PARKS AND FORESTRY

Urban Forest Management Plan

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Natural Heritage & Urban Forest Strategy

MISSISSAUGA
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STAKEHOLDERS

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Aboriginal Organizations: Mississaugas of the New Credit First Nation, Peel Aboriginal Network, and Six Nations of the Grand River.

City of Mississauga Committees of Council: Accessibility Advisory Committee (AAC) and Heritage Advisory Committee (HAC).

Community Groups / Residents' Associations: Credit Reserve Association, Erindale-Woodlands Community Association, Gordon Woods Homeowners Association, Lakeview Estates Ratepayers' Association, Meadowvale Village Community Association, Meadow Wood Rattray Ratepayers Association, Mississauga - Kane Road Ratepayer's Association, Mississauga Oakridge Ratepayer's Association, Mississauga Road Sawmill Valley Ratepayers Association, Mississauga Resident's Association Network (MIRANET), Peel Environmental Youth Alliance (PEYA), Port Credit Village Residents Association, Streetsville Credit Valley Residents Association, Town of Port Credit Association, and Whiteoaks Lorne Park Community Association.

Economic and Business Development Organizations: Building Industry and Land Development Association (BILD), Chamber of Commerce / Tourism, Glen Schnarr & Associates, Mississauga Board of Trade, Port Credit Business Improvement Association and Streetsville Business Improvement Association.

Educational Organizations: Association for Canadian Educational Resources (ACER), Dufferin-Peel Catholic District School Board, Peel District School Board; Sheridan College (Sheridan Institute of Technology and Advanced Learning), Tutored by Nature and University of Toronto.

Environmental Organizations: Credit River Alliance (CRA), David Suzuki Foundation, EcoSource Mississauga, Environmental Defence, Evergreen Foundation, Halton Peel Biodiversity Network, Halton-Peel Stewardship Council, Nature Conservancy of Canada (NCC), Ontario Nature; Partners in Project Green, Peel Environmental Network, Peel Naturalists' Club, Rattray Marsh Protection Association, Riverwood Conservancy, Sierra Club and South Peel Naturalists' Club.

Federal and Provincial Government: Environment Canada (EC), Ministry of the Environment (MOE), Infrastructure Ontario, Ministry of Municipal Affairs and Housing (MMAH), Ministry of Natural Resources (OMNR) and Ministry of Transportation (MTO).

Municipal Governments, Local Conservation Authorities and Agencies: City of Brampton, City of Toronto, Credit Valley Conservation (CVC), Greater Toronto Airport Authority (GTAA), Halton Region Conservation (HRC), Region of Halton, Town of Caledon, Town of Milton, Town of Oakville, Region of Peel, Toronto and Region Conservation Authority (TRCA).

Recreational Groups / Organizations: Braeben Golf Course, Credit River Anglers Association, Credit Valley Golf and Country Club, Lakeview Golf Course, Mississauga Bassmasters, Mississauga Canoe Club, Mississauga Golf and Country Club and Toronto Golf & Country Club.

Utility Companies and Arboriculture Firms: Arborcorp Tree Service, Colonial Tree Care, Diamond Tree Care, Hydro One Networks Inc., Ontario Power Authority (OPA), Ontario Power Generation and Pineridge Tree Care.

Summaries of the input received from stakeholders and the community are provided in Appendices A and B to the NH&UFS under separate cover.

Special thanks are extended to Peel Region for providing project-specific technical support related to urban forest cover analyses.

EXECUTIVE SUMMARY

Value of the Urban Forest and Natural Areas

Mississauga's Urban Forest is fundamental to the City's environmental, social and economic well-being. The City's estimated 2.1 million trees provide millions of dollars' worth of environmental services such as pollution filtration and carbon storage annually (see table below), as well as many other ecosystem services.

Some of the ecosystem services provided by Mississauga's Urban Forest

Ecosystem Service	Estimated Amount (Dollar Value)*
Carbon Sequestration	7,400 tonnes annually ($220,000 estimated value)
Carbon Storage	203,000 tonnes ($5.8 million estimated value)
Air Pollution Removal	292 tonnes annually ($4.8 million estimated value)
Energy Consumption Reduction	79,000 MBTUS and 7,300 MWH annually ($1.2 million estimated value)

* estimates from the *City of Mississauga Urban Forest Study* (2011)

Additional valuable ecosystem services that the Urban Forest and Natural Heritage System in Mississauga provide but are harder to measure include:

- reducing exposure to ultraviolet radiation and extreme heat by providing shade and cooling
- encouraging active living
- providing social settings that tend to reduce incidences of crime
- supporting human health by reducing exposure to certain environmental risks, such as pollutants, and creating environments supportive of outdoors activities and recreation
- reducing mental fatigue by providing relaxing places and views
- building stronger communities by facilitating social interactions
- increasing the safety of community streets by calming traffic flow
- increasing the value of nearby homes, and
- increasing the attractiveness of commercial areas.

Rationale for an Urban Forest Management Plan (UFMP)

The development and implementation of an UFMP in Mississauga is a timely response to the challenges facing the City's Urban Forest and Natural Heritage System as the city moves into a phase of infill and intensification-based growth.

The pressures of redevelopment and intensification on existing trees and potential tree habitat are compounded by other environmental threats such as climate change-induced drought stress, and invasive pests and pathogens. However, effectively managing these challenges also provides opportunities for improving the sustainability of the Urban Forest and Natural Heritage System, which in turn creates a healthier community.

Key opportunities, as identified through this UFMP, include:

- pursuing proactive tree health and risk management on public lands and encouraging (and, where possible, supporting) it on private lands[1]

[1] One of the opportunities arising out of the invasion of emerald ash borer is the potential to replace infested ash with a greater diversity of native and non-invasive species, and ensure they are provided with adequate soil volume and quality.

- working with planners, engineers and architects to find planning and design solutions that can accommodate long-lived, and where possible, large-statured trees
- ensuring that some type of compensation is provided for trees that must be removed and that opportunities for naturalization are not overlooked
- ensuring that trees are given adequate above and below-ground soil volume and soil quality by introducing and enforcing minimum requirements, as well as working with other disciplines and partners to find creative ways to give trees space while still meeting other requirements
- managing highly invasive plant species, as well as tree pests and diseases
- planting a diversity of tree species, including those better adapted to warmer and drier conditions anticipated under climate change
- facilitating a paradigm shift towards understanding and managing the Urban Forest and Natural Heritage System as shared community assets and vital components of the city's infrastructure through an active promotional campaign and an expanded stewardship program targeted to City staff, external stakeholders and the community, and
- building on existing partnerships and forming new ones to access resources and funding outside the City's purview.

Relationship between the UFMP and the NH&UFS

The high level of overlap and interconnectedness between natural heritage and urban forest assets has been recognized through the inclusion of both within a joint strategy: the Natural Heritage & Urban Forest Strategy (NH&UFS), which was developed in tandem with this Urban Forest Management Plan (UFMP). The two stand-alone reports can generally be distinguished as follows:

- Natural Heritage & Urban Forest Strategy (NH&UFS): the overarching document for both natural heritage and the urban forest in Mississauga providing strategies related to planning, management, engagement and tracking, with an overall emphasis on strategic planning direction and implementation
- Urban Forest Management Plan (UFMP): a plan that focuses on the operational, technical and tactical aspects required to implement the broader strategies related to the Urban Forest as well as the Natural Heritage System, with an emphasis on management and stewardship

While the NH&UFS and UFMP are stand-alone documents, the NH&UFS should be read in conjunction with this UFMP for context. As a result of their interconnections and shared values, the same vision, guiding principles, and objectives were developed for both the NH&UFS and the UFMP, as follows:

Vision

Together we will protect, enhance, restore, expand and connect Mississauga's Natural Heritage System and Urban Forest to sustain a healthy community for present and future generations.

Guiding Principles

1. Act Now
2. First Protect - then Enhance, Restore and Expand
3. Maximize Native Biodiversity
4. Recognize and Build On Past and Current Successes
5. Learn From Our Past and From Others
6. View the Natural Heritage System and Urban Forest as part of the City's broader Green System
7. Understand the Value of the City's Green System and the Essential Ecological Services it Provides
8. Make Stewardship on Public and Private Lands Part of Daily Living
9. Integrate Climate Change Considerations in Natural Heritage and Urban Forest Planning
10. Protect, Enhance, Restore, and Improve Natural Connections
11. Track the State of the Natural Heritage System and Urban Forest, and Practice Adaptive Management
12. Recognize Natural Areas and the Urban Forest as Critical Components of the City's Infrastructure

Objectives

General Objectives

1. Increase internal (within the City) and external (among the community and other stakeholders) awareness of the value and need to protect, enhance, expand and restore the Natural Heritage System and the Urban Forest.
2. Expand the Natural Heritage System and Urban Forest by pursuing opportunities through the development application process, in-filling and re-development of public and private lands, and public acquisition.
3. Build on existing, and develop new, public and private sector partnerships to help pursue and implement the vision and targets for the Natural Heritage System and Urban Forest.
4. Undertake regular monitoring of the Natural Heritage System and Urban Forest to evaluate performance and identify trends or changes that may require a shift in management approaches or practices.

Objectives for Public Lands

5. Protect the Natural Heritage System and Urban Forest on public lands through proactive management, enforcement of applicable regulations, and education.
6. Enhance and restore the Natural Heritage System and Urban Forest on public lands by establishing service levels to improve: the condition of natural areas, linkages among protected natural areas, and tree establishment practices.
7. Support the Natural Heritage System and the Urban Forest by managing public open spaces to maximize their ecological functions (while maintaining their existing uses).

Objectives for Private Lands

8. Protect the Natural Heritage System and Urban Forest on private lands through education, implementation of applicable policies and regulations, the development review process and enforcement.
9. Enhance and restore the Natural Heritage System and Urban Forest on private lands by promoting stewardship, naturalization, restoration, tree planting and proactive tree care with creative outreach and incentives.

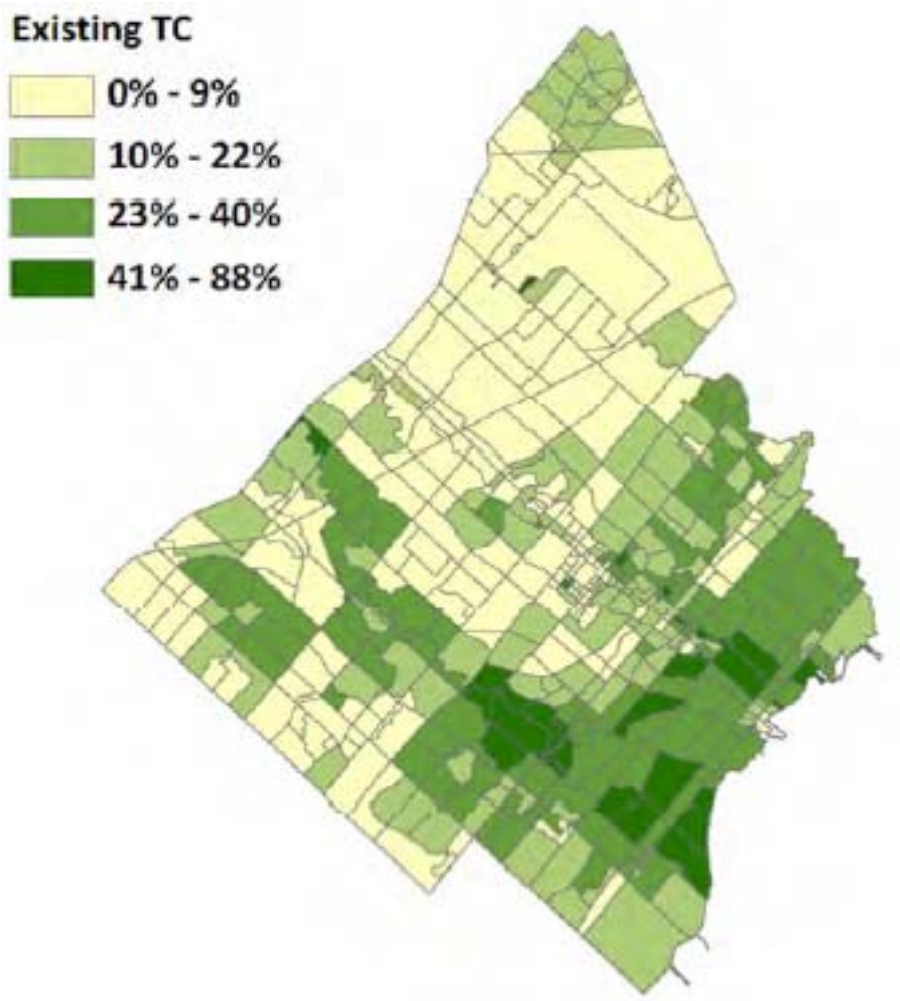
Plan (and Strategy) Monitoring and Review

The overall timeframe for this UFMP (and the umbrella NH&UFS) is a 20-year horizon (i.e., 2014 to 2033), and the targets and Actions have been developed in the context of this timeline. Targets for the Urban Forest and Natural Heritage System are identified, and explained, in the NH&UFS.

The recommended review and monitoring for Mississauga's Urban Forest (as per NH&UFS Strategy #26, and supporting UFMP Actions #1 and #2) should consist of:

1. a review and update of the monitoring framework for the Natural Heritage System and the Urban Forest (as provided in Appendix A of the UFMP)
2. a review of the status, timing and anticipated budgetary requirements of each NH&UFS Strategy and supporting UFMP Action (as identified in the Implementation Guides under separate cover), and
3. a summary of this information in a simplified, stand-alone format for release to City staff in all departments, Council and the community at least once every four years.

Notably, some of the more resource-intensive criteria (e.g., such as the collection of plot-based data) should not be re-assessed every four years, but rather should be re-examined every eight to 12 years.



Existing tree canopy cover (TC) by small geographic units (from *City of Mississauga Urban Forest Study*, 2011)

Recommended Actions

The following recommended actions have been developed with consideration of existing conditions and available resources, relevant best practices and precedents from the scientific and technical literature and other jurisdictions, recommendations from the studies completed by the Peel Urban Forest Working Group, and input from broad consultations with City staff and a range of stakeholders and representatives of the community.

The following 30 Actions have also been developed to provide more detailed technical, operational and/or tactical guidance regarding the implementation of a number of the Strategies identified within the broader Natural Heritage & Urban Forest Strategy (NH&UFS). The Strategies from the NH&UFS that relate to the UFMP Actions described in this Plan are identified below. Although each Action can be understood as part of this Plan, they are best understood within the broader context of the NH&UFS as well.

While the ultimate goal of the City's strategic urban forest management planning is to achieve sustainability for its Urban Forest and Natural Heritage System, targets and Actions developed are intentionally practical (i.e., considered achievable based on the existing conditions and analyses) and considered appropriate for the City's resource base. These Actions are also expected to be implemented under the City's leadership, but with the support of a wide range of external partners, as well as supplementary funding where available. These sources of support are identified in the UFMP Implementation Guide (under separate cover).

It has been recognized throughout the development of this Plan, and the broader NH&UFS, that although there are a number of actions the City can take to help achieve Urban Forest and Natural Heritage System objectives in Mississauga, because so much of the City's natural heritage and urban forest assets reside on private lands, it is ultimately the community (including homeowners, tenants, businesses, schools, institutions, etc.) who will determine the extent to which this Plan, and the umbrella NH&UFS, are successful. Although found in the last section of this Plan, actions intended to support education, communication, promotion and partnerships are considered among the most important.

URBAN FOREST PROGRAM ADMINISTRATION

- Action #1: Adopt the monitoring framework developed for Mississauga's Natural Heritage System and Urban Forest *(provides support to NH&UFS Strategy #26)*
- Action #2: Monitor the status of the Natural Heritage System and the Urban Forest with support from the Region, local agencies and other partners *(provides support to NH&UFS Strategy #26)*

- Action #3: Formalize involvement of City Forestry staff in City planning and information sharing related to trees and Natural Areas *(provides support to NH&UFS Strategy #1)*
- Action #4: Develop consistent and improved City-wide tree preservation and planting specifications and guidelines *(provides support to NH&UFS Strategies #14 and #15)*
- Action #5: Update the inventory of City street and park trees, and keep it current *(provides support to NH&UFS Strategy #15)*

TREE AND NATURAL AREA HEALTH AND RISK MANAGEMENT

- Action #6: Optimize street and park tree maintenance cycles *(provides support to NH&UFS Strategy #15)*
- Action #7: Implement a young street and park tree maintenance program *(provides support to NH&UFS Strategy #15)*
- Action #8: Develop and implement a street and park tree risk management protocol *(provides support to NH&UFS Strategy #15)*
- Action #9: Develop a pest management plan for the Urban Forest *(provides support to NH&UFS Strategy #15)*
- Action #10: Undertake targeted invasive plant management in the Natural Heritage System *(provides support to NH&UFS Strategies #11 and #16)*

TREE ESTABLISHMENT, NATURALIZATION AND URBAN FOREST EXPANSION

- Action #11: Develop a targeted Urban Forest expansion plan *(provides support to NH&UFS Strategies #11 and #13)*
- Action #12: Implement a targeted Urban Forest expansion plan *(provides support to NH&UFS Strategies #11 and #13)*
- Action #13: Track and recognize naturalization / stewardship initiatives on public and private lands *(provides support to NH&UFS Strategies #11 and #12)*
- Action #14: Implement and enforce improved tree establishment practices on public and private lands *(provides support to NH&UFS Strategies #15 and #20)*

TREE PROTECTION AND NATURAL AREA MANAGEMENT

- Action #15: Update the Public Tree Protection by-law *(provides support to NH&UFS Strategy #8)*
- Action #16: Update the Erosion Control, Nuisance Weeds and Encroachment by-laws *(provides support to NH&UFS Strategy #8)*
- Action #17: Review the Private Tree Protection By-law and update as needed *(provides support to NH&UFS Strategy #8)*
- Action #18: Increase effectiveness of tree preservation as part of private projects *(provides support to NH&UFS Strategies #14, #18 and #20)*
- Action #19: Increase effectiveness of tree preservation as part of municipal operations and capital projects *(provides support to NH&UFS Strategies #14, #18 and #20)*
- Action #20: Develop and implement Conservation Management Plans for City-owned Significant Natural Areas *(provides support to NH&UFS Strategy #16)*

PROMOTION, EDUCATION, STEWARDSHIP AND PARTNERSHIPS

- Action #21: Create, post and promote short video clips on topics and issues related to he Natural Heritage system and Urban Forest *(provides support to NH&UFS Strategies #19 and #22)*
- Action #22: Make the City's tree inventory publicly accessible to support outreach, education and stewardship *(provides support to NH&UFS Strategy #19)*
- Action #23: Improve and maintain awareness about current Natural Heritage System and Urban Forest policies, by-laws and technical guidelines *(provides support to NH&UFS Strategies #1 and #20)*
- Action #24: Continue to support and expand targeted stewardship of local business and utility lands *(provides support to NH&UFS Strategy #21)*
- Action #25: Continue to support and expand targeted engagement of youth and stewardship of school grounds *(provides support to NH&UFS Strategy #21)*
- Action #26: Continue to support and expand targeted engagement of residents and community groups, and stewardship of residential lands *(provides support to NH&UFS Strategy #21)*
- Action #27: Continue to work with various partners to undertake stewardship on public lands *(provides support to NH&UFS Strategy #21)*
- Action #28: Design and operate a City Arboretum / Memorial Forest for the community that provides a place for spiritual connections to nature *(provides support to NH&UFS Strategy #21)*

- Action #29: Partner with local agencies and institutions to pursue shared research and monitoring objectives *(provides support to NH&UFS Strategy #23)*
- Action #30: Build on existing partnerships with the Region of Peel and nearby municipalities to facilitate information sharing and coordinated responses *(provides support to NH&UFS Strategy #23)*

Implementation

A stand alone Implementation Guide for the UFMP has been developed that is designed to facilitate implementation by:

- providing recommended timing for implementation
- identifying City department(s) or division(s) that will lead the implementation
- listing the key implementation components
- identifying which Actions require new City resources for their implementation, and
- indicating which groups or organizations could provide potential partnerships and/or resources and/or funding.

The current new budget identified through this UFMP Implementation Guide is $2,866,970 including two seasonal staff and two students to support expanded stewardship efforts starting in the second four year period (i.e., 2018). The resource requirements are spread across the 20 year period of the Plan as follows:

- 2014 – 2017: $915,000
- 2018 – 2021: $291,710
- 2022 – 2025: $603,420
- 2026 – 2029: $453,420
- 2030 – 2033: $603,420

The primary areas requiring new resources are:

- updating and maintaining the City's street and park tree inventory (the primary tool for ensuring proactive and effective management of the City's treed assets) – projected for 2014 to 2017
- development of a City-wide pest management plan, and implementation of targeted invasive plant management in the City's most valued Natural Areas, and
- expansion of stewardship efforts on lands not under the City's jurisdiction (e.g., schools, commercial and industrial open spaces, residential lots, etc.) in partnership with the Region, local conservation authorities, businesses, academic institutions, community groups, and others.

Although the NH&UFS and UFMP are each stand-alone documents with their own Implementation Guides, effective implementation of this UFMP will require coordination with implementation of the NH&UFS, as well as adequate funding. This allocation of funds is a cost-effective and necessary investment into Mississauga's sustainability. This investment recognizes that the City's continued growth and economic development are reliant on and enhanced by a healthy Natural Heritage System and Urban Forest within the city, and beyond, and will help ensure the physical and mental well-being of the community, while also helping Mississauga mitigate and adapt to climate change.

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

Mississauga's urban forest is fundamental to the City's environmental, social and economic health. The City's estimated 2.1 million trees provide valuable ecosystem services such as pollution filtration, flood control, and carbon storage, as well as many other benefits to mental and physical health, and many economic spin-offs.

Mississauga's Urban Forest currently has an overall canopy cover of about 15%. These trees remove an estimated 292 tonnes of ozone from the atmosphere annually, reducing ambient ground level ozone during the day by about 12 parts per billion (ppb).

Data from 2008 indicate that ozone levels in parts of the city remain well above "safe" thresholds set by Health Canada for most of the day (i.e., between 10 am and 8 pm). Increasing the City's Urban Forest cover can effectively reduce the time which ozone levels are above safe levels, and help the community breathe easier.

Toronto Region Conservation (through the Peel Urban Forest Working Group)

However, trees in an urban setting cannot sustain themselves and face many challenges to successful establishment and long-term growth. To be effectively sustained, an urban forest requires planning, management and stewardship that considers the protection, maintenance, replacement and integration of trees a priority. This Urban Forest Management Plan (UFMP), along with the "umbrella" Natural Heritage & Urban Forest Strategy (NH&UFS) document, is intended to provide the strategic and technical guidance required to ensure the sustainability of Mississauga's urban forest.

Investments in the health and longevity of existing trees, and to expand the urban forest will, over time, result in the provision of greater and more widespread urban forest benefits. These benefits will become increasingly important and valuable as Mississauga's population, which is currently more than 740,000, continues to increase.

This UFMP was developed as part of a unique municipal approach of looking at the City's Urban Forest and Natural Heritage System in an integrated way so that opportunities for protecting, enhancing, restoring and expanding both of these assets could be considered together. As a result of this approach, the UFMP takes its direction from the vision, guiding principles, and objectives of the NH&UFS and provides more detailed technical, operational and tactical guidance for many of the Strategies identified in the NH&UFS through the 30 Actions identified in this Plan.

