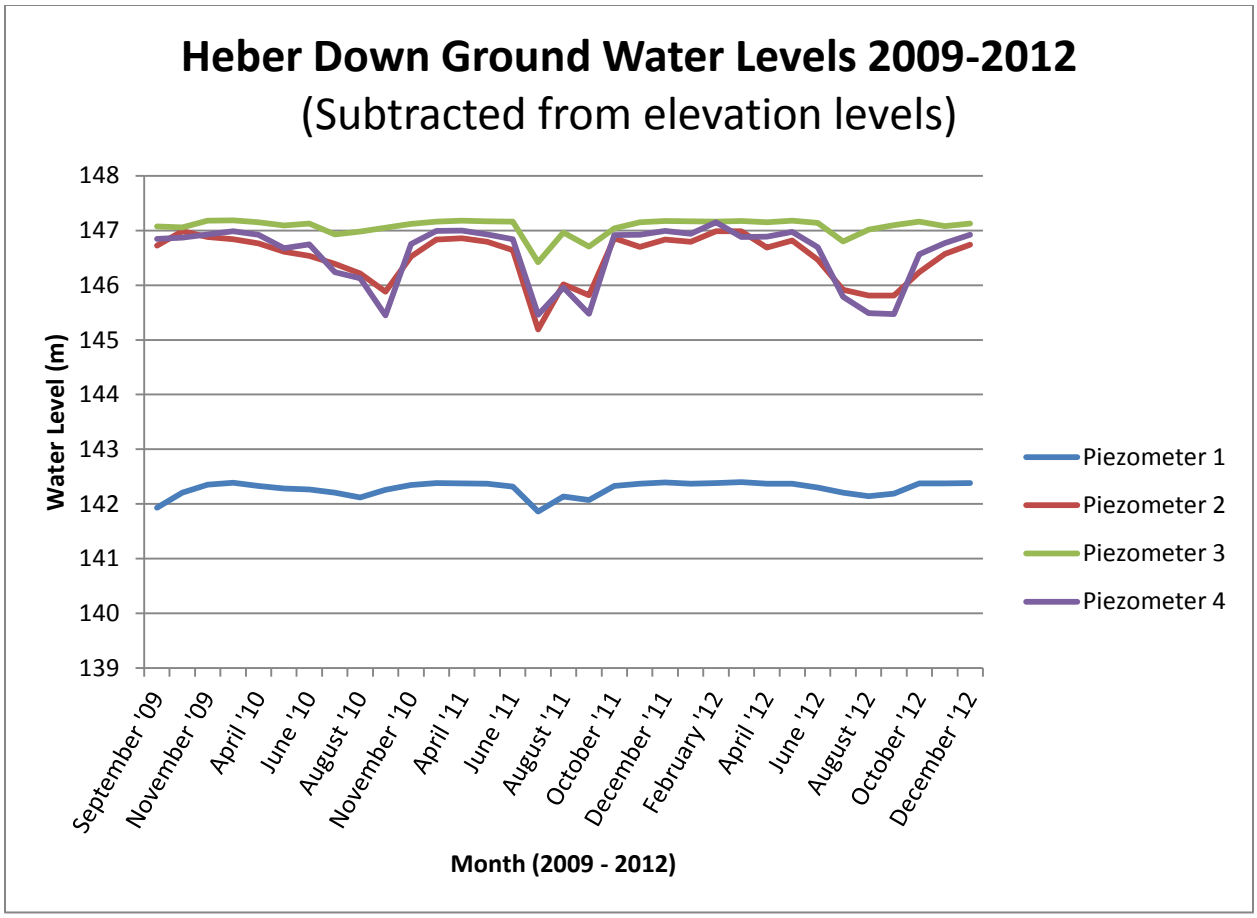

Figure 6: Piezometer Groundwater Levels

Figure 6 shows the water levels from 2009 to 2012; each of the sites are observed monthly, on an annual basis. It is still too early to discern the results and determine if there has been a change in species composition which correlates to groundwater data. Figure 7 shows the rain gauge data that is collected at Transect 1 on a monthly basis. As expected there are dips during the mid-summer months as a result of high temperatures and increased evapotranspiration. These sites will continue to be monitored through the construction and post-construction phase of the Highway 407 east extension.