The UFMP Actions are intended to improve the health, sustainability and performance of the urban forest on both private and public lands by being more proactive and innovative about administration, health and risk management, establishment and expansion, protection, engagement and stewardship related to trees and the urban forest as a whole.

This UFMP has been developed:

- based on a comprehensive review of the City's current policies, practices and resources
- by building on the canopy cover data and analyses conducted and provided by the Peel Urban Forest Working Group[2]
- with consideration for the findings and recommendations presented in the *Peel Region Urban Forest Strategy* (2011) and the *City of Mississauga Urban Forest Study* (2011), developed by Toronto Region Conservation with support from the Peel Urban Forest Working Group
- with consideration for relevant best management practices and precedents in other jurisdictions, and in the scientific and technical literature, and
- with input from City staff, a wide range of stakeholders[3], and members of the community.

The following key considerations have shaped the development of this UFMP:

- Mississauga is almost entirely built-out, with future development expected to be largely through infill and intensification.
- There will be considerable challenges involved in protecting and maintaining the city's current tree cover under existing and anticipated conditions (as described in Section 2).
- Although the City is responsible for hundreds of thousands of trees on its streets and in its parks and open spaces, more than half of Mississauga's existing urban forest canopy is on private lands, and the majority of the opportunities for planting additional trees are on the landscaped areas of the city's private residential, commercial and industrial lands.
- Mississauga has been gradually building and improving its capacity to implement proactive urban forestry policies, practices and programs over the past two decades. As such, there are a number of innovative policies and successful programs to build on.

This UFMP is intended for use by City staff to guide the planning and implementation of actions to achieve strategic objectives, and to be a resource for City staff and stakeholders to become better informed about the importance of the urban forest, challenges to urban forest health and sustainability, and what can be done to manage this valuable asset proactively and effectively.

1.1 DEFINING THE URBAN FOREST

The 'urban forest' is generally understood to be all the trees in a given urban or urbanizing jurisdiction. However, this UFMP recognizes that other components (such as the above and below-ground growing conditions) must also be considered if management is to result in genuine enhancement and expansion of the urban forest, and related increases in benefits and services. As such, this UFMP adopts the definition of the urban forest from the *Peel Region Urban Forest Strategy* (2011), which defines the urban forest as: "*a dynamic system that includes all trees, shrubs and understory plants, as well as the soils that sustain them, located on public and private property*".

In accordance with this definition, a successful urban forest management program must consider more than just trees in both strategic initiatives and daily operations. Consequently, this UFMP considers a wide range of topics beyond tree maintenance, such as urban planning, infrastructure development, natural areas connectivity, naturalization, public education, and partnerships, among others.

The Urban Forest as Green Infrastructure

The Urban Forest is a key component of what is called the City's "green infrastructure". A city's "grey" infrastructure is generally understood to be the sewage and water systems, waste management systems, electric power generation and transmission networks, communication networks, transit and transportation corridors, and energy pipelines that provide all the services required for modern day living. However, it is increasingly becoming recognized that trees (as well as untreed open spaces and natural areas) also provide a

[2] The Peel Urban Forest Working Group, formed after the development of the *Peel Region Urban Forest Strategy* (2011), includes representatives from the Region of Peel, City of Mississauga, City of Brampton, Town of Caledon, Credit Valley Conservation and Toronto Region Conservation with expertise in urban forestry.

[3] Stakeholders consulted as part of the joint development of the NH&UFS and the UFMP include representatives from aboriginal organizations, government and agencies (including adjacent municipalities and local conservation authorities), committees to City Council, local educational institutions, environmental groups, community groups and residents associations, recreational facilities, business and development organizations, local utilities and transit, and arboriculture firms. Summaries of input received through these consultations are provided in the NH&UFS (Appendices A and B).

number of essential and highly desirable services and benefits that facilitate modern life, particularly in urban areas. These components have been labelled "green infrastructure" to highlight their functional value in a way that is comparable to the built "grey infrastructure". Specific examples are illustrated in **Table 1**.

Table 1. Examples of grey versus green infrastructure

Grey Infrastructure	Green Infrastructure
• Buildings • Roads, highways and parking lots • Storm and sanitary sewer lines • Public utilities (e.g., hydroelectric lines and stations, natural gas lines, water pipes and filtration plants)	• Trees, shrubs and soil • Rain gardens and naturalized swales • Wetlands (constructed and natural), woodlands and meadows • Green roofs and living walls • Engineered soils and permeable pavement

1.2 CONTENT OF THE UFMP AND RELATIONSHIP TO THE NH&UFS

The content of this UFMP is as follows:

- a framework for monitoring both the Natural Heritage System and the Urban Forest (**Section 1.3**)
- an overview of the state of Mississauga's Urban Forest (**Section 2**)
- a summary of the value of Mississauga's Urban Forest (**Section 3**)
- an overview of challenges to Urban Forest sustainability (**Section 4**)
- the vision, guiding principles, objectives and targets for the Plan (**Section 5**)
- a review of Mississauga's current practices and programs (**Section 6**)
- relevant best practices and opportunities for improvement (**Section 7**)
- recommended Actions (and related NH&UFS Strategies) (**Section 8**)
- implementation guidance (**Section 9**), and
- a glossary of key technical terms (**Section 10**).

The City's NH&UFS identifies opportunities for protecting, enhancing, restoring and expanding both the Natural Heritage System and Urban Forest together. These opportunities, and strategies for implementing them, are identified in this NH&UFS. However, in order to implement some aspects of the Strategy, the City requires more specific technical, operational and tactical guidance. This guidance as it relates to Urban Forest and Natural Areas management and stewardship is provided in this UFMP.

As a result of this close relationship between the two documents: (a) the NH&UFS and UFMP share the same vision, guiding principles, objectives, and targets, and (b) many of the NH&UFS Strategies are supported by UFMP Actions (as indicated in **Section 8**), which are detailed in this report.

1.3 UFMP STRUCTURE, REVIEW AND MONITORING FRAMEWORK

The overall timeframe for this UFMP is a 20-year horizon (i.e., 2014 to 2033), and the targets and Actions have been developed in this context. The 20-year planning framework for this UFMP is divided into three tiers to support an adaptive management approach, as per **Figure 1**.

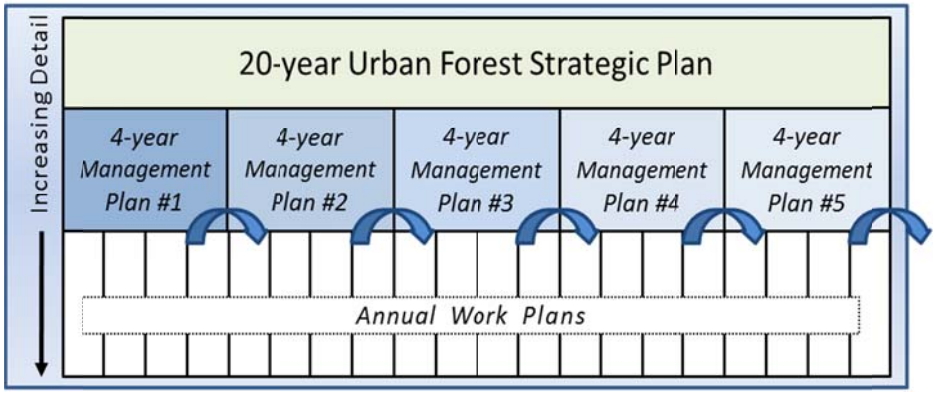


Figure 1. Framework for implementation of Mississauga's Urban Forest Management Plan

Tier 1: 20-year Strategic Direction (2014-2033)

- Identifies a long-term vision, guiding principles and strategic objectives
- Sets targets to be achieved in the 20-year period
- Reviews current practices in Mississauga
- Considers best practices from technical and scientific literature
- Identifies opportunities to improve Mississauga's urban forest management practices and programs that are appropriate for the City's context and in line with the long-term vision

Tier 2: Five Four-year Management Plans (2014-2017, 2018-2021, etc.)

- Links guiding principles and long-term objectives with daily practices and on-the-ground operations
- To be implemented by the appropriate departments (i.e., Parks and Forestry, Planning and Building. and Transportation and Works)
- To be tied to recommended budgets and current priorities, but developed with the longer-term vision in mind, as laid out in the UFMP
- To be reviewed and updated at the end of every 4th year of implementation and updated in response to objectives met, as well as those yet to be met, and changes in existing conditions while maintaining the overall objectives of the Plan.

Tier 3: Annual Operating Plan (AOP)

- Provides the applied and specific guidance for day-to-day operations
- Includes operational plans for planting, pruning, removals, inspections, inventory maintenance and public engagement/outreach
- Considers budgets and current priorities, but developed with consideration for the vision and objectives, as outlined in the Four-year Management Plans and the UFMP

This UFMP is the "Tier 1" plan. The City's Forestry Division will take the lead on developing the Tier 2 and Tier 3 plans related to this UFMP. This structure will help ensure that the UFMP is treated as a 'living document' through built-in periodic plan assessment and review cycles, further described below.

The 20 year time frame for this Plan aligns with the 20 year time frame for the broader NH&UFS, and also:

- is considered an appropriate time frame to enable implementation and document substantial changes in urban forest cover and sustainability, but not so long as to lose sight of long-term objectives
- coincides with the 20 year time frame for the One Million Trees Program and with the *Future Directions Master Plan for Parks and Natural Areas* (2009) time frame which extends to 2031, and
- falls within the City's broader 50 year strategic planning horizon .

After the 20 year period for this Plan (and the related NH&UFS), it is anticipated that both the overall Strategy and the UFMP will undergo a comprehensive review and update, and a new NH&UFS and UFMP will be developed for the subsequent 20 years.

Adaptive Management

Natural forested ecosystems are complex and dynamic entities, and urban forests have the added complexity of being heavily influenced by human activities. In this context, it is difficult for urban forest managers to anticipate changes or events (such as ice storms or pest infestations) that they may have to accommodate. Available resources can also change. For this reason, the concept of active adaptive management is firmly embedded in this UFMP (and the broader NH&UFS).

What is Active Adaptive Management?

A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices. In active adaptive management, management is treated as a deliberate experiment for the purpose of learning.

United Nations Millennium Ecosystem Assessment, 2005

Adaptive management is embedded in both the NH&UFS and the UFMP through the following recommendations for monitoring and regular review (as per NH&UFS Strategy #25, and supporting Actions #1 and #2):

- Adopt the monitoring framework developed for the NH&UFS, and the supporting UFMP (see **Appendix A**), and use the criteria and indicators in this framework as a basis for assessing the status of the City's Natural Heritage System and Urban Forest, as well as the status of planning, management and engagement related to these assets, and
- Summarize and report on the state of the City's Natural Heritage System and Urban Forest once every four years In addition, the implementation guidance for the UFMP (as described in **Section 9**) has been developed as a separate document so that it can be revised as needed in response to new information and/or changes in priorities and/or resource availability.

Review and Monitoring Framework

Kenney et al., 2011[4] built on a previous framework (from 1997) to develop a comprehensive suite of 25 criteria and indicators designed to monitor key aspects the urban forest. This monitoring framework fully recognizes the important role of people in urban forest sustainability in that it has criteria related to the (1) state, (2) management, and (3) stewardship of the urban forest. Each criterion can be assessed as "low", "moderate", "good" or "optimal" using technical indicators based on the current science (where the data is available) or measures of success relative to what is possible in a given jurisdiction. This framework has been adapted and expanded, in consultation with the original paper authors, for the NH&UFS (see **Appendix A**) to include criteria and indicators related to the Natural Heritage System, and tailored to incorporate targets that consider Mississauga's current and projected land use context for the next 20 years.

The recommended review and monitoring for Mississauga's Urban Forest (as per NH&UFS Strategy #25, and supporting UFMP Actions #1 and #2) should consist of:

1. **a review and update of the monitoring framework for the Natural Heritage System and the Urban Forest (as provided in Appendix A)**
2. **a review of the status, timing and anticipated budgetary requirements of each NH&UFS Strategy and supporting UFMP Action (as identified in the Implementation Guides under separate cover), and**
3. **a summary of this information in a simplified, stand-alone format for release to City staff in all departments, Council and the community at least once every four years.**

Notably, some of the more resource-intensive criteria (e.g., such as the collection of plot-based data) should not be re-assessed every four years, but rather should be re-examined every eight to 12 years.

[4] Kenney, W.A., van Wassenaer, P.J. and A. Satel. 2011. Criteria and Indicators for Strategic Urban Forest Planning and Management. Arboriculture & Urban Forestry, Volume 37, Number 3 April 2011 pp 108-117.

2 STATE OF MISSISSAUGA'S URBAN FOREST

In 2011, Toronto and Region Conservation in partnership with the Region of Peel, Credit Valley Conservation, and the local area municipalities of Mississauga, Brampton and Caledon, developed the *Peel Region Urban Forest Strategy* as well as more technical urban forest studies for the urban areas within each of the area municipalities (i.e., the entire City of Mississauga, the City of Brampton's Urban System area, and the rural Service Centres of Bolton and Caledon East in the Town of Caledon)[5]. These technical urban forest studies used the United States Department of Agriculture Forest Service's i-Tree Eco field sampling methodology combined with satellite imagery analysis and computer modeling tools to compile data about the Region's urban forest (e.g., approximate tree cover and distribution, tree age size/class distribution, tree species diversity) and estimate the value of some of the services provided by the urban forest (see **Section 3**).

The *Peel Region Urban Forest Strategy* (2011) and associated *Mississauga Urban Forest Study* (2011), along with subsequent studies, have found that:

- there are approximately 2.1 million trees in Mississauga,
- Mississauga's current urban forest canopy cover is approximately 15%[6] (see **Figure 2**)
- most of Mississauga's trees are in relatively good health, but small in stature
- the dominant trees in the city are maples and ash, with ash accounting for about 18% of the trees in residential areas and 10% of the street trees, and
- more than half of the city's canopy cover is located in residential areas, and almost a third of the city's canopy cover is found in woodlands in the City's Natural Areas System (hereto referred to in this Plan as the Natural Heritage System), with the remaining canopy cover scattered across institutional, commercial, industrial and other land uses.

[5] These six municipal and agency partners joined to form the Peel Urban Forest Working Group following development of the *Peel Region Urban Forest Strategy* (2011). This group has provided both technical support for and input to this UFMP.

[6] Based on imagery from 2011

Historical Land Use Context

Mississauga's Urban Forest is largely shaped by land use patterns and the history of development across the City's more than 290 square kilometres. Prior to the arrival of Europeans, the lands in and around Mississauga were home to a number of aboriginal tribes such as the Ojibway (Anishanabe), who farmed, fished and hunted within the area's diversity of woodlands, wetlands, grasslands and rivers. Starting in the 1800's, a number of European settlements were established (e.g., Clarkson, Cooksville, Dixie, Lorne Park, Malton, Meadowvale, Port Credit, Streetsville and Summerville) and the area was quickly dominated by resource extraction and agricultural land uses. This included logging which resulted in the removal of much of the area's woodlands. The next major transition, which has occurred since the 1950's, was from agriculture to urbanization, with construction of major transit routes (i.e., Highways 401, 403 and – most recently - 407) and a related surge of industrial, commercial and residential development.

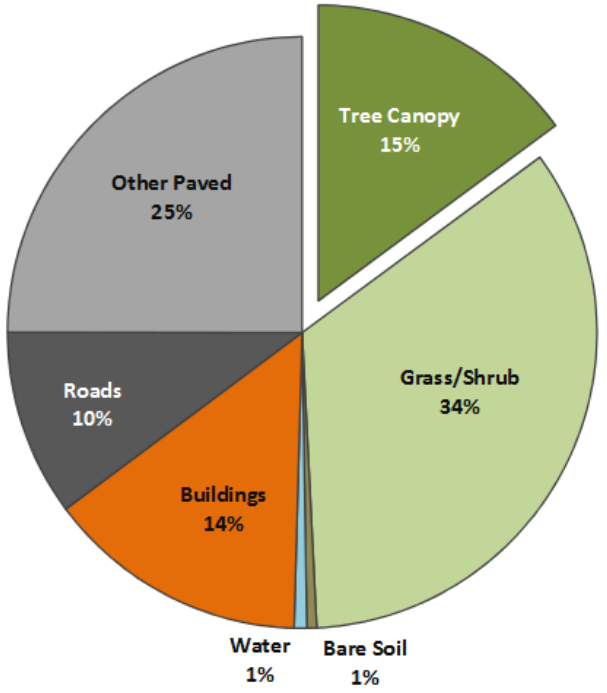


Figure 2. Land cover estimates in Mississauga
(from *City of Mississauga Urban Forest Study*, 2011)

Current Land Use Context and Canopy Cover Distribution

Today, trees are found across the city along its right-of-ways and within parks and Natural Areas, as well as residential yards, school grounds, and the landscaped grounds of commercial and industrial lots. These trees are found in either Natural Areas that have regenerated through active or passive management, or in landscaped areas where they have been planted.

From an urban forestry perspective, the city's landscape ranges from older lakeside and riverfront residential communities with relatively high levels of canopy cover (such as Port Credit, Mineola and Clarkson-Lorne Park) to the industrial parks and commercial areas with relatively low levels of urban forest canopy. In more recently developed subdivisions (such as Meadowvale, Lisgar and Malton) trees have been planted in boulevards, yards and parks, but the extent to which these will mature into large, canopied trees remains to be seen. The City's roadways vary from quiet neighbourhood streets to high-speed, high-capacity thoroughfares. Opportunities for tree protection along transit corridors have been limited, particularly along the major corridors, but efforts over the past few decades to try and work with the applicable authorities to integrate trees (and other vegetation) along utility and transportation rights-of-ways (where it does not compromise safety considerations) has resulted in more tree planting and naturalization projects.

Current analyses indicate that Mississauga's Urban Forest canopy cover was approximately 15% in 2011 (*City of Mississauga Urban Forest Study* 2011), with most of this canopy in older residential areas, open spaces and natural areas. The total tree canopy cover is shown in **Figure 2**, and the variability in tree canopy cover in different parts of the city is shown in **Figure 3**.

Like most urban forests, Mississauga's is comprised of trees of a range of species, age/size classes, and health/condition categories. However, development of most of the land base means that natural regenerative processes no longer govern the structure of most of the urban forest. Instead, tree selection and planting by City staff and private property landowners determines what kinds of trees grow within the city, and where. A summary of the diversity, age / structure and condition of Mississauga's urban forest is provided below.

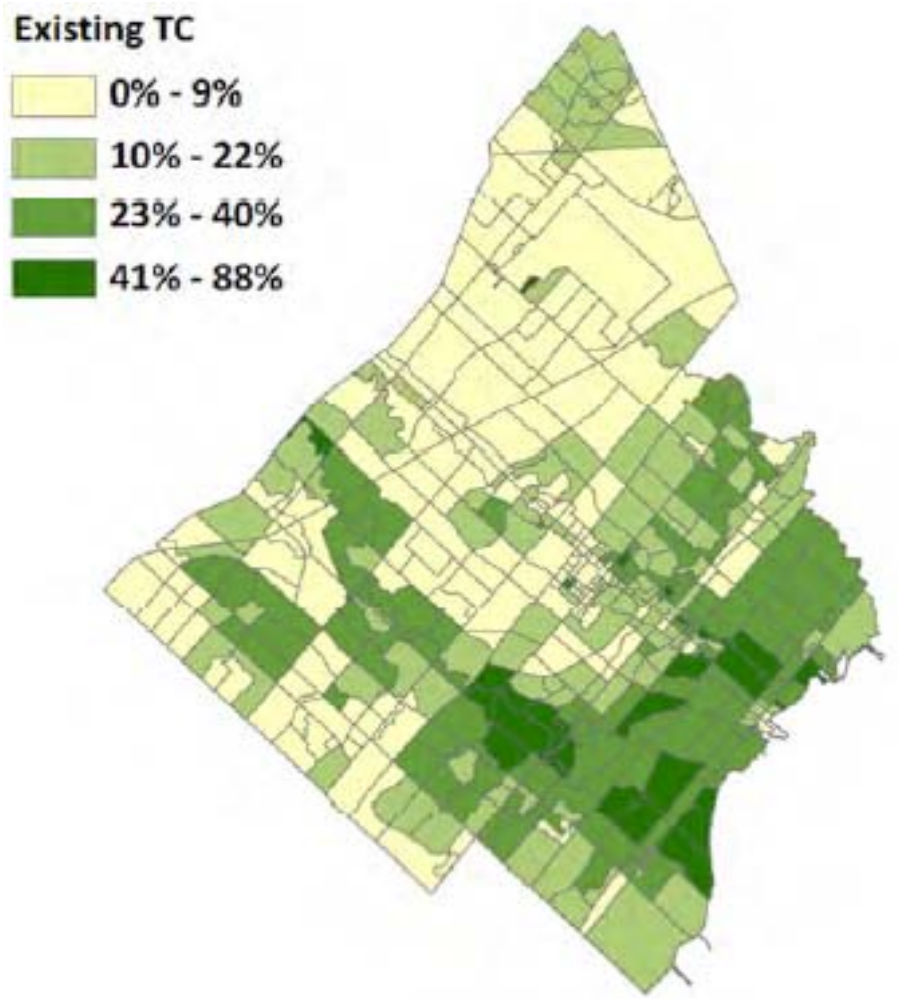


Figure 3. Existing tree canopy cover (TC) by small geographic units
(from *City of Mississauga Urban Forest Study*, 2011)

Diversity

Mississauga's Urban Forest Study (2011) found that although there are 234 different tree species and cultivars in Mississauga's street tree population, the overall diversity of the urban forest is relatively low. The top five most common tree species, by leaf area[7], include sugar maple, Norway maple, Manitoba maple, green ash and white ash. Maples together comprise over one-third of tree species across the city, and both Norway and Manitoba maples are considered invasive. This relatively low level of tree species diversity leaves the City vulnerable to pests such as Asian longhorned beetle (ALHB)[8] or emerald ash borer (EAB)[9] that target certain species or genera of trees.

Data generated from the City's street tree inventory (completed in 2006) indicates that the diversity of the City's street trees (as illustrated in **Figure 4**) is similarly low, with four species (i.e., Norway maples, green ash, little leaf linden and honey locust) accounting for almost half of all species planted (by stem count) and many of the most dominant species being invasive (i.e., Norway maples account for 22% of the City's street trees).

Age/Size

The majority of Mississauga's trees are relatively small. In 2011 more than 60% of trees in the City were less than 15.3 cm in diameter[10], showing an Urban Forest structure dominated by younger trees. The largest trees are mainly found in older neighbourhoods and Natural Areas. Many of the recently developed residential areas dominated by smaller trees do not receive the same level of ecosystem services (see **Section 3**) as more established neighbourhoods. The uneven canopy cover distribution is illustrated in **Figure 3**.

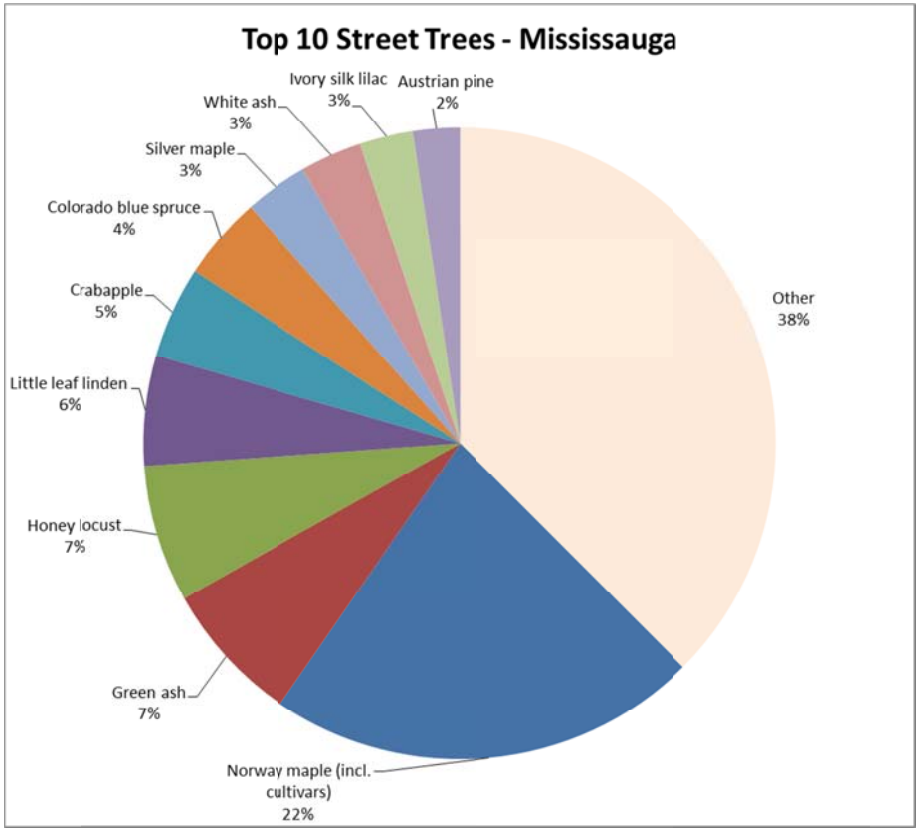


Figure 4. Representation of the diversity of Mississauga's street trees (by stem count)

Condition

Most of Mississauga's trees are estimated to be in good to excellent condition (*Mississauga's Urban Forest Study* 2011). Similarly, street tree inventory data from 2006 show that 73% of the City's street trees were in good condition, and only 5% were in poor condition. This is a positive indicator but also reflects the relatively young age and small stature of most trees in the city. It is likely that as trees age and younger trees in newer developments reach the limits imposed by their difficult growing sites, tree health and condition across the city will decline and more effort to maintain and improve tree condition will be needed.

[7] The abundance of trees can be measured in several ways, but the two most commonly used are by stem (i.e., by individual tree) or by leaf area (i.e., the approximate amount of area occupied by a given tree's leaves). Leaf area can be useful because it reflects the volume of a given species as opposed to simply the number of specimens.

[8] Despite the effectiveness of sustained government efforts in achieving localized eradication in parts of the GTA, the pest has recently been confirmed near Pearson International Airport.

[9] EAB, which has already been confirmed as established and spreading in the city, threatens about 10% (more than 27,400), of the City's street trees, and many thousands more in its parks, Natural Areas and on other public and private lands.

[10] Tree diameter is typically measured as "diameter at breast height" (DBH), which is translated as 1.3 m to 1.4 m above the ground.

3 VALUING MISSISSAUGA'S URBAN FOREST

The ecosystem services[11] provided by trees and green spaces in urban areas are well-documented in the scientific and technical literature[12], and are more broadly described in Section 4 of Mississauga's NH&UFS. The fundamental message from more than a decade of research is that trees in cities are more than just something nice to look at; they are critical assets (just like roads, buildings, and water lines) that provide a wide range of services that make cities healthy and vibrant places to live. While the air quality and cooling benefits of trees are well-established, there is also mounting evidence that trees (both within and outside of natural areas) directly improve human physical and mental health. This information has not been lost on schools where "outdoor classrooms" and wilderness courses are becoming a more mainstream component of the curriculum.

The Urban Forest in Mississauga provides a wide range of environmental, social and health, and economic benefits that accrue to all those who live and work in the city, and beyond. Trees and shrubs not only clean the air and water, they also moderate local climate fluctuations, reduce energy consumption in homes and buildings, store atmospheric carbon (which contributes to climate change), provide shade, control stormwater runoff, and provide habitat for local and migrating wildlife. Trees and natural areas in neighbourhoods also contribute to increased property values, sustain human mental and physical health, and support safer communities. This section of the UFMP presents an overview of these environmental services and benefits.

[11] "Ecosystem services" is a term used to describe the processes of nature needed to support the health and survival of humans. Ecological services are required and used by all living organisms, but the term typically refers to their direct value (quantified or not) to humans. Ecosystem services include processes such as air and water purification, flood and drought mitigation, waste detoxification and decomposition, pollination of crops and other vegetation, carbon storage and sequestration, and maintenance of biodiversity. Less tangible services that have also been associated with natural areas and green spaces include the provision of mental health and spiritual well-being. "Ecosystem goods" are products provided by nature such food, fibre, timber and medicines that are readily valued as recognizable products that can be bought and sold, unlike ecosystem services which are harder to value and in our current market economy are considered "free".

[12] A comprehensive listing and summary of the published scientific and technical literature on this subject can be viewed at websites such as the USDA Forest Services' "Green Cities" site at www.depts.washington.edu/hhwb/

3.1 ENVIRONMENTAL SERVICES

Table 2. Some of the ecosystem services provided by Mississauga's urban forest

Ecosystem Service	Estimated Amount (Dollar Value)*
Carbon Sequestration	7,400 tonnes annually ($220,000 estimated value)
Carbon Storage	203,000 tonnes ($5.8 million estimated value)
Air Pollution Removal	292 tonnes annually ($4.8 million estimated value)
Energy Consumption Reduction	79,000 MBTUS and 7,300 MWH annually ($1.2 million estimated value)

* estimates from the *City of Mississauga Urban Forest Study* (2011)

Recent assessments (*City of Mississauga Urban Forest Study* 2011) estimate that the city's urban forest has a basic replacement value[13] of $1.4 billion, and provides more than $6 million worth of environmental services every year, as well as many other benefits that are equally (or more) valuable but cannot be as readily quantified. These include:

- improving stream water quality (e.g., by reducing surface runoff rates and cooling water temperatures)
- reducing high urban air temperatures in the summer (through shading and evapotranspiration) (see **Figure 5**)
- reducing energy usage by shading buildings and vehicles in the summer and buffering the effects of cold winds in the winter
- conserving soil resources by stabilizing slopes and intercepting water with root networks, and
- providing habitat for urban wildlife such as mammals, birds, as well as aquatic species (e.g., by providing riparian cover).

[13] The basic "replacement value" (also known as the basic structural value) is the estimated cost of simply replacing every tree in the city with young nursery tree stock.

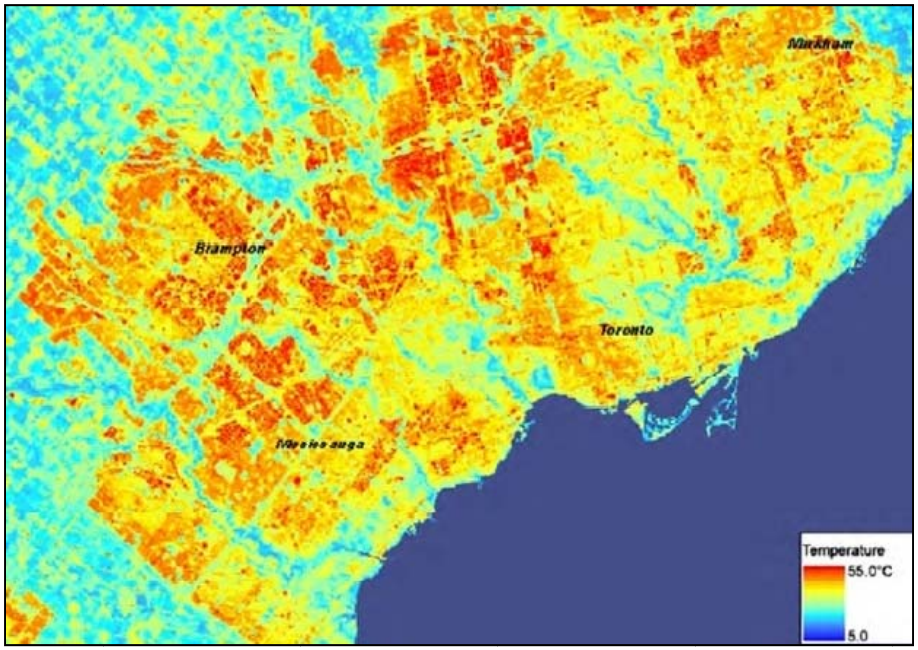


Figure 5. Land surface temperature, Greater Toronto Area, July 2008, showing summer time "hot spots" in urban areas
(from *City of Mississauga Urban Forest Study*, 2011)

Climate Change Adaptation and Mitigation

Among the most important environmental services provided by a healthy urban forest are climate change adaptation and mitigation[14]. By moderating local temperatures through shading and evapotranspiration, removing pollution from the air, and moderating storm water flows, Mississauga's trees help the community adapt and be more resilient to climate change. Trees also sequester and store carbon, thereby reducing the concentrations of this greenhouse gas in the atmosphere, and potentially helping to mitigate the impacts of climate change.

[12] Climate change "adaptation" refers to adjustments in natural or human systems made in response to actual or expected climate change effects; "mitigation" are initiatives and measures taken to reduce the vulnerability of natural or human systems to actual or expected climate change effects.

3.2 SOCIAL AND HEALTH BENEFITS

Trees provide important community and human health benefits, particularly in urban areas where population densities are greater. These benefits include:

- reducing exposure to ultraviolet radiation and extreme heat by providing shade and cooling
- encouraging active living
- providing social settings that tend to reduce incidences of crime
- supporting human health by reducing exposure to certain environmental risks, such as pollutants, and creating environments supportive of outdoors activities and recreation
- reducing mental fatigue by providing relaxing places and views
- building stronger communities by facilitating social interactions, and
- increasing the safety of community streets by calming traffic flow.

Studies have shown that exposure to treed and natural areas can improve recovery after surgery, reduce stress and improve learning and creativity. Reductions in property crimes in residential areas with street trees and vegetation, and 5% to 20% decreases in motor vehicle accidents on roads with trees on the roadsides, have also been documented. Many of these community and health benefits are difficult to quantify in dollar values, but contribute to making Mississauga a liveable community.

3.3 ECONOMIC BENEFITS

Although trees in cities are not generally grown for their timber value, or for generation of products that can be bought and sold, trees in urban forests are good for the local economy. Studies have demonstrated that:

- The presence of large trees in yards and streetscapes can add between 3% and 15% to the value of homes, even if the trees are on neighbouring properties
- Homes on wooded lots typically sell faster than comparable untreed properties, and
- Shoppers express a willingness to pay, on average, between 9% and 12% more for goods and services in well-treed business districts, and are also willing to travel longer distances to such areas.

Recent movements for re-introducing agriculture into urban environments also present opportunities for considering the potential value of tangible goods produced by some trees such as edible fruits and nuts, as well as maple syrup. In addition, at the end of their life spans, urban trees can become valuable and highly-sought after wood products, or be used as high-quality mulch.

Trees and natural areas are also considered assets in terms of attracting visitors and supporting local tourism, as well as attracting new businesses who must consider the desirability of the city for their employees and their families.

4 URBAN FOREST AND NATURAL AREA MANAGEMENT CHALLENGES AND OPPORTUNITIES

The development and implementation of an UFMP in Mississauga is a timely response to the challenges facing the City's Urban Forest and Natural Heritage System as the city moves into a phase of infill and intensification-based growth. The pressures of redevelopment and intensification on existing trees and potential tree habitat are compounded by other environmental threats such as climate change-induced drought stress, and invasive pests and pathogens. However, effectively managing these challenges also provides opportunities for improving the Urban Forest's sustainability, which in turn creates a healthier community.

4.1 KEY CHALLENGES

Big picture challenges in Mississauga related to the Natural Heritage System and Urban Forest (as identified in the NH&UFS) include:

- instilling a mind-set of the "total landscape as a life-support system"
- trying to maintain and enhance ecological connectivity
- reconciling Natural Heritage System and Urban Forest objectives with the need to accommodate continued growth
- building resilience to climate change and related stressors
- getting more support from higher levels of government, and getting the entire community to become more fully engaged in stewardship, and
- recognizing and accepting the need for sustained management of the Natural Heritage System and Urban Forest.

More specific management, operational and tactical challenges faced by Mississauga's Urban Forest and Natural Heritage System are described in more detail below, and include:

- invasive species, pests and pathogens
- ongoing development and redevelopment pressures
- conflicts between trees and "grey" infrastructure,
- the impacts of climate change and related stressors
- difficult growing conditions in urban landscapes
- fragmented ownership of the urban forest, and
- limited community awareness and stewardship.

In addition, these challenges must be addressed within the limits of the City's current resources, supplemented by resources that may be available through partnerships within the community and other supporting partners, as well as external funding where possible.

Invasive Species, Pests and Pathogens

Trees in urban areas tend to be more susceptible to the effects of invasive species, pests and pathogens than trees in natural settings because they are already stressed by being in sub-optimal habitats. Across North America, urban forests have been affected by a number of invaders. In the past, Dutch elm disease wrought widespread damage to urban elm tree populations; today, emerald ash borer (EAB) threatens to destroy all of Mississauga's ash (*Fraxinus*) trees, representing a potential loss of $208 million in structural value and 16% of the Urban Forest's leaf area. About 10% of the City's street trees (more than 23,000 ash trees) are at risk (**Figure 6**), in addition to thousands of ash in public and private Natural Areas, parks, yards and open spaces. EAB is already ravaging Mississauga's urban forest, and the Active Management Plan response will cost an estimated $51 million over the next nine to ten years[15]. This wide-scale pest infestation may affect the City's ability to provide core urban forestry services for some time, as available resources will need to be mobilized to address EAB-related tree mortality, treatments and other immediate management needs.

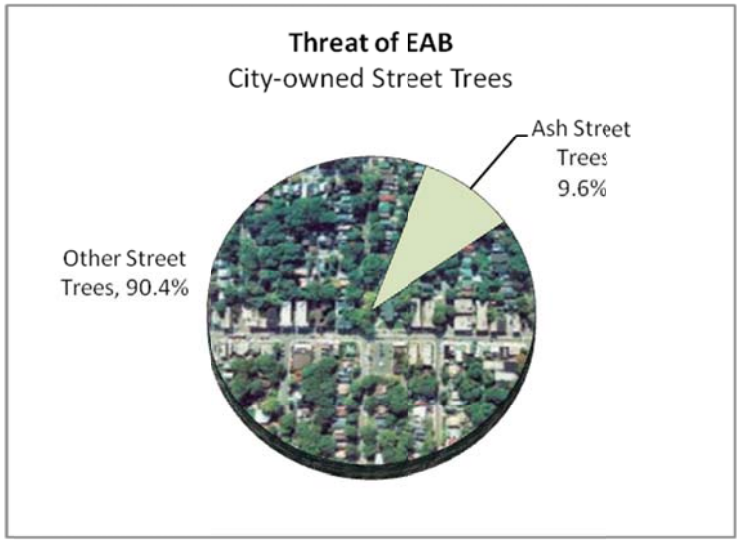


Figure 6. Illustration of the proportion of city-owned street trees at risk from emerald ash borer (based on the street tree inventory data from 2006)

[15] The *City of Mississauga Emerald Ash Borer Management* Plan (2012) that was recently adopted by Council provides details about the components and costs of an Active Management Plan.

Development Pressures

Mississauga's population is forecast to grow by more than 10% over the next 20 years. New residents bring diversity, ideas and opportunities, but also increase demand for housing and municipal services, including roads, sewers, parks and Natural Areas. Intensification and redevelopment will make preservation of existing trees and integration of new trees into developed landscapes more challenging, and will also increase the pressure on remaining Natural Areas and parks.

Tree and Infrastructure Conflicts

Trees occupy space both above and below ground, and must therefore compete with a number of "grey" infrastructure components such as electric and gas utilities, storm and sanitary sewers, water services, roadways and sidewalks, signs, and parking lots. In a highly urbanized setting like Mississauga, trees and Natural Areas also compete for space with buildings. Finding creative solutions so that trees (i.e., "green" infrastructure) and "grey" infrastructure can effectively co-exist presents both a challenge and an opportunity to collaborate and innovate.

Climate Change

Climate change is already thought to have increased average annual temperatures in southern Ontario by 0.5°C over the past two decades[16]. Furthermore, the incidence and duration of extreme weather events (e.g., wind and ice storms, intense rainfall) and drought stress is expected to increase in the coming years, making the Urban Forest more vulnerable to pests, pathogens, invasive species, physical damage and general decline. In urbanized communities such as Mississauga, these effects are likely to be compounded by the extent of impervious and unvegetated surfaces. However, this challenge also presents an opportunity to embrace proactive urban forest management practices, which can make both the city's trees and the city as a whole more resilient to climate change[17].

[16] See http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085423.pdf

[17] The *Peel Climate Change Strategy* (2011) includes an action that specifically identifies "implementing best practices related to urban forestry" as one of its proactive adaptation actions.

Difficult Growing Conditions

Most trees are naturally adapted to growing in forest conditions. Growing conditions in urban areas are markedly different, and are typically characterized by a more exposed environment, degraded and compacted soils, altered moisture regimes, and substantially reduced soil biological activity to support tree growth. Another stressor, particularly for street trees, is being subjected to road salts and other de-icing agents in the winter.

When trees are an afterthought in planning, insufficient consideration is given to providing suitable growing conditions, which causes greater susceptibility to drought and/or nutrient stress, pests and pathogens. In recent years, strides have been made in Mississauga to improve below-ground growing conditions for trees; the City must continue to manage salt use as well as a legacy of difficult growing conditions, and prevent such conditions from recurring in the future.

Tree Preservation on Private Property

As in most communities in southern Ontario, much of the City's Urban Forest is on privately-owned lands, as are many of the opportunities for urban forest planting and enhancement. Although the City has a Private Tree Protection by-law to help regulate tree removal on private lands, this in and of itself does not ensure all opportunities for tree protection and replanting are pursued. Official Plan policies that are supportive of the Urban Forest, and related zoning provisions, can help ensure that further opportunities for tree protection and replanting are explored through the planning process. Even where there is existing zoning in place that supports some type of development (as in many parts of Mississauga), the type or extent of development may be modified to work around existing trees and/or incorporate additional tree plantings, where policies support it,

The City is also continually working to acquire wooded (and other) natural areas as opportunities arise. However, the comprehensive care and stewardship of the urban forest on private lands can only be achieved through widespread recognition of the value that trees bring to the community, and a willingness to help sustain the urban forest.

Limited Community Awareness and Engagement

Available evidence indicates that while Mississauga's residents generally seem to support having trees in their yards and their neighbourhoods, there is less support for regulatory mechanisms regarding tree protection, and a limited appreciation for the full value of trees in urban areas[18]. Forestry Division staff have indicated that while members from various sectors of the community regularly participate in stewardship activities, the level and extent of engagement could be a lot broader. Because most of the City's Urban Forest is on private lands, it is imperative for all residents and private landowners to fully understand the value of maintaining and expanding the Urban Forest, and to contribute to its sustainability through tree preservation, tree planting and naturalization, and stewardship on their lands.

[18] T. Conway and T. Shakeel. 2012. Trees and residents: An exploration of residents' role in growing Mississauga's urban forest. Paper for the Department of Geography, University of Toronto, Mississauga, 13 p.

4.2 KEY OPPORTUNITIES

Implementation of the Actions recommended in this UFMP (see **Section 8**) will benefit the City's Urban Forest through good management, improved operational practices, and increased engagement and stewardship. Opportunities related to the key challenges outlined above include:

- INVASIVE SPECIES, PESTS AND PATHOGENS: Pursuing proactive tree health and risk management on public lands (e.g., implementation of the City's emerald ash borer strategy), and encouraging (and, where possible, supporting) it on private lands will support a healthier Urban Forest[19];
- DEVELOPMENT PRESSURES: Ensuring opportunities for Urban Forest canopy expansion are identified in areas that are not expected to accommodate extensive intensification, and that some type of compensation for trees removed where required is provided will help maintain and expand canopy.
- TREE AND INFRASTRUCTURE CONFLICTS: Working with planners, engineers and architects to find planning and design solutions that can accommodate long-lived, and where possible, large-statured trees will maximize the provision of ecosystem services in the City;
- CLIMATE CHANGE: Managing the Urban Forest and Natural Heritage System in an integrated way to help the community mitigate stressors associated with climate change (see below) will create a more resilient Urban Forest;
- DIFFICULT GROWING CONDITIONS: Ensuring that trees are given adequate above and below-ground space, soil volume and soil quality by introducing and enforcing minimum requirements, as well as working with other disciplines and partners to find creative ways to give trees space, will help ensure that trees planted grow to maturity and are long-lived;
- TREE PRESERVATION ON PRIVATE PROPERTY: Facilitating a paradigm shift towards understanding and managing the Urban Forest and Natural Heritage System as shared community assets and vital components of the city's infrastructure through an active promotional campaign and an expanded stewardship program targeted to City staff, external stakeholders and the community will result in greater community support and stewardship;, and
- LIMITED COMMUNITY AWARENESS AND ENGAGEMENT: Leveraging social media, building on existing partnerships and forming new ones to access resources and funding will make the most of the City's resources.

[19] One of the opportunities arising out of the invasion of EAB is the potential to replace diseased ash with a greater diversity of native and non-invasive species, and ensure they are provided with adequate soil volume and quality.

Opportunities Associated with Climate Change

Climate change presents one of the most pressing challenges for urban trees, some of which already suffer from non-climatic stressors such as competition for resources, soil compaction, drought, pests and diseases. Fortunately, strategies to reduce the effects of climate change on the Urban Forest are well-aligned with activities that contribute to overall urban forest sustainability, as follows:

- minimizing the further expansion of non-climate stressors
- managing highly invasive plant species, as well as tree pests and diseases
- planting a diversity of tree species, including those better adapted to warmer and drier conditions (e.g., Carolinian zone species)
- developing and implementing an extreme weather response strategy,
- planting trees strategically around residences and other two or three storey buildings to reduce heat loss in the winter and cooling needs in the summer, and
- protecting and enhancing Natural Heritage System connectivity to facilitate native species movement and adaptation.

Urban forest management is a resource-intensive undertaking. The wide range of urban forest-related issues in Mississauga – from routine tree maintenance, to invasive species management, to development plan review and site inspection - requires adequate staffing, appropriate training, and adequate resources. As in all municipalities, the City will be challenged to achieve levels of service for various management activities that meet planned or optimal levels. Therefore, it is critical that this UFMP be broadly embraced and used by City staff, stakeholders, and the community alike.