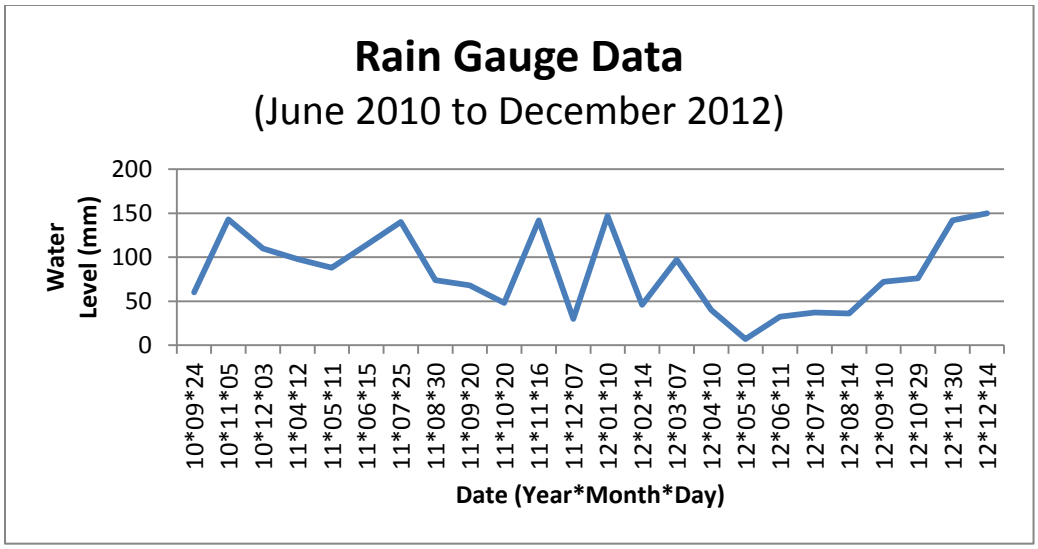

Figure 7: Rain Gauge Data

3.3 Natural Heritage Systems Inventory Pilot Project

In 2010, CLOCA developed their Natural Heritage System (NHS), a tool designed to manage watershed resources in accordance with the Conservation Authorities Act. The NHS represents a healthy, self-sustaining, connected system that supports: a diversity of native terrestrial, wetland and aquatic species, communities and habitats; natural healthy fish and riparian habitats; and a natural and healthy watershed hydrological cycle. Several tools have been identified within the watershed plans to work towards achieving healthy watershed targets and implementing watershed recommendations. One of these tools is the NHS Restoration Plan which will identify opportunities and priorities for restoration within the watershed. To better plan for these active and passive restoration initiatives, staff developed a pilot project to get more detailed information on the functional Natural Heritage System that can be used to contribute to prioritizing the restoration of the Natural Heritage System.

The ELC Pilot Project was conducted within the north end of the Lynde Creek Watershed and focused on ground-truthing vegetation communities within the Natural Heritage System. Seventeen landowners were contacted with a 24% response rate. In total, 70ha of private lands were ground-truthed and updated within CLOCA's ELC database and mapping. Headwater wetlands were also surveyed during this pilot project, revealing mature organic forested wetlands and regionally rare plant species. Generally, the ground-truthing further refined the desk-top mapping exercise conducted for the development of the NHS, and provided more detailed information.