5 SETTING THE DIRECTION

Figure 7. Illustration of where the City's Urban Forest Management Plan fits in relation to other City guiding documents

5.1 PLANNING CONTEXT AND PRECEDENTS

There are a number of city-wide planning documents that provide context and guidance for this UFMP, as illustrated in **Figure 7**. The relevant components from each of these, and higher level planning documents, are summarized in Section 5 of the NH&UFS. Additional guidance related specifically to the Urban Forest from each of these documents is provided below.

Strategic Plan (2009)

The City's *Strategic Plan* identifies five pillars for change with the pillar most relevant to this UFMP being the "living green" pillar. The "connect" pillar also has some relevance in so far as trees are a cornerstone of complete communities, and of complete active transportation links and streetscapes.

Specific strategic actions under the "green" pillar related directly to this plan include:

- Plant one million trees in Mississauga (Action 4)[20]
- Implement a city boulevard beautification program to foster civic pride and raise environmental awareness (Action 5)
- Create an educational program that promotes "living green" (Action 10)

Although Action 7 "Implement an incentive/loan program for energy improvements" does not specifically mention trees, this program could include a subsidy for tree planting in view of the energy conservation benefits provided by trees[21]. In addition, although Action 24 "Make streets safer" (under the "connect" pillar) does not mention trees, it has been documented that treed streets can be safer than those without trees (see **Section 3.1**).

Official Plan (2011)

The City's recently adopted *Official Plan* recognizes the city is entering a new stage in its evolution, "one of intensification and urbanization" and also recognizes the importance of creating an environment where "where people, businesses and the natural environment thrive". Section 6 "Value the Environment" includes a framework for the City's Green System, which includes a wide range of treed areas on both public and private lands, and a specific set of policies for the Urban Forest that include direction for tree protection, tree planting, and urban forest education, stewardship and partnerships (see **Section 6.4**).

Future Directions Master Plan for Parks and Natural Areas (2009)

The Future Direction Master Plan looks at the City's parks and Natural Areas in an integrated, holistic manner, explicitly acknowledges the interrelatedness of parks and Natural Areas, particularly in urban settings, and also highlights the joint benefits to the community provided by these areas. Many of the 61 recommendations found in the document relate to trees and woodlands, however recommendation 60 - *"Allocate dedicated and sustained funds towards the adequate long term maintenance required to sustain a healthy urban forest."* - relates directly to this UFMP.

[20] Notably the One Million Trees Program was launched in April 2013.

[21] The *City of Mississauga Urban Forest Study* (2011) cites research indicating trees of at least 6 m tall and within 20 m of one or two-storey building confer measurable savings in cooling costs in the summer (from shade) and heating in the winter (by buffering winds).

Living Green Master Plan (LGMP) (2012)

The recently completed LGMP provides guidance related to City policies and programs so that the environmental objectives of the Strategic Plan are met. The 49 actions identified in the LGMP are intended to be met by 2021. In addition, the LGMP includes "tree canopy intensity" and "Natural Heritage system coverage" as two of its 18 performance monitoring indicators. These indicators have been adopted and developed through this UFMP (see **Appendix A**).

Natural Heritage & Urban Forest Strategy (NH&UFS)

In Mississauga, the high degree of overlap and interconnectedness between the Natural Heritage System and the Urban Forest has been recognized through the inclusion of both within a joint strategy. The NH&UFS, which has been developed in tandem with this UFMP, recognizes that the Urban Forest includes all treed Natural Areas, as well as trees outside those Natural Areas throughout the city, and that the Natural Heritage System and Urban Forest needs are therefore most effectively addressed with an integrated approach.

Other Key Sources of Information and Guidance

The two other key sources of information and guidance for the UFMP (as described in **Section 2** and **Section 6.1.1**) are the *Peel Region Urban Forest Strategy* (2011) and *City of Mississauga Urban Forest Study* (2011), developed by Toronto Region Conservation with support from the Region of Peel, Area Municipalities (Mississauga, Brampton and Caledon), and Credit Valley Conservation.

The *Peel Region Urban Forest Strategy* (2011) outlines six guiding principles and eight strategic goals (see **Table 3**) to facilitate a coordinated and consistent approach to sustainable urban forest management across the Region. These principles are echoed in Mississauga's principles for this study, while the objectives provide some higher level support and resources to facilitate implementation of Mississauga's objectives (see **Section 5.2**).

The *City of Mississauga Urban Forest Study* (2011) provides 27 recommendations to help Mississauga move forward with its urban forest program and practices. A summary of how each of these has been addressed through this study is provided in **Appendix B**.

Table 3. *Peel Region Urban Forest Strategy* (2011) guiding principles and strategic objectives

Guiding Principles
1. A sustainable urban forest promotes quality of life, human health and longevity
2. Residents of Peel Region are the most important and influential stewards of the urban forest
3. All residents should have the opportunity and means to benefit equally from the ecosystem services provided by the urban forest
4. Improved communication and coordinated action will result in a more informed, streamlined, and effective approach to urban forest management
5. The urban forest, as natural infrastructure, requires long-term, stable funding
6. Municipal Governments should lead by example

Strategic Objectives
1. Facilitate partnerships and coordinate action across Peel Region
2. Develop urban forest targets
3. Develop and implement urban forest management plans
4. Create a comprehensive urban forest policy framework
5. Gain formal support from upper levels of government for sustainable management of the urban forest as natural infrastructure
6. Implement effective monitoring and research programs
7. Secure long-term funding for urban forest management
8. Provide comprehensive training, education, and support for residents and members of the public and private sector

5.2 VISION, GUIDING PRINCIPLES & OBJECTIVES

As discussed above, a vision, guiding principles, and objectives were developed for the NH&UFS, which is the umbrella Strategy for the UFMP. These are provided in both documents so that each document can be read and understood independently (with cross-references as appropriate). However, the NH&UFS should also be read in order to develop an understanding of the broader study context and how the vision and objectives are intended to be achieved.

Vision for the Natural Heritage & Urban Forest Strategy (NH&UFS)

Together we will protect, enhance, restore, expand and connect Mississauga's Natural Heritage System and Urban Forest to sustain a healthy community for present and future generations.

Guiding Principles for the Natural Heritage & Urban Forest Strategy (NH&UFS)

The following are recommended guiding principles for the long-term protection, enhancement, restoration and expansion of the City's Natural Heritage System (NHS) and Urban Forest within the broader Green System.

1. Act Now
2. First Protect - then Enhance, Restore and Expand
3. Maximize Native Biodiversity
4. Recognize and Build On Past and Current Successes
5. Learn From Our Past and From Others
6. View the Natural Heritage System and Urban Forest as part of the City's broader Green System
7. Understand the Value of the City's Green System and the Essential Ecological Services it Provides
8. Make Stewardship on Public and Private Lands Part of Daily Living
9. Integrate Climate Change Considerations in Natural Heritage and Urban Forest Planning
10. Protect, Enhance, Restore, and Improve Natural Connections
11. Track the State of the Natural Heritage System and Urban Forest, and Practice Adaptive Management
12. Recognize Natural Areas and the Urban Forest as Critical Components of the City's Infrastructure

Objectives for the Natural Heritage & Urban Forest Strategy (NH&UFS)

These objectives are intended to provide guidance for the long-term implementation and evaluation of the Actions identified in the UFMP (as well as the NH&UFS), and for meeting the established targets (see **Section 5.3**). Measures for evaluating the objectives are provided through the Monitoring Framework (see **Appendix A**).

The UFMP and NH&UFS both include city-wide strategies directed to both public and private lands. It is understood that while some approaches may be applied equally irrespective of landownership, in many cases distinct approaches are required for lands that are public versus those that are not. Therefore, the objectives have been organized into categories that reflect this distinction.

General Objectives

1. Increase internal (within the City) and external (among the community and other stakeholders) awareness of the value and need to protect, enhance, expand and restore the Natural Heritage System and the Urban Forest.
2. Expand the Natural Heritage System and Urban Forest by pursuing opportunities through the development application process, in-filling and re-development of public and private lands, and public acquisition.
3. Build on existing, and develop new, public and private sector partnerships to help pursue and implement the vision and targets for the Natural Heritage System and Urban Forest.
4. Undertake regular monitoring of the Natural Heritage System and Urban Forest to evaluate performance and identify trends or changes that may require a shift in management approaches or practices.

Objectives for Public Lands

5. Protect the Natural Heritage System and Urban Forest on public lands through proactive management, enforcement of applicable regulations, and education.
6. Enhance and restore the Natural Heritage System and Urban Forest on public lands by establishing service levels to improve: the condition of natural areas, linkages among protected natural areas, and tree establishment practices.
7. Support the Natural Heritage System and the Urban Forest by managing public open spaces to maximize their ecological functions (while maintaining their existing uses).

Objectives for Private Lands

8. Protect the Natural Heritage System and Urban Forest on private lands through education, implementation of applicable policies and regulations, the development review process and enforcement.
9. Enhance and restore the Natural Heritage System and Urban Forest on private lands by promoting stewardship, naturalization, restoration, tree planting and proactive tree care with creative outreach and incentives.

5.3 TARGETS

There are many ways to measure the success of an urban forest management program and to gauge urban forest sustainability. Quantitative targets are one way to assess the state of the urban forest, and when considered in conjunction with a broader range of criteria and indicators (as provided in the Monitoring Framework in **Appendix A**) can provide a fairly comprehensive assessment of the state of urban forests sustainability in a municipality. Notably, because of the integrated approach taken through the NH&UFS, both the targets and the Monitoring Framework address both the City's Natural Heritage System and its Urban Forest. The six targets developed for Mississauga's Natural Heritage System (NHS) and Urban Forest (UF) to be achieved over the 20 year period of this Plan (and the broader Strategy) are as follows:

1. NHS Size: 12% to 14% of the City
2. NHS Connectivity: (a) 75% of the watercourses have vegetation for at least 30 m on both sides, and (b) 85% of Significant Natural Areas are linked through the NHS or other Green System components
3. NHS Quality: (a) overall terrestrial and aquatic quality across the city is substantially improved using 2013 as a baseline, and (b) Conservation Management Plans are developed and in effect for all high priority publicly-owned Significant Natural Areas
4. UF Canopy Cover: 15% to 20%
5. UF Quality (of City Street and Park Trees): (a) the City tree inventory is comprehensive, up to date, and actively maintained, (b) no tree species represents >5% of the tree population City-wide or >20% on a given street, and (c) invasive tree species represent less than 8% of the street and park tree population
6. UF Canopy Distribution: Canopy cover meets or exceeds 15% (i.e., the current city-wide average) in at least 95% of the City's residential areas and in 50% to 75% of the city's other land use categories

These targets have been developed based on: consideration for other relevant studies, an understanding of the extent and condition of the current Urban Forest and that Mississauga is an urbanized jurisdiction that will continue to experience population growth and intensification, recognition of the value of the ecosystem services provided by the Urban Forest, and input from various consultations. *Discussion of the rationale behind each of these targets is provided in Section 7 of the NH&UFS.*

6 CURRENT URBAN FOREST PRACTICES IN MISSISSAUGA

The City of Mississauga is further ahead than many municipalities in terms of its urban forest management program. The Parks and Forestry Division's staff are involved in many aspects of administration, maintenance, management and restoration of both the Natural Heritage System and the Urban Forest, particularly on public lands. The City also has a number of regulations and policies intended to help protect trees and Natural Areas, and several successful stewardship programs to engage the community in naturalization, tree planting and follow-up care of trees and natural spaces. However, Mississauga's Urban Forest and Natural Heritage System face many challenges to their sustainability (see **Section 4**), and a critical review of current practices, provides a good basis for the identification of best practices and opportunities (see **Section 7**).

This section of the UFMP provides an overview of the City's current urban forest management administration, policies, practices and programs directed to both public and private lands.

Current approaches to planning and operations activities related to the five key topic areas considered in this UFMP are reviewed, highlighting the role of the Parks and Forestry Division, and other stakeholders, in maintaining Mississauga's Urban Forest. Topic areas, each presented in more detail in this section, include:

- **Urban forest management and administration (Section 6.1):** examines the administrative structure of the urban forestry program, considers resource allocation related to forestry, and reviews overall approaches to urban forest asset management
- **Tree health and risk management (Section 6.2):** reviews the implementation of urban forest health, maintenance and risk management activities
- **Tree establishment and urban forest expansion (Section 6.3):** reviews tree establishment practices and programs
- **Urban forest protection and preservation (Section 6.4):** examines relevant legislation, policies and guidelines, and
- **Promotion, education, stewardship and partnerships (Section 6.5):** focuses on current approaches being used to increase engagement and stewardship related to the Urban Forest and Natural Heritage System on public and private lands.

6.1 URBAN FOREST PROGRAM ADMINISTRATION

This section of the plan provides an overview of:

- the roles of different jurisdictional levels for the urban forest as they relate to Mississauga
- Mississauga's Parks and Forestry Division's administrative structure, organization and processes, and
- management of the City's Urban Forest and Natural Heritage System assets.

6.1.1 RESPONSIBILITY FOR THE URBAN FOREST

Federal Government

The involvement of the federal government in urban forest management has, to date, been limited and indirect. The primary source of support has been through the Canadian Food Inspection Agency (CFIA) and Canadian Forest Service efforts to monitor and control the spread of invasive insect pests, the most important of which include (ALHB, *Anoplophora glabripennis*) and (EAB, *Agrilus planipennis*).

Provincial Government

Similar to the federal government, the government of Ontario has not gotten involved in urban forest management. However, a wide range of provincial legislation directly and indirectly affects the ability of municipalities to regulate their urban forest resources. **Table 4** provides a list of relevant provincial statutes and policies which directly relate to urban forest management.

Other provincial documents that include support for local urban forest initiatives include:

- *Grow Green: Ontario's Climate Change Action Plan* (2007), which sets a planting target of 50 million new trees in Southern Ontario by 2020, and provides funding for volunteer-driven tree planting projects
- *Ontario Invasive Species Strategic Plan* (2012) which identifies some strategies the various partners can use to help fight invasive species, and
- *Ontario's Biodiversity Strategy* (2011) which sets out a framework for engaging people, reducing threats, enhancing resilience and improving knowledge in relation to native biodiversity and ecosystems, including woodlands, in the Province.

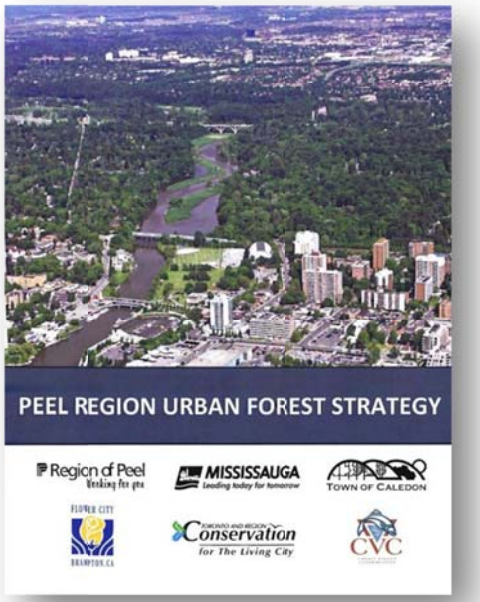
Table 4. Provincial statutes and policies with relevance to urban forest management

Statute or Policy	Relevance
Planning Act, 1990	Establishes the framework for municipal planning in the province. Empowers municipalities to develop official plans and regulate development, including requiring landscaping with trees and shrubs.
Ontario Heritage Act, 1990	Allows for the designation of heritage properties and/or landscapes in the Province, including trees on such lands that may have heritage value.
Forestry Act, 1990	Provides a legal definition for "woodlands" and "good forestry practices", as well as certain provisions pertaining to boundary/shared trees.
Conservation Authorities Act, 1990	Establishes conservation authorities as watershed-based authorities with various responsibilities, including regulation of lands adjacent to watercourses, wetlands and shorelines.
Municipal Act, 2001	Establishes municipal powers. Sec. 223.2 allows any municipality greater than 10,000 people to regulate the injury or destruction of trees, while Sec 135-146 provides the legal framework for municipal tree and site alteration by-laws.
Places to Grow Act, 2005	Enables Province to designate population growth areas, requiring certain jurisdictions to meet established growth targets by certain dates.
Provincial Policy Statement, 2005	Provides guidance for land use planning, protection for significant woodlands.
Greenbelt Act, 2005	The *Greenbelt Act* and the supporting Greenbelt Plan were recently amended to provide an additional designation of Urban River Valleys to the Natural Heritage System. This designation is intended to include publicly owned lands located in the urban river valleys extending south from the Greenbelt Plan. The lands within the Greenbelt Urban River Valleys are to be governed by the applicable municipal Official Plan policies provided they have regard for the objectives of the Greenbelt Plan.

Region of Peel

Mississauga is a lower-tier municipality within the Region of Peel, along with the other Area Municipalities of Brampton and Caledon. The updated Regional *Official Plan* recognizes the importance of maintaining the Region's Greenlands System, and includes policies that support a range of studies and plans for different components of its natural heritage system. Official Plan Amendment 21B, adopted in 2010, directs the Region to "*...work jointly with the agencies and Area Municipalities to develop urban forest strategies and to encourage and support programs and initiatives that maintain and enhance the urban forest canopy*".

The Region, in collaboration with its Area Municipalities, Credit Valley Conservation and the Toronto and Region Conservation, undertook the development of the *Peel Region Urban Forest Strategy (2011)*. One outcome of this Strategy has been the establishment of an interagency Urban Forest Working Group, which includes members from the Region, Area Municipalities and local conservation authorities, who meet on a semi-regular basis to work towards implementing the strategy's action items.



The *Peel Climate Change Strategy* (2011) is the strategic framework of the Region of Peel, area municipalities (i.e., Mississauga, Brampton and Caledon) and conservation authorities. The strategy contains 38 actions that will help Peel Region to mitigate the impacts of and adapt to climate change. It recognizes the importance of the urban forest in both these endeavours. The strategy directs regional partners (Area Municipalities and Conservation Authorities) to, on an ongoing basis, "*undertake specific initiatives, such as implementing best practices related to urban forestry, which are intended to maintain and restore natural habitats, trees and naturalized spaces within the urban system*". The Region provides support to its partners in this regard.

City of Mississauga

The City of Mississauga bears the primary responsibility for the planning and implementation of urban forest management within the City. The City's urban forest planning and operations activities focus on:

- establishment and maintenance of trees on public lands
- tree removal and tree planting on private property as part of development projects
- the development and enforcement of regulations related to privately-owned trees
- encroachments from private lands into adjacent public Natural Areas, and
- activities related to the maintenance and restoration of the City's Natural Areas and parks.

Urban forest management and maintenance is largely administered by the Forestry Section of the Parks and Forestry Division within the Community Services Department. Forestry staff are responsible for the maintenance of over 240,000 street trees, as well as trees in parks and City-owned Natural Areas.

Most other departments are also directly or indirectly involved in planning and operations which may affect existing trees and/or opportunities for future growth of the urban forest, although some to a lesser degree. The key departments whose work includes decisions affecting planning, operations, outreach and stewardship related to tree preservation and/or planting issues on a regular basis include:

- Community Services Department
  - Environment Division
  - Parks and Forestry Division
    - Park Planning
    - Park Development
    - Parks Operations
    - Forestry
- Planning and Building Department
  - Policy Planning Division
  - Development and Design Division
  - Building Division
- Transportation and Works Department
  - Transportation and Infrastructure Division
  - Development Engineering Division
  - Engineering and Works Division
    - Development Construction Division
- Corporate Services Department
  - Office of the City Clerk (including Committee of Adjustment)
  - Realty Services

Landscape Architects, Landscape Technologists, Site Plan Technologists, and Land Use Planners in Community Services, Planning and Building, and Transportation and Works regularly undertake review of tree preservation and/or planting plans, as well as site inspections. Staff in the Parks and Forestry Division play a role in most tree-related decisions on municipal and private projects, but are not always involved at the outset of the process, and may not be involved in situations where only one or two trees are being removed, or where no trees are being removed but opportunities for planting exist.

While the Parks and Forestry Division is the primary group charged with the management and administration of Mississauga's urban forest, responsibility for this vital asset extends to various staff in other City departments and divisions. Consequently, sustainable urban forest management can only occur if all departments work together to achieve the common vision, objectives and targets established through the NH&UFS (see **Section 5**).

6.1.2 FORESTRY RESOURCES AND ASSET MANAGEMENT

The Forestry Section currently has staff with forestry, arboriculture, ecology and other relevant areas of expertise under the direction of the section Manager that are divided among five key tasks: contract administration, protection and preservation, inspections, City tree maintenance, and woodland/natural area services (including community planting and stewardship).

Mississauga currently has an inventory of about 243,000 city-owned street trees. The intention is to expand this inventory to include trees in City parks plus hundreds of thousands more added through the One Million Trees program (launched April 2013). Some Region of Peel trees are also included in the inventory, as the City maintains the trees on some Regional roads as well. The inventory is GIS-based, but contains a limited amount of information about each tree. Attributes include a unique identification number, municipal address of property closest to street tree, forestry management zone, overall condition rating, diameter (in cm), service status (Operations or Warranty), and location coordinates.

The Parks and Forestry Division uses asset management software to receive service requests and develop work orders for planning operations such as tree pruning or planting. In its 2013 business plan, the Parks and Forestry Division put forward a budget request to enable the Forestry Section to transition towards a more comprehensive asset management system, including in-field solutions such as mobile computers, wireless access and mobile printers. This will increase staff productivity by enabling real-time or automated information updating, work order generation, and other tasks currently done manually in-office, and should result in improved timing of service delivery.

6.2 TREE AND NATURAL AREA HEALTH AND RISK MANAGEMENT

6.2.1 STREET TREE MAINTENANCE AND BLOCK PRUNING

Street Tree Elevation Program

Mississauga's Forestry Section staff regularly undertake street tree pruning across the City through the Street Tree Elevation Program. The program focuses on providing the minimum required clearances between tree branches, roads and sidewalks, and typically begins when trees are between 10 and 20 years of age. The program is intended to operate on an 8-year cycle, meaning that most trees along City streets should be pruned once every 8 years. This length of cycle is generally considered adequate to balance maintenance costs and the benefits provided by proper pruning.

Young Tree Training

Currently, the City prunes some young trees, typically three to four years following planting. However, the young tree pruning program is not formalized, not all young trees are pruned, and pruned trees may not be revisited again until they are incorporated into the Street Tree Elevation Program, which may be long enough after the initial pruning that significant structural problems may develop.

6.2.2 URBAN FOREST HEALTH MANAGEMENT

Urban forest health management primarily involves using a range of management practices to monitor and mitigate the effects of tree pests, diseases, and invasive plant species (in Natural Areas).

Pest and Disease Management

As in most jurisdictions, Mississauga's approach to pest and disease management is a combination of proactive (e.g., site inspections, monitoring, tree pruning) and reactive (e.g., tree removal, pesticide treatment) measures. As part of their duties, the City's Parks and Forestry Division Inspectors monitor City-owned street and park trees for signs of invasive pests or pathogens. Forestry Section staff monitor for invasive plants in Natural Areas as resources permit. In recent decades, the City has committed to implementing an Integrated Pest Management (IPM)-based approach to pest and disease management. This holistic approach balances cultural and biological approaches (such as maintaining tree health) with methods to reduce pest or disease populations, while reducing the use of chemical pesticides.

Emerald Ash Borer (EAB)

The recent emergence of EAB places an estimated 16% of the City's urban forest in significant danger. This invasive beetle causes near-complete mortality of ash trees wherever they occur if they are not treated with a stem-injectable pesticide. The borer is established across the entire City, and widespread ash mortality is already beginning. In response, the City has begun implementation of an EAB Management Plan scheduled over the next nine to 10 years that will see approximately 20,000 trees treated, and will help fund the costly removal of dead and potentially hazardous trees and their replacement. The cost of the EAB Management Plan is an estimated $51 million over the plan horizon, and may vary depending on the rate and extent of tree mortality. The Plan is funded in part by a Special Purpose tax levy.

Natural Areas Invasive Species Management

Invasive plant species, such as dog-strangling vine, buckthorn, and garlic mustard, are a significant threat to the ecological integrity and health of the City's Natural Areas. The City's approach to managing invasive species has, to date, been relatively limited and focused on intensive management of individual infestations, rather than broader strategic efforts. Stewardship events involving the community are occasionally undertaken in public Natural Areas and invasive species removals are often required by the conservation authorities as part of development approvals on regulated private Natural Areas. In addition, the conservation authorities have extensive resources related to the identification and management of invasive species on their websites, and support this work in Mississauga, and elsewhere in the watershed.

6.2.3 TREE RISK MANAGEMENT

Street Tree Risk Management

Currently, street tree risk management is undertaken through a combination of proactive and reactive methods. Risk reduction on City trees through methods such as deadwood and structural pruning is undertaken during the course of the operations undertaken by the Forestry Section. The City's Forestry Inspectors also respond to resident requests for tree risk assessment and, where appropriate, create work orders through the City's asset management system. Some Forestry staff have received training in both basic and advanced methods of tree risk assessment in order to improve the City's ability to practice more conservation-based tree risk management, where appropriate.

Woodland Tree Risk Management

The City does not currently have a formalized program for tree risk inspection or mitigation in the 152 public woodlands or other Natural Areas it manages. In some woodlands, where risk is a known issue, there has been some mitigation work (e.g., selective tree removal) and woodlands in Riverwood Park have some tree risk inspection done by volunteers.

6.3 TREE ESTABLISHMENT, NATURALIZATION AND URBAN FOREST EXPANSION

Direct management is necessary to ensure the expansion of the urban forest. This is in large part due to the fact that trees in predominantly urban settings often cannot regenerate naturally; seeding and vegetative growth account for only a small part of urban forest regeneration. In addition, there are stressors and threats specifically related to the urban context (e.g., encroachment, vandalism) that require active management.

6.3.1 TREE ESTABLISHMENT PROGRAMS AND PROCEDURES

A key component of Mississauga's urban forest program is the establishment and expansion of the urban forest, primarily through tree planting. Trees in Mississauga are generally planted under City programs by municipal staff and contractors, or by private property landowners, as well as with some volunteer support on public and private lands.

Street Tree Planting Program

The City plants caliper-size trees as replacements for removed trees or to fill available planting sites on the public portions of streetscapes. City residents can submit requests for tree planting, which are addressed in a similar manner as other work order requests.

Commemorative Tree Program

The City maintains a Commemorative Tree Program whereby residents can donate a commemorative tree for a set fee. Forestry staff work with the contributor to determine an appropriate species and location. Commemorative plaques may also be installed for an additional fee.

Planting in New Developments and Redevelopments

The City assumes responsibility for street trees planted on public rights-of-way as part of new development, redevelopment, and other dwelling projects, under agreement with the developer, after the plantings are completed and the warranty period (usually two years) has passed. Costs for tree planting are usually incorporated into the closing purchase price of new residences, and securities for estimated landscape costs are provided by the developer.

Trees are typically planted after homes have been built, roadways have been paved, and other streetscape elements have been completed. While this may delay the provision of trees in a new neighbourhood, it is consistent with best practices as it greatly reduces the likelihood of tree damage and enables better maintenance. Typically, one tree is planted per 10 m, except where trees need to be excluded to avoid infrastructure conflicts.

One Million Trees Mississauga

One Million Trees Mississauga, a program to plant one million trees on public and private lands throughout the city over the next 20 years, started in 2012 and had its official launch in April 2013. The program is an action item from the City's *Living Green Master Plan* (2012) and *Strategic Plan* (2009). Trees will be planted by City staff on public lands, and support will be given to individual volunteers, community groups, organizations and businesses to plant trees across the City. The program will track plantings conducted through various activities on public and private lands, including tree establishment through site plan and subdivision development, and plantings on private residential lots (where the land owners choose to report it) through the program's website.

Naturalization and Urban Forest Expansion

The City facilitates a number of community tree planting, naturalization and stewardship programs in the spring, summer and fall. These activities are often conducted in conjunction with Credit Valley Conservation, the Toronto Region Conservation, non-profit organization (e.g., Evergreen) and/or local business events. Every year thousands of small-stock native trees and shrubs are planted through such programs, and in 2012 nearly 30,000 trees and shrubs were planted.

6.3.2 STANDARDS AND SPECIFICATIONS

Planting standards and technical specifications can help ensure the consistent application of proper tree planting techniques, including site preparation, species selection, tree installation and post-planting maintenance.

Technical Requirements

Several standards and specifications help guide the tree establishment process in Mississauga. Guiding documents which outline aspects of tree planting standards and specifications include:

- *Site Plan Application: Process Guidelines* (Planning and Building Department, 2012)
- *Development Requirements Manual, Subdivision Requirements, Section 1: General Requirements for Servicing Subdivisions* (Transportation and Works Department, 2009)
- *Community Services Subdivision Requirements Manual* (Community Services Department, last rev. 2006, currently under review)
- *Green Development Standards* (Planning and Building Department, 2010)

Mississauga's tree planting specifications outline the City's requirements for aspects of tree establishment, including planting stock selection (species, size, quality, etc.), tree spacing, soil quality and volumes, and establishment methods. The primary guiding document which outlines these specifications is the *Community Services Subdivision Requirements Manual,* and its associated detail drawings and specifications. Section 02950 – Planting, was last revised in 2002 and is the primary specification used by the City to guide planting on municipal rights-of-way in new developments. Many of the provisions of this specification are in accordance with recognized best practices, but some require updating or modification to promote improved tree health and successful urban forest establishment. Most notably, minimum soil volume requirements should be included and should reflect the City's *Green Development Standards* (2010), and specifications for soil quality and texture should be revised to better reflect the scientific and technical understanding of urban tree soils and tree requirements.

Currently, the City maintains two different sets of tree protection fencing/hoarding standard detail drawings and one set of written specifications. Standard drawing No. 02950-8 was published in 2002 by the Community

Services department and is contained within the *Community Services Subdivision Requirements Manual* (currently under review). It provides details for installation of 'farm fence' tree protection fencing, along with standard notes, and is supported by Specification No. 02104 – Site Protection.

Tree Species Selection

The City's Parks and Forestry Division currently has a list of acceptable or appropriate tree species. Typically, species selection for development plans on private property is reviewed by the Landscape Architects or Site Plan Technologists in the Development and Design Division of the Planning and Building Department, while Forestry staff typically review species selection for trees proposed on public lands through the planning process. Notably, Credit Valley Conservation has a comprehensive Plant Selection Guideline that includes desirable and undesirable species suitable for the watershed, particularly for naturalization projects.

Commonly-planted street tree species include varieties of maple, linden, elm, oak, hackberry, Kentucky coffee tree, honey locust, ivory silk lilac, and some species of conifers. Species selection for parks and naturalization projects tends to be more focused on native species, and greater species diversity.

Due to limited soil volumes and the difficult growing sites across the City (and particularly in boulevards), the available palette of suitable hardy tree species is limited. As a consequence, opportunities for increasing species diversity are reduced, and an increased amount of resources must be dedicated to sustaining planted trees.

Mississauga Green Development Standards

In 2010, the City published its first *Green Development Standards* as part of its Green Development Strategy. The Standards address several aspects of sustainable development, including storm water management, green roofs, bird strike prevention and incorporation of new trees into development sites. These standards support the implementation of known best practices, including the provision of 30 m^3 of soil per individual tree in hardscape areas, or 15 m^3 per tree when open soil areas are shared among more than one tree. These standards also recognize the importance of planting large-stature shade trees at an appropriate spacing (6 to 8 m) to enable the development of large canopies along frontages and pedestrian areas. Currently, implementation of the Green Development Standards is encouraged.

6.4 TREE PROTECTION AND NATURAL AREA MANAGEMENT

The City's approach to tree protection and urban forest preservation is fairly comprehensive in terms of introducing and revising policies, by-laws, standards and specifications that support protection of trees and require replacement for healthy trees that need to be removed. A summary of the current policies, by-laws and specifications is provided below.

6.4.1 OFFICIAL PLAN POLICIES

Mississauga is one of the few municipalities with a specific section dedicated to urban forest policies in its Official Plan. The policies (found in Section 6.4 of the *Official Plan*, 2011), provide support for a range of tools to protect and plant trees, while also providing flexibility to accommodate appropriate development. The policies encourage tree protection and planting on public and private lands, and provide specific direction for:

- developing a strategic planting program that targets different parts of the City

- implementing a strategic maintenance program for trees on public land
- ensuring development and site alteration will have "no negative impact" on the urban forest
- planting the right tree in the right place, with enough soil to sustain it
- implementing and complying with tree by-laws
- promoting greater awareness and stewardship, both internally and externally; and
- building strategic partnerships for promotion and implementation.

Some of this policy direction carries over into policies for desirable urban form and neighbourhoods where consideration for and integration of trees is recognized as important, particularly in those neighbourhoods with Residential Woodlands.

The Natural Environment section of the Official Plan (Section 6) presents a framework for a City-wide Green System. Although this system does not explicitly include the urban forest, it incorporates treed natural areas, Residential Woodlands, and Parks and Open Spaces, which include many natural and manicured treed areas.

Residential Woodlands (as shown in **Figure 8**) are residential areas, primarily on private property, identified as having relatively high levels of canopy cover and mapped[22] as part of the City's Green System. The Residential Woodlands overlay is a unique policy tool that identifies areas where tree preservation and replacement are particularly important because of the relatively high levels of canopy cover and the ecological value[23] of some of these areas. The Residential Woodlands policies encourage protection and enhancement of the urban forest in these areas, and some Special Policy Areas require it (e.g., parts of Cooksville).

In some cases these policies have been used successfully as tools to prevent significant expansion of existing residential developments into treed areas, and treed areas identified for protection through the redevelopment process have been zoned as Greenbelt to allow for natural regeneration, effectively protecting them from future re-development or expansion proposals.

More details on the City's Natural Areas System policies, which include significant woodlands, valleylands and wetlands, are provided in Section 5 and Section 9.1 of the NH&UFS.

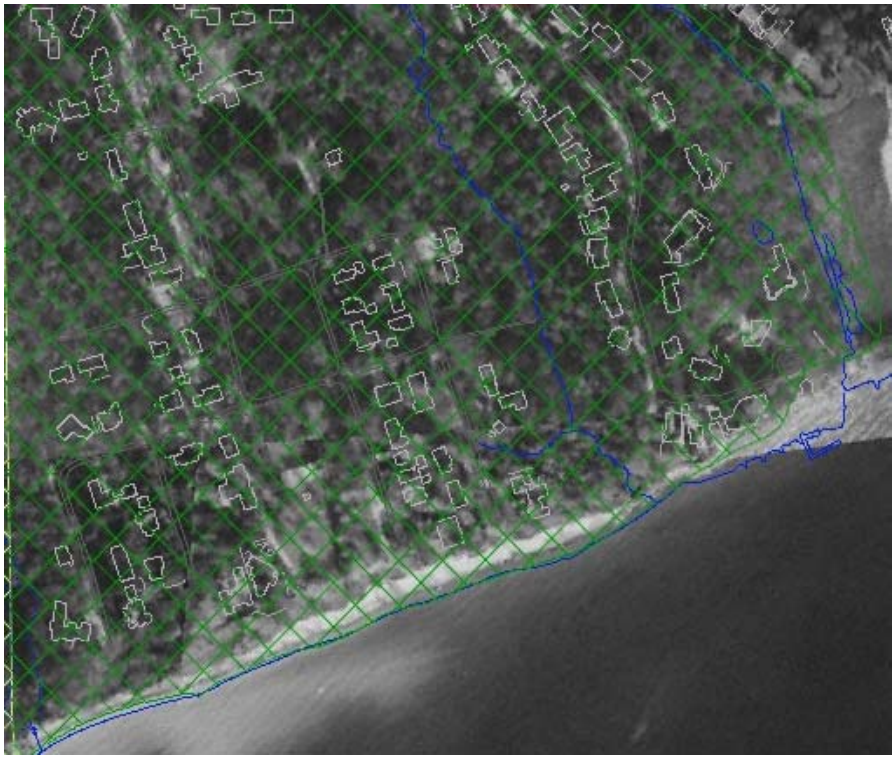


Figure 8. The density of canopy cover in a mapped Residential Woodland area (CL7) in dark green hatching along Mississauga's lakeshore

[22] The Residential Woodlands mapping in the City's current Official Plan has been carried forward from the previous Official Plan, and is based on data and analyses from the late 1980s.

[23] Examples of ecological value provided by some of these residential woodlands include stopover habitat for migratory birds in the spring and fall, and habitat for resident urban-adapted wildlife.

6.4.2 BY-LAWS

Any municipality with a population over 10,000 residents is empowered to enact legislation to regulate the injury and destruction of trees on public or private lands under the authority of the provincial *Municipal Act* (2001). Tree protection by-laws are primarily enacted to regulate the injury or destruction of trees outside of the development process. Mississauga has enacted three by-laws specifically addressing these issues, and several others that also support urban forest objectives. However, development proponents are typically required to adhere to Mississauga's tree protection by-laws under both subdivision planning and Site Plan Control processes.

Private Tree Protection By-law

The City's first private Tree Permit by-law (0624-2001) was approved December 2001. This by-law was amended in December 2005 (474-05) and was recently revised again, and passed by Council in 2012. The 2012 amendment, which changed the by-law name to the Private Tree Protection by-law (0254-2012), has been in effect since March 1, 2013.

The Private Tree Protection by-law has always regulated the injury or destruction (removal) of trees on private property in the City. Key changes in the recent amendment making the by-law more restrictive include:

- regulation of three or more trees with diameters greater than 15 cm per calendar year (as opposed to five)
- requirements for one or two replacement trees to be planted for each healthy tree removed (depending on the diameter of the one removed) or that a contribution be made to the Corporate Replacement Tree Planting Fund equivalent to the replacement costs, and
- increases in the penalties for by-law infraction to the maximum allowable under the *Municipal Act*.

Street Tree By-law

By-law 91-75 regulates injury and destruction of trees located in City-owned rights-of-way and other publicly owned lands. This older by-law is currently being revised by City staff to bring it into accordance with the current legislative framework and practices, and should be completed shortly. This by-law will improve the City's ability to prevent and/ or stop works which may result in the injury or removal of City-owned trees, and fine parties responsible for such damages.

Encroachment By-law

The Encroachment By-law (57-04), enacted in 2004 and last amended in 2011, is intended to prohibit any type of encroachment on to City lands unless specifically approved by the City or other public landowners (e.g., the Conservation Authorities). This by-law has been used effectively to prevent and require removal of any structures or changes in land use that extend from private property into adjacent City-owned natural areas, most of which are wooded. Over the past nine years, since by-law enactment, approximately 3.44 hectares (8.2 acres) have been effectively reclaimed.

Other Relevant By-laws

In addition to these "tree-specific" by-laws, the City has enacted a Parks By-law (186-05) and an Erosion and Sediment Control By-law (512-91). The Parks By-law prohibits persons from engaging *"in any activity that may cause injury or damage to any… tree"* and from planting, pruning, climbing, removing, damaging or defacing any trees in City parks.

The City's Erosion and Sediment Control By-law, which is currently being updated, regulates the removal or placement of topsoil from any lands (public or private) throughout the city without a permit. It currently exempts removal from lots 1 ha and less in area, except for removal within 30 m of water bodies, which requires a permit in all cases. As part of the permitting process, applicants must provide the location and type of vegetative cover in the area to be affected. This by-law is not currently being used as a tool to support urban forestry or natural area objectives.

6.4.3 TREE PRESERVATION AS PART OF PRIVATE PROJECTS

Tree Preservation through Subdivision Development

The subdivision development process is coordinated by staff from the Planning and Building, Community Services and Transportation and Works departments. The *Community Services Subdivision Requirements Manual* (last revised in 2006, currently under review) outlines requirements for site-wide and individual lot/block preservation plans, including tree and site information, standard notes, and tree hoarding. In accordance with the manual, woodland management plans may also be required.

Various City staff are involved in overseeing tree preservation, depending on the location of the tree(s). Landscape Architects in the Planning and Building Department oversee tree preservation on private property; Landscape Architects in the Community Services Department oversee tree preservation on public property and lands to be dedicated to the City, and Certified Arborists from Forestry provide site-specific expertise on request from other staff.

The *Manual* is currently being revised to ensure its continued utility as a guiding document for infill and intensification projects, as the number of subdivision developments declines.

Tree Preservation under Site Plan Control

Site Plan Control is intended to ensure development conforms to the policies of the City's Official Plan, including those relating to the environment. Site Plan Control applies to several different categories of lands, including certain residential areas of the City. Through this process, development proponents must submit detailed Site Plan Applications, outlining various aspects of the proposed development for review by City staff, other regulatory bodies and potentially affected stakeholders. Unlike the subdivision planning process, Site Plan Control is primarily administered by one City department - Planning and Building, with support from Landscape Architects and Planners in Park Planning where the proposals are adjacent to City-owned lands. Other departments may also provide comment, if required, through participation in the Development Application Review Committee (DARC), and Certified Arborists in the Forestry Section are sometimes called in for additional technical support.

The City's *Site Plan Applications: Process Guidelines* manual is the primary guiding document for this form of development planning (specifically under Site Plan Control By-law 0293-2006). Key requirements for tree preservation planning under Site Plan Control include a tree survey plan (including mapping and identification of trees >15 cm DBH), general site information, and tree protection hoarding (if applicable to the site). There is no formal requirement for a written arborist report, although these are often requested as part of the Site Plan Application. The City's *Design Guidelines and Site Plan Requirements: New Dwellings, Replacement Housing and Additions* manual (May 2010) also provides guidance for tree protection during development specifically tailored to infill situations.

The City is able to request and hold financial securities against tree protection, in addition to several other elements of development. Securities against tree protection are typically released within one growing season following completion of all site works, and are only held longer if hoarding is not in place during construction works or if damage to trees due to construction practices is observed.

Tree Preservation outside Development Control

Certain types of site development are subject to municipal zoning regulations or provincial statutes rather than development controls. This includes many forms of construction outside of Site Plan Control areas (which still require Building Permits), or relatively minor works such as swimming pool installations.

Mechanisms for exploring tree preservation or replacement in these situations are limited to the City's tree protection by-laws (where they apply) and the *Tree Injury or Destruction Questionnaire and Declaration* form associated with the Building Permit process. It is a challenge to ensure that these forms are always filled out accurately, and that opportunities for tree preservation / replacement are explored with the proponents because of the provincial legislation which mandates short timelines for Building Permit issuance following submission of an application.

Tree preservation issues are also sometimes considered through the Committee of Adjustment process, where development applications requesting variances from zoning by-laws are reviewed by community members and City staff. The Development and Design division reviews and comments on applications, and may consult with Forestry staff, but because Committee of Adjustment review is a largely precedent-based, "applicant-driven" process, tree protection usually only becomes an issue if public pressure is brought to bear on the review process.

6.4.4 TREE PROTECTION AS PART OF PUBLIC PROJECTS

Existing trees, particularly those owned by the City, can be impacted during the course of public projects ranging from common maintenance operations such as sidewalk panel repair, to major capital projects such as road widening. While the relevant public agency (e.g., City, Region or Province depending on the type of project) generally makes efforts to ensure that trees are not adversely affected, tree protection during municipal works may be overlooked or not fully implemented as a result of gaps in the process, including:

- the lack of involvement by staff focused on tree preservation and/or replacement at the outset of the process (i.e., when the designs are being developed)
- the absence of City-wide standard engineering specifications or detailed drawings for tree protection that apply to public projects, and
- the lack of consistent requirements for site supervision and follow-inspection by a Certified Arborist at key points during and following construction.

Increasingly, City staff in other departments leading municipal projects are consulting with Forestry Section staff when tree preservation issues arise. However, when these requests are made late in the process it may be too late to adjust plans in order to implement effective tree preservation.

6.5 PROMOTION, EDUCATION, STEWARDSHIP AND PARTNERSHIPS

Both the *Peel Region Urban Forest Strategy* (2011) and the *Mississauga Urban Forest Study* (2011) recognize that private property owners and tenants manage most of the existing Urban Forest, and also oversee the lands where most of the opportunities for Urban Forest expansion exist in the city. Therefore, their awareness and support of local Urban Forest objectives is critical in achieving established targets and goals.

> ***Residents of Peel Region have ... expressed a desire to steward the urban forest; however, direction is needed. In addition, many New Canadians must now be introduced to the urban forest.***
>
> *Peel Region Urban Forest Strategy*, 2011

In recognition of this reality, the City of Mississauga, and its agency partners and adjacent municipalities, are becoming increasingly involved in various forms of outreach to specific stakeholder groups and the community at large, on a wide range of topics related to urban forestry and natural heritage. Existing awareness campaigns, tools and programs that apply in Mississauga are led by the Region of Peel, City of Mississauga, local conservation authorities, community groups and industry partners. Current initiatives involve promotion, education, stewardship and partnerships, and/or a combination of those elements, and are described briefly below.

6.5.1 WEBSITE AND SOCIAL MEDIA

The City now provides a range of social media connections. Recent developments include the ability of anyone to join the City on Facebook, Twitter, blogs (e.g., for the *Living Green Master Plan*) or newsfeeds. The City also has its own Call Center (3-1-1) which is available Monday to Friday from 7 a.m. to 7 p.m. for various inquiries about City or Regional programs or services, including Forestry. Common forestry and natural heritage inquiries include reports of noxious Giant Hogweed, questions about the Private Tree Protection By-law, and reports of trees on City property that may be hazardous. Live streaming of public committee meetings is also provided through the City's website.

The City's website has a Forestry section that has been recently updated and includes specific pages on:

- City trees and boulevards
- Private trees and encroachment
- Pests and disease management
- Maintaining the City's Natural Areas
- Getting involved (i.e., tree planting and stewardship programs, including links to the One Million Trees program website)
- Tree-related by-laws

The website section is well-organized, comprehensive and concise. In addition to information and links it also includes an interactive map of all the City's Natural Areas where detailed ecological maps and fact sheets on each one can be downloaded. This is a valuable tool that facilitates natural heritage planning, and keeps the process transparent from an information sharing perspective. Although the City does have a street tree inventory, this inventory is out of date and has not been made available to the public through the website.

The City recently launched a stand-alone website for the One Million Trees Mississauga (www.onemilliontrees.ca/) which has a very fresh look, an on-line tracking log for the number of trees planted since program inception and a list of who has planted them, and clear information on:

- who should participate
- how to participate
- different planning considerations for different planting objectives (e.g., for saving energy, for creating a woodland)
- recommended species and planting tips (including deer and rabbit resistant plants)
- planting programs for public lands, residential properties, business properties, and school grounds, and
- the benefits of trees.