In addition to this, communicating with the landowners and residents of the area revealed incidental observations of their own, as well as stewardship initiatives that are currently taking place which can be updated in CLOCA's stewardship database. The area targeted sits right on the border of the CLOCA and Toronto Region Conservation Area (TRCA) boundary line. During visits, it was made known that some landowners have recently participated in Forestry Management Plans with the TRCA, as well as tree plantings in fallow fields. While CLOCA did not partner in the stewarding of this land, all work done helps towards enhancing and restoring the Natural Heritage System. Overall, this project was a success and will be continued in 2013.

3.4 Invasive Species Management

In 2010 CLOCA developed a board endorsed Invasive Species Management Strategy. Since then, CLOCA's internal invasive species working group has been working diligently to implement the strategy, with the goal to help increase awareness and prevent the spread and introduction of invasive species. The strategy focuses on prevention, education & outreach, best management practices and collaborating with a broad professional network that works on invasive species related issues. CLOCA staff had the opportunity to implement several of the Invasive Species pilot projects developed in preceding years, surveying of storm water management ponds for invasive species, as well as a number of other initiatives.

3.4.1 Pilot Project Implementation

In 2011 members of the working group developed seven invasive species management pilot projects. The sites were chosen based on population size, ecological sensitivity and public access. This exercise is to help determine what control measures work best and report back to our partnering organizations as well as educate the public on how to manage invasive species on their own properties. In 2012, summer staff, volunteers and MNR rangers assisted in the implementation of four pilot projects. This included the removal of over 25 large garbage bags (320lbs) of Garlic Mustard from Purple Woods Conservation Area; two trailer loads of European Frog-bit from Enniskillen Pond (Enniskillen Conservation Area); two truckloads of Yellow Iris from Lynde Shores Conservation Area (Figure 8); and large common buckthorn tree removal using heavy equipment. Two of the four projects were implemented for the first time in 2012, while frog-bit and buckthorn management had been executed in previous years.

Figure 8: European Frog-bit Removal, Enniskillen CA Pond (left); Yellow Iris Removal, Lynde Shores CA (right)

3.4.2 Outreach Initiatives

Each summer CLOCA partners with the Ontario Federation of Angler's and Hunters Invading Species Awareness Program to hire an Invasive Species Hit Squad summer student. This student actively pursued organizations within the community to educate them about invasive species prevention and awareness. In 2012, the summer student attended a number of community events including Camp Samac Fishing Derby, Darlington Provincial Park's interpretive program, Rotary Club of Whitby and a number of other events. In addition to this, in 2012 she also developed and created two videos on Common Buckthorn ID and Management, which is a useful tool for the public and is available on the CLOCA website.

3.4.3 Storm Water Management Pond Surveys

Every year the City of Oshawa's storm water management ponds (SWMP) are drained into watercourses prior to freezing, releasing fish into the natural watercourses. An effort in recent years has been made to inform the public that release of their aquarium fish into storm water ponds is not desirable, however, invasive fish species such as gold fish and Koi continue to be present in these ponds. In 2012, CLOCA staff initiated a survey of storm water management ponds across the Authority's jurisdiction to look for the presence of invasive species. The goal of the project was to determine the presence/ absence of invasive fish species, specifically gold-fish. Nineteen ponds were surveyed in total, 11 in the Oshawa Creek watershed, 2 in Harmony Creek watershed, 2 in Pringle Creek watershed, and one in each of Lynde Creek, Robinson Creek, Bennett Creek and the Coastal watersheds. Of the 12 Oshawa City owned ponds surveyed, three had gold fish present, and of these three ponds one had Koi present.

For each of the surveys, a number of parameters were observed to assess the physical and ecological components of the sites. For each of the parameters, presence/absence was observed and turbidity measurements were taken at each of the storm water management ponds. Physical parameters included noting whether it was a manicured pond, if paths were present, if the subdivision was complete or not, if there was fencing around the entire pond and if there was any erosion along the banks of the pond. Ecological parameters that were observed include the presence/absence of: goldfish, other fish, flow in pond, frogs (visible), Adult dragonflies/damselflies, amphibians (vocal), birds (visible), algae and swimming insects (Figure 9).

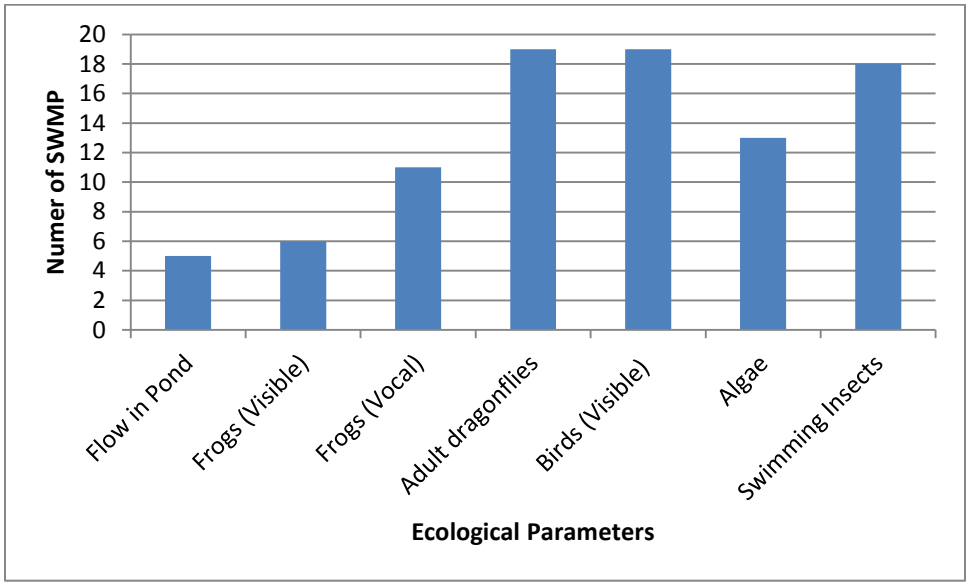

Figure 9: Ecological Parameters Inventoried at SWMPs

Invasive plant species were also recorded, targeting 25 specific invasive plants, only eleven were observed at the storm water management facilities, as shown in Error! Reference source not found.**;** Table 21 lists the remaining fourteen species not observed at the SWMPs.

This project will continue in the 2013 field season, pending funding from the Ontario Federation of Anglers and Hunters Invading Species Awareness Program. The information obtained is valuable to

determine how and where gold fish are being introduced into water ways. This information can be used in conjunction with CLOCA's Aquatic Monitoring data to better plan for managing aquatic invasive species.