Although entirely voluntary, this will be the first mechanism for tracking plantings on private as well as public property throughout Mississauga. This website also provides a cohesive umbrella for a number of supporting organizations that contribute resources and information. The One Million Trees Mississauga campaign also has hardcopy posters and flyers that have been circulated and posted in various public venues, and are available at selected public events.

Although not specific to urban forestry, the City and Region have partnered on a "Let Your Green Show" campaign with its own website (www.letyourgreenshow.ca) that encourages residents to: (1) grow and eat local, (2) use less water, and (3) give their cars a break. Having drought tolerant gardens of native species and planting trees are part of what is promoted through this program.

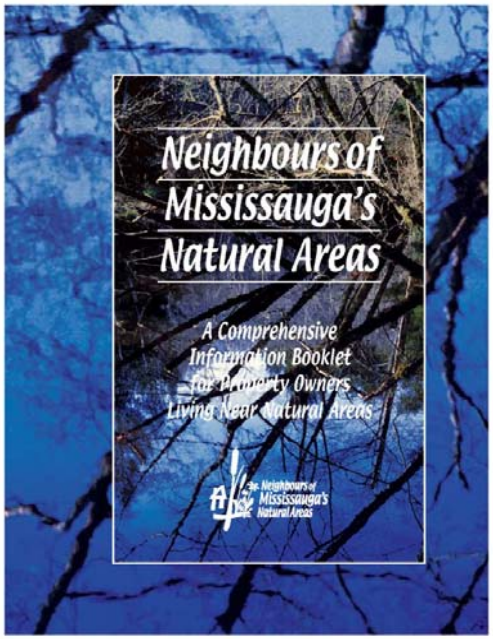
The local conservation authorities also have a number of resources posted on their websites that are directly relevant both to natural heritage and urban forest planning, management and outreach. Examples include plant lists of desirable native species (and undesirable invasive species to avoid), a series of publications on ecosystem services, and brochures providing guidance on how to plant trees and naturalize landscapes.

6.5.2 PROMOTION AND EDUCATION

Staff in the Forestry Section that support by-law enforcement and stewardship consider education a key part of their job, and use face-to-face meetings as opportunities for outreach. This Section has also developed a series of pamphlets and information post cards (printed in colour, with a consistent look to them, and written in non-technical language) on key topics including: gypsy moth, emerald ash borer, and the private tree protection by-law. These publications are available through the Parks and Forestry Division, and are disseminated to residents as appropriate. City staff in other departments (e.g., Planning and Building, Transportation and Works) also have opportunities to educate proponents on the benefits of trees and the City's current policies, guidelines and by-laws related to trees.

The City regularly holds open houses on "hot" urban forestry topics (e.g., emerald ash borer), typically at a City venue (such as City Hall or the community centers). The City has also been involved in some outreach to youth through its various stewardship initiatives.

The City of Mississauga was one of the first municipalities to develop a city-wide brochure for residents abutting City-owned Natural Areas that provides guidance about "do's" and "don'ts". While the information and guidance in this booklet remains relevant, it should be updated.



In addition, some information is posted on a few high profile public Natural Areas on the City's website, and the City and Credit Valley Conservation have developed colourful information brochures on selected public Natural Areas, such as the Lakefront Promenade Park and Marina brochure.

City programs related to urban forestry and natural heritage that have been in place for some time include the Annual Arbour Day Program, Annual Earth Day Program / week, and the Commemorative Tree program that is administered through the Forestry Section, in conjunction with the Commemorative Bench program to provide members of the public a way to recognize or honour others through a lasting tribute of a tree.

SIGNIFICANT TREES

The City also has a Significant Trees Program to get residents to think about the value of trees in their neighborhoods by nominating old, large, interesting and / or unique trees on City property.

6.5.3 STEWARDSHIP, PARTNERSHIPS AND FUNDING

The Region of Peel currently has a couple of programs that provide outreach to the community on topics related to urban forestry and natural heritage:

- the *Teach Green in Peel* program is an on-line database that helps teachers in the Region find locally-relevant environmental education resources and programs, and
- Peel's *Fusion Landscapes* program targets residential homeowners or tenants who are interested in landscaping their yard with drought-tolerant and native species, and provides home visits from a landscape technician to a certain number of residences annually.

Over the past decade, the City has been gradually expanding partnerships to pursue a range of stewardship activities with the local conservation authorities as well as a number of other non-profit organizations (e.g., Evergreen, Tree Canada, Riverwood Conservancy, Credit River Anglers, Ecosource, etc.), schools (e.g., University of Toronto Mississauga Campus), the Greater Toronto Airport Authority, and a number of local businesses. This resulted in the planting of close to 30,000 trees and shrubs in 2012 in various locations throughout the City, primarily on City lands. As opportunities for tree planting and/or naturalization on City lands are becoming increasingly limited, more effort will be required to pursue opportunities on other lands in the city.

A total of 33 stewardship programs currently available within the City of Mississauga are listed, along with their sponsors, target group(s), purpose and contact information, in **Appendix E**.

In terms of partnerships with higher levels of government, the City of Mississauga has been actively working with the Region of Peel on urban forest issues since 2009 and continues to benefit from membership in the Peel Region Urban Forest Working Group where information and ideas are shared, along with some joint initiatives and resources.

The City has also collaborated with adjacent municipalities and the Canadian Food Inspection Agency (CFIA) on cross-boundary invasive pest issues (e.g., ALHB control, and more recently, EAB research).

The local conservation authorities, and in particular Credit Valley Conservation, (CVC), continue to be very active partners with respect to maintaining and restoring natural cover within their regulated areas, and in other public lands across the City. CVC also has a number of outreach and stewardship programs (see **Appendix E**) designed to educate and engage various sectors of Mississauga's community, as well as annual stewardship and volunteer appreciation events. A number of these are pursued in partnership with, and/or with the support of the City. CVC has also been a very active partner with the City in terms of natural heritage planning, and in 2010 completed a Landscape Scale Analysis identifying all current natural areas in the City, as well as prioritizing some of these sites (e.g., for restoration and/or protection) based on ecological attributes. They have also been conducting comprehensive ecological monitoring in a number of the City's public wooded areas, collecting data that can assist the City in management of these areas.

Toronto Region Conservation also provides a number of outreach and stewardship programs available to Mississauga residents (see **Appendix E**), continues to be a source of technical support on natural heritage matters, and has been a key partner in the development of urban forestry products through the Peel Urban Forest Working Group.

Toronto Region Conservation has also been working with the City to establish a Sustainable Neighbourhood Retrofit Action Plan (known as SNAP) initiative in the Applewood area. The SNAP program is an innovative initiative that seeks to develop action plans to improve the local environment on the neighbourhood

scale and build resiliency against climate change by greening local infrastructure and encouraging positive behaviour changes among residents. Each plan builds the business case for implementation by measuring individual and community benefits and cost savings.

Halton Conservation, although only a small area of their jurisdiction falls within the City, have also provided natural heritage technical support and resources for outreach and stewardship.

The local Association for Canadian Educational Resources (ACER) is also very active locally and has established a number of plots in Mississauga, and elsewhere in the GTA, looking at changes to forested ecosystems over time. Their programs are specifically targeted at engaging youth and are both science-based and applied.

The City has also been very successful through the Partners in Project Green in working with a community of businesses to develop an internationally recognized eco-business zone around Pearson Airport. Activities range from sharing power generation to tree planting and naturalization. The group is now seeking to expand their initiative beyond the Pearson Airport area.

Although there is interest in building more local research partnerships (e.g., with local academic institutions), none have been established to date beyond a partnership with University of Toronto in Mississauga's intern program which includes a short-term research component.

With respect to funding, the Parks and Forestry Division has been successfully pursuing funding and resource sharing opportunities through Evergreen, TD Green Streets, and various partnerships. The partnership with Evergreen began in 2004 and now includes annual activities in more than 10 City parks. Evergreen also participates in local Earth Day events and the Mississauga Fall Fair, has partnered with the University of Toronto in Mississauga to plant 22 sites on campus, and launched the Greening Corporate Grounds campaign with CVC.

TD Green Streets is another example of a program that provides matching funding (of up to $15,000) to municipalities for a variety of community-based urban forestry initiatives.

7 BEST PRACTICES AND OPPORTUNITIES FOR IMPROVEMENT

This section of the UFMP presents relevant best practices and identifies key opportunities for improvement related to Mississauga's Urban Forest and Natural Heritage System. The bulk of the discussion around policies is found in the NH&UFS; the discussion in this document is focussed on policy implementation, management, operational practices, and engagement / stewardship activities. Examples of innovative practices and programs from a number of municipalities in Southern Ontario and beyond are also presented.

7.1 URBAN FOREST MANAGEMENT AND ADMINISTRATION

7.1.1 URBAN FOREST MONITORING

Monitoring the status of Mississauga's Urban Forest and Natural Heritage System, and of actions intended to improve their management and stewardship, is necessary if active adaptive management is to be effectively implemented, targets are to be achieved, and progress is to be made regarding urban forest and natural heritage sustainability.

Building on a previous model, a set of standard criteria and indicators for urban forest management (Kenney *et al.* 2011) was recently developed[24] to provide a useful tool for tracking the three key components of effective urban forest management: the status of the asset, the municipal management approach, and the level of community and stakeholder engagement. The 25 criteria laid out in the model include measures that are commonly used (e.g., canopy cover, species distribution, agency co-operation, tree inventory and tree risk management) and ensure that all aspects of urban forest management are considered and evaluated.

This framework has been adopted for monitoring as part of several other Urban Forest Management Plans in Ontario (e.g., City of Guelph, City of Toronto, Town of Ajax), but is not entirely suited to Mississauga's NH&UFS which looks at the Urban Forest and Natural Heritage System in an integrated manner. Therefore, as discussed in **Section 1.3**, it is recommended that this framework be expanded to include natural heritage considerations, and be adopted for the NHUFS. This expanded framework, which is presented in **Appendix A**, has been developed in consultation with the original framework authors (who are part of the study team for this project).

For the NH&UFS and the UFMP, a review cycle of four years is recommended (see **Section 1.3**), recognizing that the more technical and resource-intensive criteria (e.g., change in canopy cover), may be re-assessed at longer intervals, such as every eight years.

7.1.2 TREE INVENTORY

Municipal tree inventories are typically focussed on trees occurring on municipal and/or public lands where the given municipality has jurisdiction. An inventory allows each tree to be assessed for a wide range of variables including location, size, health and condition, and required maintenance. Having this information in a centralized and accessible digital format is essential for the effective management of an urban forest. Key uses for a comprehensive tree inventory include:

[24] Kenney, W.A., van Wassenaer, P.J. and A. Satel. 2011. Criteria and Indicators for Strategic Urban Forest Planning and Management. Arboriculture & Urban Forestry 37(3): 108-117

- IMPROVED AND MORE EFFICIENT URBAN FOREST MANAGEMENT AND MAINTENANCE: Staff can use tree inventory information to accomplish a variety of goals and objectives. For example, tree planting locations and storm response activities can be prioritized, and species-based pest management strategies can be developed and implemented. Ideally, the tree inventory should be the main tool for public urban forest management at the individual tree level.

- A BROADER UNDERSTANDING OF URBAN FOREST STRUCTURE: Tree inventory data in combination with spatial data allows for urban forest structure indicators such as diameter class and species distribution to be mapped and assessed. These data can guide tree establishment planning and priority maintenance, and inform urban forest monitoring.

- IMPROVED PROJECT PLANNING: An urban forest inventory integrated into the municipal GIS (Geographic Information System) enables Engineers, Planners, Landscape Architects, and Forestry staff to work collaboratively to locate individual trees in proximity to proposed municipal works, identify potential conflicts, and plan effective tree protection measures in the earliest stages of planning. This can all be accomplished well in advance of project implementation, saving time and costs, and reducing uncertainties.

Mississauga maintains an operating inventory for about 243,000 street trees and some park trees. However, the inventory is not currently optimized for street tree management. In order to be a useful urban forest management tool, a tree inventory must be: 1) maintained up-to-date, 2) user-friendly and integrated into municipal asset management systems and practices, and 3) sufficiently detailed to enable operational planning. The City's tree inventory currently has few attributes that enable tree-by-tree management planning, and should be expanded to include attributes such as site type, maintenance requirements, risk assessment and pest/pathogen identification to be used to its full potential. The inventory should also be expanded to include trees in actively-managed parks (as opposed to City-owned Natural Areas, which do not require an inventory of individual trees), as the same types of risk management and maintenance requirements are generally required for these trees and street trees.

Examples of nearby municipalities with effective and exemplary tree inventories include Kitchener, London and New Tecumseth, Ontario, whose inventories all include maintenance requirements for each tree. Further abroad, good examples include Pittsburgh, Pennsylvania and San Francisco, California, whose inventories are also used in management and maintenance planning due to the inclusion of detailed inventory attributes.

In Ontario, Oakville, London and Ottawa now have portions of their inventories available on-line to the public, as do Pittsburgh and San Francisco, making the inventory an outreach as well as a management tool. In San Francisco, members of the public can contribute to the City's tree inventory by inputting tree location, species and other data on-line.

7.1.3 INTERDEPARTMENTAL COORDINATION

In most municipalities where there are staff dedicated to urban forest and natural heritage management, it is recognized that a multi-departmental and multi-disciplinary approach is required. In Mississauga, while interdepartmental coordination around urban forestry and natural heritage issues is increasing (e.g., recent creation of the Environment Division), additional opportunities for improvement have been identified. These include:

- having Directors and Managers from different departments be familiar with, and help support, the implementation of the NH&UFS and UFMP
- involvement of Forestry Section staff in the early stages of planning for both private and public projects to help ensure that opportunities for tree protection and/or planting are identified at the outset of the process
- keeping staff in various departments, and at all levels, informed about current policies, by-laws, guidelines and practices related to the Urban Forest and Natural Heritage System, and
- establishing a multi-departmental group of key staff who regularly work with trees that meets to share information and identify ways to improve municipal processes.

In Oakville, one of the first municipalities in southern Ontario to undertake an urban forest study (Town of Oakville 2006) and to develop a comprehensive urban forest management plan, one of the recommendations was to create an Interdepartmental / Interagency Technical Advisory Committee comprised of staff from Parks and Open Space, Engineering, and Planning. The intent was for this group to:

- bring a multi-disciplinary perspective
- review plans (particularly larger scale plans) early in the process to ensure all opportunities for tree preservation and planting are considered, and
- review / develop staff operating procedures or policies supportive of urban forest sustainability.
- A comparable recommendation was made in Guelph, Ontario and Saanich, British Columbia, other municipalities that recently developed urban forest management plans.

In Mississauga, establishment of an internal 'Urban Forest Working Team' including management and staff from Parks and Forestry Division (Community Services Department), Development and Design division (Planning and Building Department), Engineering and Works and Transportation and Infrastructure Planning Divisions (Transportation and Works Department) will help ensure improved interdepartmental coordination, build a better environment for the identification and collaborative resolution of urban forest-related issues, enable knowledge transfer, and ensure consistent application of municipal standards and adherence to policies.

7.1.4 SPECIFICATIONS, STANDARDS AND GUIDELINES

Written specifications, standard detail drawings and guidelines related to tree preservation and planting are useful to ensure best practices suited to the given municipality are adhered to. In Mississauga, tree-related specifications and standards in different departments are not consistent or complete, or entirely aligned with appropriate best practices. For example, the Development and Design Division provides specifications for solid panel or framed hoarding, while Community Services specifications require farm fencing.

To address such issues, some municipalities have developed comprehensive, jurisdiction-wide tree protection and planting specifications for implementation on all types of projects where the municipality has some type of authority. Some examples include:

- City of Palo Alto, CA – "Tree Technical Manual"
- Barrie, ON – "Tree Protection Manual"
- City of Toronto, ON – "Tree Protection Policy and Specifications for Construction near Trees" and "Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual"
- Regional Municipality of York, ON – "Street Tree Preservation and Planting Design Guidelines"
- Town of Markham, ON – "Trees for Tomorrow Streetscape Manual"
- Town of Oakville, ON – "Tree Protection and Preservation Guidelines for Site Plan Applications"
- Town of Richmond Hill, ON – "Tree Preservation By-Law No. 41-07 Fact Sheet No. 5 – Guidelines for Construction near Trees"

Such documents provide an easy-to-use and detailed 'one-stop' reference for residents, site plan applicants, municipal staff and others involved for all tree works. In Mississauga, the development of a comprehensive tree technical manual (or similar document) would encourage consistent application of City requirements and facilitate more efficient review and revision of all standards and regulations in the future to ensure Mississauga continues to be a leader in urban forest management.

While tree protection policies and standards are in place in Mississauga, opportunities to strengthen them to promote more effective tree protection should be explored through a comprehensive review and updating of tree

protection specifications. Factors to consider include improved fencing techniques (solid hoarding except where sightlines are an issue), diameter-based tree protection zones to protect larger root zone areas, and innovative technologies such as directional boring, hydraulic and pneumatic soil excavation and "tree-first" design, to protect existing trees affected by construction and development.

Municipalities with leading examples of tree protection specifications and standards include The City of Burlington (Specification SS12), City of Toronto (*Tree Protection Policy and Specifications for Construction near Trees) and* Palo Alto, California.

7.2 TREE AND NATURAL AREA HEALTH AND RISK MANAGEMENT

7.2.1 YOUNG TREE PRUNING

Pruning of young trees to develop good structure, often called 'training', is one of the best investments in the health of the future urban forest. Proactive and early pruning provides trees with good form which can be maintained throughout their lives, thereby lowering the risk of future failure and reducing liability and long-term arboricultural maintenance requirements and costs.

Maintenance during the 'formative years' of a tree's life (which can be conducted from the ground and at little cost) increases the prospects for long-term tree survival and also greatly reduces future liability by ensuring good form and structure early on.

Research and experience from leading municipalities suggests that immature trees should generally be pruned at least three times within the first 10 years after planting, preferably at regular intervals. Young trees should be pruned to 'train' them towards good structure, and typically no more than five to eight pruning cuts are required during each pruning round.

Mississauga should formalize its existing program with an annual implementation plan and supporting budget. Annual planting lists should be used to direct the pruning, which should take place three times within 10 years after planting.

It is suggested that this program be independent from the broader block pruning maintenance (see **Section 7.2.2**) because given the fast growth rate of young trees in good growing sites, it is difficult to incorporate young tree pruning into a cyclical pruning program, and longer cycles will lead to backlogs in structural pruning requirements. Furthermore, young tree pruning can be done much more quickly with much less equipment. While the number of trees planted (and subsequently pruned) in Mississauga varies annually, the City currently plants up to 4000 caliper trees per year as part the street tree replacement, new subdivision and park tree planting programs, and will be planting many more as part of the EAB Management Plan. These trees will all require a targeted young tree pruning program.

A leading example of a successful young tree pruning program can be found in Calgary, Alberta, where young trees are inspected and pruned (if necessary) a minimum of three times in the first ten years.

7.2.2 CYCLICAL PRUNING

Many municipalities inspect and maintain street trees in a scheduled, cyclical manner called "grid", "block" or "cyclical" pruning. There are many variations to cyclical pruning approaches, and a sampling of municipalities across North America shows that inspection and pruning intervals vary widely between municipalities, from five year cycles to 16-year cycles.

Another strategic approach to cyclical pruning is to establish a different cycle depending on the age or species of the trees being maintained. For example, most trees in Edmonton, Alberta are pruned on a seven year cycle, while elm trees are pruned on a four year cycle.

Over the long term, a planned and cyclical approach can provide significant cost savings over reactionary pruning and tree maintenance. A shorter cycle (i.e., five to eight years) reduces the number of resident service requests which are costly to fulfill as inspection staff time is spent travelling from site to site, rather than progressing through a linear work area. Furthermore, systematic tree maintenance enables earlier detection of pest and other plant health issues, resulting in improved overall urban forest condition.

Mississauga's current pruning cycle is close to optimal at eight years. Funding to improve this level of service from an 11 to 12 year cycle to an 8 year cycle was approved in 2010 and has been implemented gradually. Although this is longer than the optimal cycle of four to five years quoted in some best practices, experience in southern Ontario and elsewhere suggests that a seven to nine year street tree pruning cycle effectively balances costs with tree maintenance

requirements. Cities with long-standing urban forestry programs in Ontario such as Burlington, Hamilton, and Toronto, as well as Calgary (Alberta), Edmonton (Alberta), and Vancouver (British Columbia) all operate on seven to nine-year street tree pruning cycles.

7.2.3 PARK TREE MAINTENANCE

Park tree maintenance in Mississauga is carried out reactively, as it is in many Canadian municipalities. According to the International Society for Arboriculture's Ontario Municipal Arborists and Urban Foresters Committee *Best Management Practices for Ontario Municipalities* (2000), trees in active parks (as opposed to public natural areas) should be visually inspected annually, with maintenance on an as-needed basis. However, this is not achievable in most jurisdictions due to resource constraints. Inspection cycles of once every five years are considered acceptable, however even this cycle can be difficult to achieve for some.

It is recommended that a maximum five year inspection cycle be implemented in Mississauga for actively-managed park trees, with maintenance continuing to be undertaken on an as-needed basis based on work order requests and the results of visual inspection. Expansion of the City tree inventory to actively-managed park areas should also generate some more immediate maintenance recommendations and, once carried out, will reduce future work requirements and result in longer-term cost savings.

7.2.4 TREE AND WOODLAND RISK MANAGEMENT

Despite being an extremely valuable asset (see **Section 3**), trees can, under some circumstances, pose risks to persons or property. Although tree risk is statistically minimal in relation to many factors of daily life, the potential for tree-related risk increases as trees age, if tree health and condition decline, or if young trees are not properly pruned to develop good structure. The City is responsible for ensuring that its trees are maintained to minimize potential risks presented by them.

Tree risk assessment and mitigation are becoming increasingly recognized as critical components of urban forest management. The key to effective tree risk management lies in an operational policy or protocol that coordinates inspection, mitigation and proactive planning in order to reduce risk, uncertainty and liability. A dedicated protocol that sets minimum standards for risk assessment and documentation, will result in consistent levels of assessment over the long term. Key components of an effective risk management policy or protocol include:

- a policy statement framing the scope of work (i.e., which trees/areas are to be included), assigning responsibility, setting goals and outlining a realistic Standard of Care statement
- determination of acceptable risk, outlining what the City considers an acceptable threshold for risk of tree failure
- minimum levels of training and qualifications of risk assessors, outlining the expected credentials that tree risk assessors should possess
- frequency of assessment, outlining how often publicly-owned trees in different settings (e.g., trails, high-traffic streets, new communities) are to be inspected for risk
- management options, outlining what arboricultural treatments the City will consider for implementation to mitigate risk (such as pruning, cabling, bracing, or removal)

- record-keeping protocols, to enable tracking of inspections and mitigation actions
- strategy funding and/or partnerships, to identify expected costs and anticipated sources of funding to enable the implementation of the strategy, and
- a strategy for program assessment and reporting to enable active adaptive management and ongoing improvement.