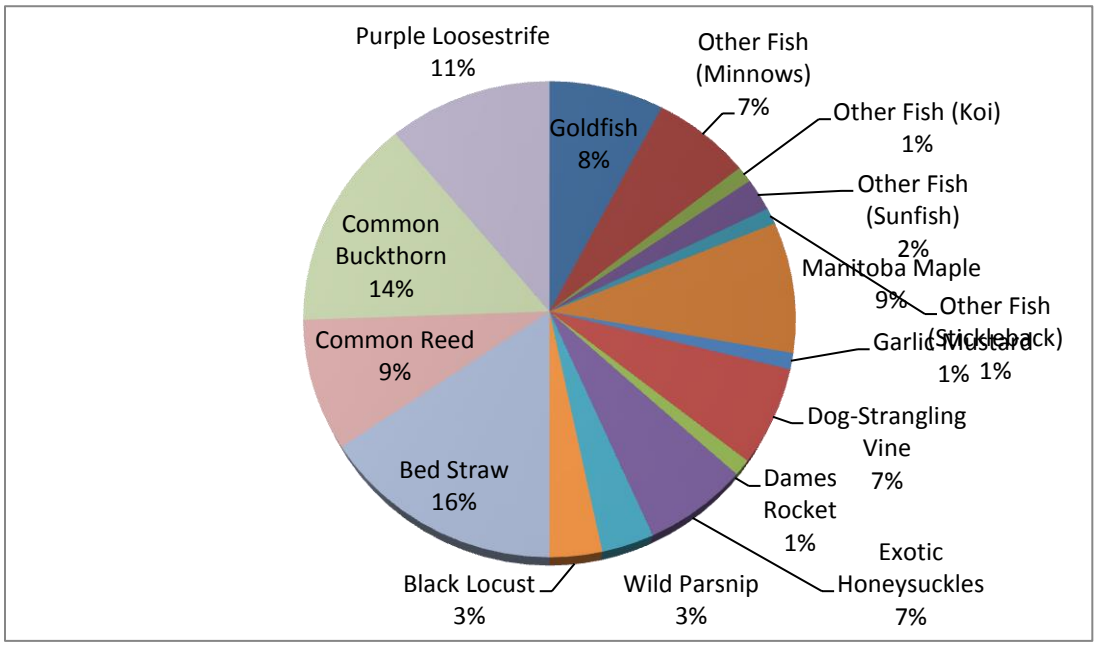

Figure 10: Percent of Invasive Species Found Overall

Table 21: List of Invasive Plant Species not found at any SWMP

INVASIVE SPECIES NAME
Norway Maple
Flowering Rush
Water Hyacinth
European Frog-bit
Yellow Iris
Floating Heart
Water Lettuce
Water Soldier
Water Chestnut
Japanese Knotweed
Himalayan Balsam
Day Lilly
Giant Hogweed
Russian/Autumn Olive

3.4.4 Partnerships

Central Lake Ontario Conservation staff have been very involved in a number of provincial Invasive Species initiatives, including participating on committees of the Ontario Invasive Plant council, assisting in the development of a variety of Best Management Practices, and sitting on Regional Working groups.

Some of the products CLOCA has helped produce to date include: Grow Me Instead (Southern Guide); Garlic Mustard BMP; Giant Hogweed BMP; Dog-Strangling Vine BMP; Common Buckthorn BMP; Reed Canary Grass BMP and the Clean Equipment BMP. The Invasive Species professional network is vast, and continually expanding as the breadth of the problem is realized. These partnerships between public, private, provincial and local organizations are key in developing resources and educating the public on the prevention of invasive species.

3.4.5 Emerald Ash Borer

Emerald Ash Borer has been detected in the Town of Ajax, City of Pickering, Town of Whitby and City of Oshawa, as a result, the Region of Durham is considered a regulated quarantined area by the Canadian Food Inspection Agency (CFIA). As part of CLOCA's many partnerships, staff has met regularly with municipal staff, keeping up to date with the status of Emerald Ash Borer (EAB) within Durham Region and the local municipalities management strategies. Branch sampling has been conducted within one of CLOCA's CAs, however, as yet, EAB has not been confirmed within CLOCA's landholdings.

CLOCA staff has highlighted three key objectives with respect to managing EAB in our Conservation Areas: 1) confirm presence of EAB; 2) assess and determine hazards associated with EAB; and 3) identify future restoration opportunities. A mapping exercise to establish percent cover of Ash trees within our CA landholdings (Figure 11) has been prepared. From this map, the proximity of Ash trees to public use infrastructure can be determined, thus facilitating the management of potentially hazardous trees by field operation staff. Also, the information collected and mapped will help identify future restoration opportunities.