A comprehensive risk management protocol should also include consideration for post-storm emergency response, including prioritized inspection and maintenance areas.

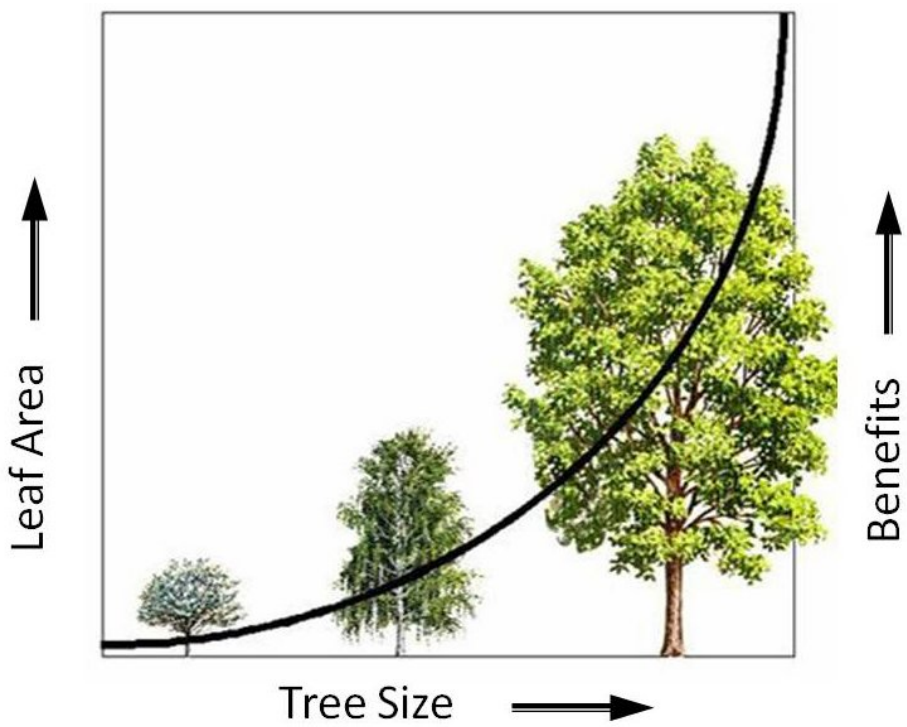


Figure 9. Illustration of the exponential increase in ecosystem services (or benefits) provided by trees as they mature.

Tree risk mitigation is an important practice and one that can extend the life of a tree that might otherwise be considered a risk. Practices such as soil amendments and structural pruning (if performed correctly and managed appropriately) can greatly reduce the risk presented by certain aging trees. Because large trees provide such a disproportionate amount of ecosystem services (as compared to smaller trees) (see **Figure 9**), investing in their retention results in exponentially more benefits to the community.

Recent advances in tree risk assessment have given rise to new levels of risk assessment training and qualification by bodies such as the International Society of Arboriculture. While Forestry staff in Mississauga have received introductory levels of tree risk assessment training, the City's Forestry Inspectors should be provided with advanced training and qualification through the ISA's Tree Risk Assessor Qualification (TRAQ) program as well to enhance this capacity.

Basic visual inspection of trees in actively managed and high-traffic locations (e.g., streetscapes, parks and along woodland trails) should be undertaken and documented systematically to demonstrate the City's fulfillment of its duty of care. Annual inspection is optimal but likely unachievable given resource constraints and fiscal realities. As such, higher-risk trees and locations should be prioritized for tree risk assessment and management.

Management of tree-related risk in woodlands and other natural areas is challenging due to the large numbers of trees present in such areas, and has recently been made even more challenging because of the resources required to deal with emerald ash borer (EAB). It is anticipated that, as the borer spreads across the City and causes increasing ash mortality, more woodlands and natural areas may require fencing or other risk management approaches, due to the rapid rate of root decay and tree uprooting following EAB-induced mortality.

7.2.5 INVASIVE PLANT SPECIES MANAGEMENT

Invasive plant species are considered one of the primary drains on ecological integrity in wooded natural areas of the urban forest. In many parts of southern Ontario, urban forests and wooded natural areas are heavily invaded by invasive trees and shrubs such as Norway maple, Tree-of-Heaven, and European buckthorn, as well as herbaceous plants such as garlic mustard, dog-strangling vine, and many others. The federal and provincial governments do not provide any resources to assist with the control of such plant species (beyond information such as Ontario's Invading Species Awareness Program), and there

are very few coordinated strategies to control invasive plant species, largely because the resources and staff required to implement such efforts would be substantial and the benefits would not be immediately evident to the general public.

Currently, invasive plant species management in Mississauga is relatively small in scale and not effective in completely controlling targeted invasive species. One exception to this has been the effective efforts to detect and control giant hogweed, an invasive plant known to burn skin and even cause blindness to people exposed to its sap,

The *Ontario Invasive Species Strategic Plan* (2012) published by the Provincial government identifies a series of 27 Actions for addressing this issue under the topics of: (1) leadership and co-ordination, (2) communication and co-ordination, (3) improving the effectiveness of existing committees, (4) legislation, regulation and policy, (5) risk analysis, (6) monitoring and science, (7) management measures, and (8) communication and education. This document considers all invasive species, not just forest plants, and includes actions that speak to the need for rapid response protocols for new infestations and increasing governmental capacity to develop and implement risk assessment tools. This provides some useful guidance, but does not really help the City prioritize its invasive plant species management approach. Direction for prioritization is provided in a targeted Invasive Species Management Plan for Mississauga, provided in **Appendix C**, which has been developed (as part of this Plan based on analyses of the City's Natural Areas surveys. More details on specific management techniques are provided in Credit Valley Conservation's Invasive Species Strategy (2009).

Effective invasive species management must consider a wide range of factors, including but not limited to: prevention of invasions, identification and mapping of invasive populations, cost-effective control measures, community partnerships, funding, and public education and awareness. Specific recommendations, as provided in **Appendix C**, include:

- Continue dialogue and development of cooperative initiatives for invasive species management with Credit Valley Conservation
- Adopt the general principle of prioritizing management by addressing the invasive species that pose the greatest potential for impact to native vegetation, and which occur in the most valued natural areas in the Natural Heritage System (i.e., "flagship" natural areas)
- Develop a landowner contact program to educate landowners about the potential threat posed by non-native species, including pets
- Identify safe and easily understood management techniques that can be implemented by volunteers, and
- Implement invasive species control for the priority species and areas identified (as identified in **Appendix C**).

7.3 TREE ESTABLISHMENT AND URBAN FOREST EXPANSION

7.3.1 TREE SPECIES SELECTION

The sustainability and health of the future urban forest will rely on the selection and planting of a diversity of tree species, planted in appropriate locations and maintained until they are well-established because doing so builds in resiliency to stressors such as species-specific insect infestations and diseases, as well as stressors linked with climate change (e.g., periods of drought, intense storms). While the use of native species is preferable, some non-invasive, non-native trees are also suitable under difficult growing conditions. Species selection should be based on a wide range of considerations. For example, planting small statured trees under utility wires can reduce the need for costly corrective pruning.

A general guiding principle for species selection of actively managed street and park trees has been the "30-20-10" rule whereby:

- no tree family exceeds 30% of the inventory
- no tree genus exceeds 20% of the inventory; and
- no tree species exceeds 10% of the inventory.

This rule has been adopted as one of the Urban Forest targets for Mississauga.

Recognizing the need to test different species in a context of climate change, the City of Peterborough, Ontario, in its strategic plan, committed to undertaking an innovative step to achieving long-term urban forest sustainability through species suitability trials. The Town of Oakville has made the same commitment. This involves planting small numbers of previously untested species, and closely tracking their performance over time.

Species selection for wooded natural area enhancement, restoration and expansion should not be based on the "rules" above, but rather should be based on ecological and biophysical considerations, and should strive to mimic the community composition of relatively undisturbed wooded areas within the same ecozone. Considerations should include local biophysical conditions and the relative age / successional stage of the wooded area, and the objectives should include the re-creation of native structural diversity over time.

Specific recommendations for Mississauga that will support increasing the diversity of street and park tree plantings include the development of a comprehensive list of suitable and acceptable tree species (to be included with the recommended comprehensive specifications, standards and guidelines) in order to better guide tree establishment planning and practices. The list should include a wide range of information about acceptable species, including site requirements, and acceptable locations. The City should also continue to undertake and monitor species suitability trials, the performance of which can be tracked along with other plantings under the Million Trees Mississauga program.

7.3.2 TREE HABITAT

Tree habitat is a critical consideration when planning tree establishment and urban forest expansion. For example, roadside boulevards rarely provide optimal growth conditions, and plantings in boulevards invariably perform worse than those in neighbouring front yards. Tree establishment success is directly related to the below-ground growing environment, including factors such as soil volume, quality, texture and drainage.

While species requirements vary, minimum recommended soil volumes for large-stature (e.g., 40 cm DBH) trees in areas which receive adequate rainfall are around 30 m^3. In accordance with these requirements, the recent North Oakville urban forest management plan requires 15 m^3, 30 m^3 and 45 m^3 of soil for small, medium and large-sized trees, respectively. The City of Toronto's recent *Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual* outlines similar requirements for streetside plantings, and recognizes some efficiencies can be achieved through "shared soil volumes" among groups of trees. Mississauga's *Green Development Standards* (2010) also outlines these soil volume requirements.

It is acknowledged that it may not be possible to substantially increase soil volume for tree plantings in established areas of the City during the course of replacement street tree plantings. However, enhanced rooting environment techniques such as soil cells or continuous trenches should be considered in order to provide adequate soil volumes during the course of new development and through capital projects. A review of the City's tree establishment specifications, standards and guidelines should also consider implementation of minimum soil volumes. While more costly than common tree establishment methods, implementing enhanced rooting environment techniques has been demonstrated to; achieve significantly higher rates of tree establishment

success, enable the development of larger trees, reduce the frequency of tree replacement, and ultimately support the provision of more ecosystem services to the community.

Another key consideration is the quality of the soil in a tree's rooting area. In addition to lack of consideration for soil quality in many planting areas over the years, salt spray continues to be a widespread problem along city streets and boulevards. This spray can damage foliage, reduce growth and sometimes cause death. The development of "witches' brooms" in tree and shrubs branches is a common response. Possible solutions include: planting more salt tolerant species in heavily affected areas, reducing salt use by using alternatives or reducing the proportion of sodium in sprays, limiting salt application in ecologically sensitive areas, and protecting susceptible plants (e.g., with burlap or snow fencing), increasing irrigation and mulching.

7.3.3 TREE ESTABLISHMENT AND NATURALIZATION PROGRAMS

In Mississauga, trees can be established through the Forestry Section's standard operational activities, tree establishment as part of private or public projects, or naturalization/restoration plantings undertaken by the City, conservation authorities, or one of the numerous stakeholders or residents in the City. Opportunities to improve planting specifications, guidelines and practices have been outlined above. Opportunities to improve the implementation of tree establishment programs are discussed in this section.

In order to promote urban forest expansion and ensure trees are planted where the likelihood of post-planting care is highest, the City's request-based tree establishment program should be more effectively promoted and formalized. Such programs exist in many communities; among the most effective examples are in Toronto and in Hamilton, where online information and brochures help residents pre-select desirable species and provide information to help City staff decide whether planting is appropriate.

Suitable sites for tree planting in municipal rights-of-ways should be identified during the course of Forestry operations and included in an inventory. Trying to keep boulevards free of above and below-ground utilities as much as possible also helps create better tree planting opportunities.

For expansion/restoration planting programs, it is important to verify the appropriate tree planting locations and ensure they can support trees for the long-term. It is discouraging for a community group, and a waste of resources, when a naturalized area is altered by an approved development a few years later. Good planning and direction of volunteer activities can avoid these scenarios. When planted trees must be removed, volunteers appreciate efforts to have them properly transplanted. A key component of the City's new One Million Trees Mississauga program should be strategic long-term planning of future potential restoration/expansion sites, which must consider existing planning commitments and future potential land uses. Considerations for prioritizing plantings should include areas where existing canopy cover is low but population densities are high, areas identified for naturalization in conservation authority subwatershed plans, and areas heavily affected by EAB-related mortality of ash trees.

Several other communities have undertaken One Million Tree planting projects, including London (Ontario), Los Angeles and New York. Through various partnerships and community involvement, London's Million Tree Challenge has seen the planting of over 97,000 trees. Among the greatest challenges associated with Million Tree-type programs is to ensure tree survival. Follow-up inspection, post-planting care, and performance tracking must be considered critical components of any large-scale planting program, and should be incorporated into One Million Trees Mississauga.

7.4 TREE PROTECTION AND NATURAL AREA MANAGEMENT

The protection of existing trees is among the most critical aspects of sustainable urban forest management. Existing mature trees provide significantly more benefits than newly-planted ones (see **Figure 9**), and the incremental loss of mature trees makes increasing urban forest canopy coverage difficult. Trees are regularly lost due to natural mortality, pests and diseases, and removal during site development, and at landowners' discretion. While tree removal may be required for risk mitigation or to accommodate development, removal of healthy trees, particularly when they are large-statured native species, should not be undertaken without full consideration of alternative development or design options in addition to tree preservation measures.

7.4.1 OFFICIAL PLAN POLICIES

Over the past few years, an increasing number of municipalities in southern Ontario with active urban forestry programs have introduced urban forest policies into their Official Plans. Examples include the Town of Oakville, Town of Ajax, City of Guelph, City of Brampton and the City of Mississauga. Some other nearby municipalities with active urban forest programs, such as the City of Toronto and the Town of Milton, have policies related to the urban forest in their Official Plans that are embedded in other policy sections.

The current Urban Forest policies in Section 6.4 of Mississauga's *Official Plan* (2011) strike a good balance between supporting overall protection, enhancement and expansion of the urban forest, while still allowing for development considered appropriate by the City.

However, these policies could be strengthened by:

- defining the "urban forest".
- including Urban Forest goals or objectives
- defining "no negative impacts to the urban forest"
- supporting the need for identification of opportunities for tree replacement (along with the current policies supporting protection) and requiring planting off-site or cash-in-lieu where replacement cannot be accommodated on site
- supporting the development and implementation of consistent city-wide standards for tree protection and replacement
- expanding the scope of strategic partnerships
- specifying the need to avoid using invasive species, and

"No negative impacts" or "no net negative impacts" to the urban forest should be understood to allow for some removal of trees where required and permitted as part of the planning process, as long as the removed trees, and to the extent possible their functions, are replaced so that ultimately there is "no net loss" and, in time, "net gain" to the urban forest as a whole.

Notably, the NH&UFS includes a section on planning with several strategies that speak to planning for the urban forest, including Strategy #6 "Strengthen Official Plan policies related to the Urban Forest", which provides guidance for moving forward on the gaps identified in this section.

7.4.2 TREE PRESERVATION BY-LAWS

Private Tree Protection By-law

Mississauga, like many urban area municipalities across southern Ontario, has a by-law in place that regulates injury and removal of trees on private property. Best practices related to private tree by-laws are difficult to assess since each municipality's by-law is tailored to local circumstances and resources, and there is currently no mechanism for tracking the relative effectiveness of the different by-laws. However, it is generally agreed among tree by-law officers that these by-laws are as much an educational tool as a regulatory tool, and that any by-law is only as effective as the resources dedicated to its implementation and enforcement.

Given that Mississauga's by-law has just been updated based on local research and consultations, some time will be required to educate residents and staff about these changes, and to see if these changes better support the City's Urban Forest. While key changes in the recent update include allowing for fewer trees of 15 cm and above to be cut without a permit each year (i.e., two instead of four), the by-law still allows for the removal of some potentially large, mature trees without a permit.

Based on the current conditions of Mississauga's urban forest (see **Section 2**) it is recommended that in four to eight years when the Private Tree Protection By-law comes up for review again, that the City consider the potential benefits of requiring permits to remove all individual trees above a certain diameter on private lands. This change should be considered in conjunction with the anticipated costs associated with regulating more trees, and enforcing this regulation. In Mississauga, as elsewhere, it is not generally advisable to have a private tree by-law that the municipality is not able to adequately enforce.

Notably, Mississauga currently has one by-law inspector dedicated to the administration and enforcement of this by-law. The recent tightening of the by-law will presumably result in a greater work load. This will need to be monitored to ensure that current levels of enforcement can be maintained.

Street Tree By-law

Many municipalities have by-laws regulating the injury or destruction of publicly-owned trees. These by-laws help protect the municipality's assets, and show municipal commitment to its urban forest. Key components of such by-laws can include requirements for compensation if trees must be removed for development, and the ability to levy fines and stop work orders to prevent unauthorized damage to publicly-owned trees.

The City's updated Public Tree Protection By-law, currently under development by City staff, will extend the current by-law to include all trees on City lands (not just on boulevards) and, among other things, will be addressing the treatment of boundary trees[25], as this can become an issue when the tree is shared between the City and a private landowner.

Other Relevant By-laws

The City's Encroachment By-law was last updated in 2011, and is increasingly being used as an effective tool for reducing the expansion of private land uses into adjacent public natural areas (as described in **Section 6.4.2**). There are not many other municipalities with such by-laws, and fewer that actively enforce them as in Mississauga. The City is currently in the process of implementing a more active enforcement program for its Encroachment By-law with assistance from the conservation authorities that includes an education component and systematic tracking of the types and severity of encroachments.

Erosion Control By-laws, also called Site Alteration By-laws, are authorized under the *Municipal Act* (2001) (just like tree by-laws) and regulate the removal or placement of topsoil within a jurisdiction. Among other things, these by-laws typically require the identification of all trees that may be impacted by the proposed grade changes, and therefore provide an opportunity for the identification of tree preservation, tree replacement and/or compensation for trees approved for removal. The benefit, from an urban forest perspective, of these by-laws is that they require permits for activities that may not be under the purview of the *Planning Act* (1990) or other City by-laws, and therefore enable identification of opportunities for tree protection and replacement that may otherwise be overlooked.

The City's Erosion and Sediment Control By-law is an existing regulatory mechanism that could be used to flag the need for tree protection and identify opportunities for tree planting and naturalization while also regulating removal

[25] Boundary trees can become an issue when activities or development on one property have the potential to harm trees shared by the adjacent property owner. The *Forestry Act* (1990) makes it an offense to injure or destroy a boundary tree without the neighbour's formal consent.

and addition of fill in the city. As this by-law is currently being updated by City staff in Transportation and Works, it is a good opportunity to ensure the by-law can be used to achieve Urban Forest and Natural Heritage System objectives. Key gaps identified in the current by-law in this context include:

- an exemption for lands of up to 1 hectare (which is quite large in a jurisdiction where most future development will be primarily infill and intensification)
- only a general requirement for the identification of vegetation on site (rather than specific requirements to provide an inventory of trees, as well as other vegetation, on site)
- an absence of any requirements related to tree protection for specimens being retained, and
- a lack of compliance with the current Private Tree Protection By-law in terms of compensation requirements for trees of at least 15 cm diameter proposed for removal.

Revisions to the by-law to make it more consistent with current in force tree by-laws, and best practices regarding tree preservation would go a long way towards making it a useful tool for identifying opportunities for tree protection and replacement. These changes would also need to be accompanied with education of the City staff administering and enforcing the by-law to ensure effective implementation of these changes, and would be facilitated with support from a Certified Arborist in the Forestry Section familiar with by-law enforcement.

7.4.3 TREE PRESERVATION THROUGH THE PLANNING PROCESS

Tree Preservation under Development Control

The *Planning Act* (1990) (in particular Section 41, Site Plan Control) provides municipalities with the authority to identify trees for protection and require replacements on private lands subject to the development application and approval process (typically termed Site Plan Control). A number of municipalities in southern Ontario use this authority and require that all trees (typically of at least 10 cm or 15 cm in diameter) be assessed and inventoried, and that detailed tree preservation plans be submitted as part of a Site Plan Application.

Site Plan review and approval, if applied in conjunction with guidelines and specifications intended to support tree health and longevity (e.g., appropriate soil volumes, adequate above-ground space, and appropriate species selection), is one of the best tools at a municipality's disposal to foster urban forest sustainability through the development process. It is at this planning level where important decisions around tree protection and planting can be made, and where municipalities with a vision for their urban forest, and the will to implement it, can ensure that all opportunities are explored.

Tree preservation and protection during development under Site Plan Control is required in Mississauga. However, opportunities exist to improve the implementation of these practices, including:

- involvement of Forestry Section staff (where trees exist on the subject lands and at the discretion of Landscape Architects in Planning and Building) in earliest stages of development pre-consultation, before Site Plan Application packages are submitted
- a "fast-tracked" collection and review process for all *Tree Injury or Destruction Questionnaire and Declaration* forms, particularly where mature trees are known to exist
- requiring detailed arborist reporting, including tree inventory and tree preservation methods, for all development applications where trees may be affected
- improving the City's ability to conduct site inspections during development
- increasing the value of securities held against tree protection to increase incentives for compliance, and
- requiring arborist inspections, with supporting reports to be submitted to the City for review.

Tree Preservation outside Development Control

Opportunities to ensure compliance with tree preservation regulations and policies outside of development control are more limited and more difficult to implement. For example, smaller development activities outside of Site Plan-regulated areas in Mississauga may not be regulated pursuant to the Erosion Control by-law, or require Committee of Adjustment approval. In such an instance, the only required permit may be a Building Permit, which must be issued within a Provincially-mandated timeline generally not exceeding 10 days (or a bit longer for larger or more complex structures). In Mississauga, a Building Permit application should be supported by a completed *Tree Injury or Destruction Questionnaire and Declaration,* but these are typically not reviewed

or field verified due to time constraints, and opportunities to explore potential tree preservation options can be missed. A similar situation can occur during installation of a swimming pool, which does not require a permit except for its enclosure.

As such, ensuring compliance with municipal tree preservation requirements outside of development control is not always possible. Nonetheless, tools such as the City's Erosion Control by-law should be reviewed and updated, and Tree Declaration forms should be reviewed and acted upon if potential injury to by-law protected trees is suspected.

Many municipalities have, and enforce, erosion control and/or site alteration by-laws for the removal or placement of topsoil within a jurisdiction, which can be used to identify or prevent contravention of tree preservation by-laws. In southern Ontario, municipalities with such by-laws include Markham, London, Kingston, Oakville, Hamilton, Guelph, and Niagara Falls.

7.4.4 TREE PROTECTION DURING MUNICIPAL WORKS

In general, tree protection planning and implementation during municipal operations or capital works should receive the same level of consideration as private site development. Review of conceptual plans, project requirements and potential conflicts should be undertaken early on in the process by a multi-disciplinary review group including project Planners, Landscape Architects, Engineers and Arborists, in order to explore opportunities to minimize tree injury or removal. Where such measures are implemented, City Arborists should be involved in the site review of tree protection measures including hoarding, root-sensitive excavation or other methods. Alternately, these could be supervised by a contract Arborist required to report to the Parks and Forestry Division.

Municipalities are increasingly realizing the benefits of interdepartmental coordination and cooperation when planning large-scale capital projects, or even smaller scale maintenance operations. For example, all Town and Regional capital projects in the Town of Oakville must be supported by a complete Arborist report, including a tree inventory, tree preservation/removal plan, tree compensation calculation and, where required, tree injury or removal permits. Securities can also be held by the department of the municipality responsible for signing off on the tree-related / landscaping works. These approaches should be adopted in Mississauga to demonstrate the City's commitment to leading by example.