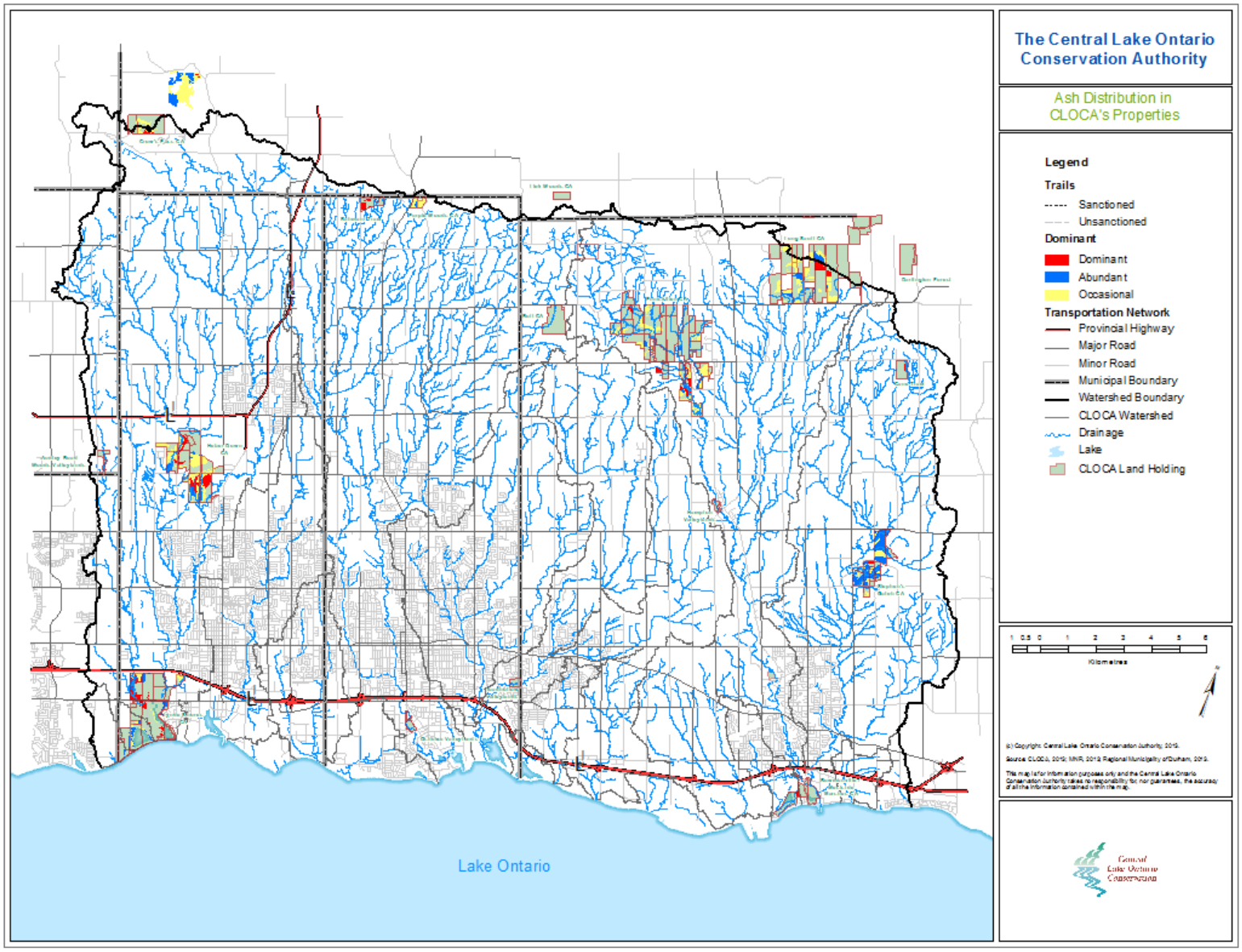

Figure 11: Ash Distribution in CLOCA's Landholdings

4.0 SUMMARY

The 2012 field season was successful and busy, establishing 10 plots within the Oshawa Creek watershed and inventorying a number of private lands within the Lynde Creek watershed. In addition to this, three special projects were continued, two of which will be pursued in the field season of 2013. Four invasive species management pilot projects were implemented, as well as a number of educational and outreach events targeting invasive species education and prevention.

This data will be used in conjunction with future existing condition reports for CLOCA's watersheds, CA management plans, and Invasive Species Management planning. Monitoring will occur once every five years, similar to those established for CLOCA's other natural heritage monitoring programs.

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