7.5 PROMOTION, EDUCATION, STEWARDSHIP AND PARTNERSHIPS

As is the case in many municipalities in southern Ontario, much of Mississauga's Urban Forest is located on lands outside of municipal ownership or control. Furthermore, the resources that the City is able to allocate to Urban Forest management cannot support the full range of desired stewardship activities, at least not within the desired timelines. Consequently, the importance of improving the community's appreciation of the value of the Urban Forest, actively encouraging proper tree care and planting practices, and nurturing partnerships with as many stakeholders with an interest in the Urban Forest as possible is critical.

7.5.1 OUTREACH USING PUBLIC WEBSITES AND SOCIAL MEDIA

Recent social marketing research conducted in the City of Toronto, and elsewhere, has found that one fundamental barrier to fostering stewardship is the growing detachment most people have from nature in our society. The key challenge, then, is how to get beyond this barrier.

Municipal websites represent a cost-effective tool for sharing a wide range of information related to a municipality's natural heritage and urban forest assets, as well as informative links to other websites. Examples of jurisdictions with very comprehensive urban forestry websites include the City of Toronto and the City of Ottawa, as well as the City of Edmonton, Alberta. The City of Mississauga has just updated the Forestry Section of its website and launched the One Million Trees program website, and should continue to update the content and look of these resources.

Websites can also be used as tool for engagement. A growing number of municipalities with active urban forestry programs are putting their municipal tree inventories on-line for use by City staff in other departments and the public. The City of London and Town of Oakville have had their inventories on-line for several years. The City of Ottawa recently launched their on-line tree inventory. The City of Mississauga should, after it is updated and expanded, look to posting its tree inventory on-line for the public (as well as for use by City staff).

Mississauga is one of the few municipalities in Ontario to post current summaries of all of its Natural Areas through an interactive city-wide map, and to undertake an ambitious One Million Trees Mississauga program over the next 20 years. Notably, the Region of Peel also has an interactive map showing data on its natural areas gathered through the CVCs Natural areas Inventory, and the City of London also launched a "Million Tree Challenge" several years ago with a local non-profit group called Reforest London. The City's Natural Areas monitoring program should be better promoted, both internally and externally, as a resource and a platform for engaging stakeholders, and for fostering broader partnerships. The City should also consider developing directories of local residents, businesses and other stakeholders that are interested in stewardship activities and willing to be contacted for future activities, or who just want to be kept informed.

Although an increasing number of municipalities are starting to build social media outreach into their day to day service, few have developed and posted video clips, particularly related to urban forest topics. The City of Calgary is one of the few that has posted videos on how to plant a tree, as has the non-profit Toronto-based organization LEAF. The City's website is already set up for Facebeook, Twitter, You Tube, and already provides live video feeds of committee meetings. Therefore, it would be relatively easy to adapt these tools so they are more targeted to natural heritage and urban forest promotion at key times of the year. Key dates would include:

- National Tree Day (September 25)
- Arbour Day / Earth Week (mid-April)
- International Day for Biodiversity (May 22)

The City should also develop a series of short video clips on topics of interest. Possible examples of topics include: ecosystem services provided by Mississauga's Natural Heritage System and Urban Forest, how to plant a tree, and a video about EAB. In all cases the messaging should be clear and engaging. Where possible, these materials should be made available in languages other than English that are widely spoken in the Mississauga. Key themes to convey through these materials include:

- the direct connections between the health of the Natural Heritage System and Urban Forest, and human health
- the ability and importance of the contributions of individual private citizens and businesses to local sustainability
- the fact that local programs and resources are readily available, and
- that the City is working to protect, manage and expand the Urban Forest and Natural Heritage System on public lands, but needs local residents, businesses and other stakeholders to contribute if natural heritage and urban forest objectives are to be met.

7.5.2 GENERAL AND TARGETED MARKETING

More municipalities are recognizing the importance of branding and marketing their messages to compete on a level playing field with the many other sources of information and imagery that people are exposed to on a daily basis. Examples include the City of Guelph's Healthy Landscapes program which has its own logo and look that appears in newspaper advertisements as well as on resources developed for this program. It is quite commonplace now for programs to have their own logos.

The One Million Trees Mississauga program is an example of a well-branded program with a unique look that carries over from the program website to the posters and pamphlets developed to date. The City has also developed a "look" for Parks and Recreation publications, and recognizes the importance of clear messaging and captivating the audience.

In addition to general marketing to the general public, the NH&UFS (and supporting UFMP) includes a range of outreach tools targeted to certain groups because of their disproportionate ability to influence the development of Mississauga's landscape. Key groups identified through the project consultations include: youth / students, businesses / corporations, local arboriculture firms and landscapers, developers and their planning consultants, and new Canadians.

Examples of approaches for targeting these groups include:

- workshops on specific topics or technical issues (e.g., native plant selection, tree planting tips, etc.) like those offered by the Town of Oakville and City of Brampton as well as the non-profit organization LEAF in the Greater Toronto Area and beyond
- presentations and workshops provided where people work or congregate for social or religious reasons, rather than having them come to a City Hall or comparable location (e.g., City of Guelph Healthy Landscapes program)
- bringing programs like TRCA's "Watershed on Wheels" (that has been designed to meet Grades 1 through 8 Ontario science and technology curriculum expectations) to the attention of the various school boards, and
- supporting programs like ACER (based in Mississauga) that provide science-based and applied learning to high schools related to trees and the environment.

7.5.3 PROMOTING THE VALUE OF NATURAL AREAS AND THEIR SENSITIVITIES

One of the key opportunities identified through this project is to better promote the ecosystem services provided by the Natural Heritage System and the Urban Forest, and specifically to promote the value of Natural Areas in the city in terms of their contributions to quality of life, and their need for management that carefully balances appropriate access with protection of key ecological functions.

Some of the most current and relevant materials related to ecosystem service provision are cited in **Section 3** of this UFMP, and in the NH&UFS. These materials and sources can be used as the basis for developing City brochures (web based and hardcopy) that promote the importance of these ecosystem services in the context of Mississauga.

In addition, the City's Natural Heritage System, and the City-owned Natural Areas within it, should be promoted for (a) their ecosystem services, and (b) their intrinsic ecological values (e.g., provision of habitat, support of biodiversity, provision of ecological connectivity in the landscape) while still highlighting their sensitivities to overuse and misuse.

A good example is the City of Kitchener which distinguishes its publicly accessible natural areas from its active recreational parks in name and in planning. Natural areas are managed very differently from active parklands, and also have their own promotional program. Kitchener's Natural Areas Program is designed to engage the community in environmental stewardship projects, educate people about Kitchener's natural areas, and create opportunities for people to experience nature in the city.

7.5.4 STAKEHOLDER ENGAGEMENT AND FOSTERING COMMUNITY PARTNERSHIPS

Municipalities with progressive natural heritage and/or urban forest agendas are recognizing that stewardship by the community and local stakeholders is key to natural heritage and urban forest sustainability because so much of the extant and potential urban forest is on private lands.

Encouraging and supporting tree planting, and particularly site-appropriate native species, is a key strategy employed by many such municipalities. The City of Guelph and Town of Richmond Hill both have municipal programs that provide: (a) information and education on how residents can naturalize their lawns and gardens with native species, (b) plants and/or advice at a discount or free. The Toronto-based non-profit organization LEAF continues to provide a range of urban forestry services focussed on supporting tree planting and care in residential yards in the Greater Toronto Area, York Region, and beyond.

In Mississauga, there are already tree planting / landscaping programs targeted to residents through the Peel Fusion Landscapes Program, Toronto Region Conservation's Healthy Yards Program and CVC's Grow Your Green Yard Program. There are also programs sponsored by the City, CVC, Toronto Region Conservation and Evergreen (see **Appendix E**) that target businesses / corporate lands and schools. The City has been able to bring many of these programs together through the One Million Trees Mississauga program where they are promoted, with relevant resources and information. The City should continue to foster and leverage these partnerships to support its urban forest objectives, and to provide support to these various initiatives where possible.

Many municipalities have commemorative tree and/or bench programs, and some larger municipalities also have arboreta (typically associated with an academic institution), however very few have memorial programs tied to a central, municipally-owned arboretum that also serves as an educational and research centre. An example of a native tree arboretum is the Louise Pearson Memorial Arboretum in Tennessee, while other notable arboreta focused on educational and research objectives include Missouri Botanical Gardens in St. Louis and the Louise Kreher Forest Ecology Preserve. Closer to Mississauga there is the Royal Botanical Gardens in Hamilton, and the University of Guelph's Arboretum which both have memorial components but are primarily focused on educational and research objectives.

Having a City-owned and operated Arboretum / Memorial Forest would be a unique opportunity to provide a centralized place of natural respite, reflection and solace for the memorial of loved ones, as well as a place for the City to educate and engage youth and other members of the community on the diversity of native trees (and shrubs) that can grow in Mississauga, the ecosystem services they provide, and techniques for planting and caring for these plants. The Arboretum could also provide a venue for selected joint research projects between the City and local academic institutions, agencies and non-profit organizations[26].

7.5.5 BUILDING RESEARCH PARTNERSHIPS

Although some municipalities try, it can be challenging to coordinate partnerships with academic and/or research institutions to conduct applied research that addresses selected local natural heritage and urban forest issues. In part, this is because many of the natural heritage and urban forest questions needing to be answered are complex and need to be studied over many years. It is also challenging because municipal staff do not generally have the time or the expertise to pursue research projects independently, and therefore must partner with nearby government agencies and/or academic institutions and/or non-profit organizations that include research as part of their mandate.

The United States Department of Agriculture (USDA) Forest Service, in collaboration with the University of Vermont, has become an excellent urban forest resource, and has worked with many municipalities in the U.S. and Canada (including the region of Peel) to develop and undertake urban forest canopy assessments using the latest tools and technologies. This relationship should continue to be fostered, and the Region and Peel Urban Forest Working Group should continue to collaborate with the USDA group if opportunities arise.

In Canada, there is no comparable government body dedicated to urban forest issues, and therefore urban forest research closer to home is left to universities, colleges and agencies. In Ontario, two of the best known and most well-established urban forestry programs are in Lakehead University (Thunder Bay), and the University of Toronto, which coincidentally has a campus in Mississauga. There have already been several Mississauga-based research projects related to urban forestry undertaken through this campus, but none in collaboration with the City. Opportunities to pursue mutually beneficial local research projects should be explored.

Both the CVC and Toronto Region Conservation authorities are active in research and monitoring generally related to natural heritage, but increasingly also looking at urban forest-specific issues as well. Several local non-profit groups, such as ACER, are also actively involved in monitoring. The City should work with these groups to determine where and how their research can support the City's urban forestry interests, and how the City may in turn be able to support their work.

Other agencies such as the Canadian Food Inspection Agency are already actively involved in EAB research. There may be opportunities to have pilot or case studies in Mississauga that would also help inform local management needs.

As discussed above, the establishment of a City-owned and operated Arboretum / Memorial Forest is currently underway. This venue will provide an ideal location for future collaborative research projects, as well as engagement, education, stewardship, and respite.

There are many potential projects that could be pursued, and these would to a large extent be determined based on joint interest, available resources, and the mandates of the individuals / organizations involved. Potential projects, several of which were recommended through the *Mississauga Urban Forest Study* (2011), could include:

- responses of different native tree species to different soil types and conditions in the city
- evaluation of the use of structural soils, subsurface cells and other enhanced rooting environment techniques for street trees
- working with local growers to diversify stock and reduce reliance on clones, and
- development of a seed collection program for native ash species (to bank the genetic stock) in partnership with Toronto Region Conservation, CVC and the National Tree Seed Centre.

[26] Notably, a terms of reference and site selection process for the Arboretum design are being completed as part of this Plan and provided to the City under separate cover.

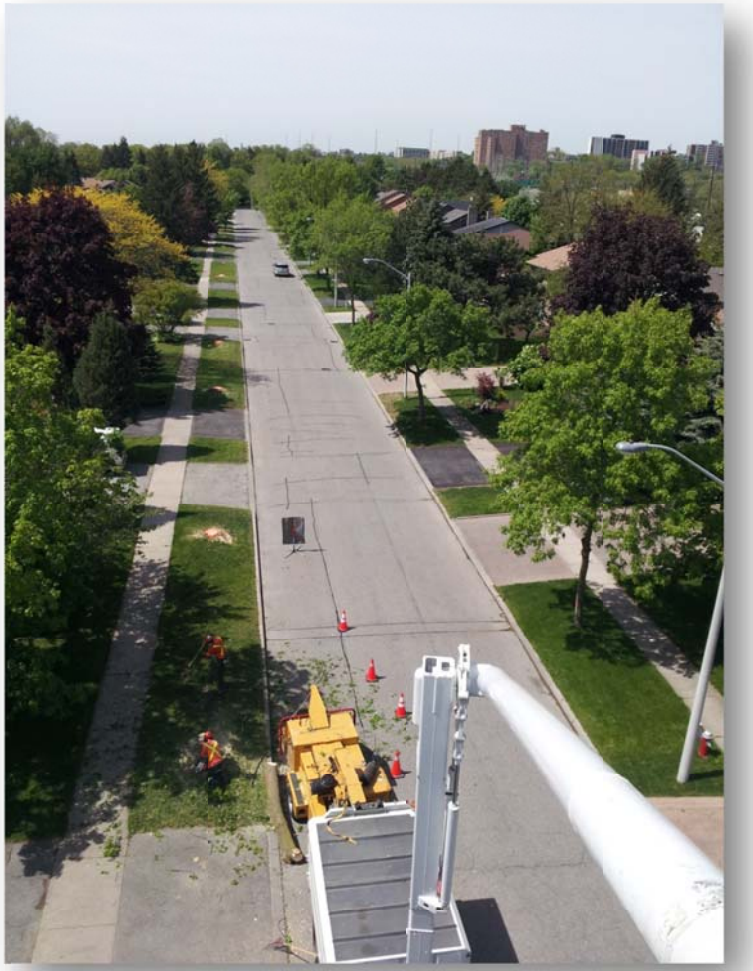
7.5.6 FUNDING OPPORTUNITIES AND INCENTIVES

Current funding for urban forest initiatives are available to the municipality, if proposals are submitted and awarded through Tree Canada (in partnership with TD, and more recently CN), but many of the funding grants require either a non-profit community group or school take the lead. Organizations such as Evergreen, the Ontario Trillium Foundation, Tree Canada, and LEAF all offer grants of variable sizes to schools and community groups. Environment Canada and the Ontario Ministry of Natural Resources also offer some tax rebates / subsidies to landowners (see Appendix F in the NH&UFS for a complete list). Even though many of these are not directly accessible to the municipality, websites like that of the One Million Trees Mississauga program can promote and be a central place for residents and local schools to review and screen these resources. The grants that are already available should also be considered when the City is exploring the development of its own incentives related to Natural Heritage System and Urban Forest stewardship.

There are a variety of incentives used in different jurisdictions to engage the community in implementation of natural heritage and urban forest objectives. One of the most common, already used in Mississauga, is the provision of a free tree for the front yards on request. In addition, the City of Mississauga is currently exploring the feasibility of a unique credit or incentive program linked to maintaining a certain proportion of the yard in permeable surface to recognize its infiltration function and contribution to storm water management. There are also various incentives (e.g., free trees, free labour), associated with many of the programs identified in **Appendix E**.

More conventional incentives that have been used elsewhere and could also be effective in Mississauga include:

- improved recognition through an awards program that includes awards specifically for natural heritage and urban forest stewardship (note this is already being pursued through the *Living Green Master Plan* 2012), and
- opportunities for support and/or recognition of larger scale efforts or support through the naming of parklands / open space, buildings / rooms, multi-use trails, and gardens.



8 RECOMMENDED ACTIONS

The following recommended actions have been developed with consideration for existing conditions and available resources, relevant best practices and precedents from the scientific and technical literature and other jurisdictions, recommendations from the studies completed by the Peel Urban Forest Working Group, and input from consultations with City staff and a range of stakeholders and representatives of the community. These recommendations have been developed to:

- work within a built-up land use context where most anticipated development will be in the form of infill and intensification
- build on existing practices, policies and programs that are supportive of Urban Forest and Natural Heritage System objectives (as laid out in **Section 5.2**)
- include a variety of implementation guidance to improve tree protection and Urban Forest establishment and expansion on both public and private lands, and
- achieve established objectives and targets using cost-effective and collaborative approaches.

The following 30 Actions have also been developed to provide more detailed technical, operational and/or tactical guidance regarding the implementation of a number of the Strategies identified within the broader Natural Heritage & Urban Forest Strategy (NH&UFS). The Strategies from the NH&UFS that relate to the UFMP Actions described in this Plan are identified below. Although each Action can be understood as part of this Plan, they are best understood within the broader context of the NH&UFS as well.

While the ultimate goal of strategic urban forest management planning is to achieve urban forest sustainability, it is important to propose realistic actions and achievable targets that are in-line with the City's resource base. The recommended Actions presented here support the longer-term goal of Urban Forest sustainability and will lead to marked improvements in the health, longevity and function of the City's Urban Forest and Natural Heritage System, but are also considered within the City's means and draw on external support, resources and funding wherever possible.

The Actions are organized by the five topics addressed through this UFMP, and in the same order, and are not listed by priority, as follows:

- **Section 8.1: Urban Forest Program Administration (Actions #1 To #5)**
- **Section 8.2: Tree and Natural Area Health and Risk Management (Actions #6 To #10)**
- **Section 8.3: Tree Establishment, Naturalization and Urban Forest Expansion (Actions #11 To #14)**
- **Section 8.4: Tree Protection and Natural Area Management (Actions #15 To #20)**
- **Section 8.5: Promotion, Education, Stewardship and Partnerships (Actions #21 To #30)**

The recommended timing for each of these Actions, as well as the anticipated new resources required to implement them, are identified in the UFMP Implementation Guide, and summarized in **Section 9**.

8.1 URBAN FOREST MANAGEMENT AND ADMINISTRATION

ACTION #1: ADOPT THE MONITORING FRAMEWORK DEVELOPED FOR MISSISSAUGA'S NATURAL HERITAGE SYSTEM AND URBAN FOREST

Related NH&UFS Strategy: #26

Implementation Guidance:

- Use the 20-year framework identified for the NH&UFS (2014 – 2033) broken down into five four-year review periods, as follows:
    - 2014 – 2017: 1st State of the Natural Heritage System and urban forest report due in early 2018
    - 2018 – 2021: 2nd report due in early 2022
    - 2022 – 2025: 3rd report due in early 2026
    - 2026 – 2029: 4th report due in early 2030
    - 2030 – 2033: 5th report due in early 2034
- Circulate highlights of these Update reports to all City departments, and to all stakeholders and the community
- Use this framework, and the related NH&UFS Strategies and UFMP Actions, to develop and implement four-year city-wide Management Plans and Annual Operating Plans (AOPs) outlining priority-based annual work plan
- Revise strategic action items at end of each four-year management planning cycle, as required
- Use the Monitoring Framework provided in **Appendix A**

Current Practices: Implementation of this action item will be a new addition to the Forestry Section work plan.

Best Practices: A number of other municipalities in southern Ontario (e.g., Town of Ajax, City of Burlington, Town of Oakville, City of Toronto) have begun the implementation of strategic urban forest management plans that include monitoring components and have adopted a comparable framework. While the planning horizon and content of the plans may differ, they share common structural elements linking higher-level objectives with implementable tasks through a three-tiered framework that allows for review, tracking and active adaptive management.

Rationale: Utilizing the framework of the UFMP to guide its implementation will ensure that regular review and active adaptive management will be undertaken. Urban forest managers will be better able to anticipate necessary changes and improve their ability to plan operating and capital budgets, allocate resources to address priorities, and incorporate new knowledge to learn from successes and shortcomings of the urban forestry program over time.

ACTION #2: MONITOR THE STATUS OF THE NATURAL HERITAGE SYSTEM AND THE URBAN FOREST WITH SUPPORT FROM THE REGION, LOCAL AGENCIES AND OTHER PARTNERS

Related NH&UFS Strategy: #26

Implementation Guidance:

- Use the data collected through the Natural Areas Survey updates for most of the monitoring of the NHS, and supplement with additional data from the conservation authorities where available and appropriate
- Assess Mississauga's canopy cover (using leaf on aerial satellite imagery) once every eight years
- Assess street and park tree species diversity and condition using the current street and park tree inventory once every eight years
- Complete an assessment at the end of each four-year management planning cycle using the integrated Monitoring Framework developed for the NH&UFS (see **Appendix A**).
- Review the status of NH&UFS Strategies and UFMP Action Items at the end of each four-year management planning cycle
    - Include consideration of the tree plantings being tracked through the One Million Trees program (i.e., how many, by whom, etc.)

Current Practices: Implementation of this action item will be a new addition to the Forestry Section work plan. The addition of natural heritage metrics to the existing framework is a unique endeavour undertaken as part of the NH&UFS.

Best Practices: Applied urban forestry research has developed a suite of criteria and indicators for use by urban forest managers to conduct periodic assessments of the urban forest, management approaches, and status of community engagement and partnerships. First adopted in the Town of Oakville in 2008, this framework is recommended by the TRCA in all its urban forest studies, and is becoming increasingly recognized by municipalities as a useful tool to establish baselines and undertake periodic urban forest program performance review.

Rationale: Tracking the status of Urban Forest and Natural Heritage System metrics and various aspects of urban forestry programs and practices will enable the implementation of active adaptive management, and will enable staff to evaluate and adjust management activities in response to changing needs and circumstances. Monitoring also provides useful information for communicating the status of urban forestry in Mississauga to staff outside the Forestry Section, to Council, stakeholders and the community.

ACTION #3: FORMALIZE INVOLVEMENT OF CITY FORESTRY STAFF IN CITY PLANNING AND INFORMATION SHARING RELATED TO TREES AND NATURAL AREAS

Related NH&UFS Strategy: #1

Implementation Guidance:

- Ensure Forestry staff are consistently circulated or consulted on development applications (Site Plan Applications, subdivision plans, Committee of Adjustment applications, etc.), and capital projects to ensure opportunities for tree protection and/or planting are identified at the outset of the process
    - Ensure a representative from the Forestry Section is involved in monthly Development Approval Review Committee meetings and capital project review meetings when required by the Landscape Architects in Planning and Building to help assess when tree preservation/planting may be required
    - Try to ensure Forestry staff are circulated on Building Permits if trees may be impacted or removed when possible
    - Consult with Forestry staff when tree issues arise through the Committee of Adjustment process
- For capital projects, confirm the process for: Forestry input and/or review, when site visits by Forestry or an Arborist may (or may not) be needed, and allocating funds for tree replacement where required
- Establish an internal urban forest working team including management and staff from the Parks and Forestry Division, Development and Design Division (Planning and Building department), Engineering and Works, and Transportation and Infrastructure Planning Divisions (Transportation and Works department)
    - Hold bimonthly meetings (6 times annually) addressing key urban forest-related issues including UFMP action item implementation, planning coordination, etc.
    - Include, as required, staff from other departments, divisions and sections

Current Practices: Several formal processes are in place to facilitate collaboration between departments, especially regarding development proposal review. These include circulation of Site Plan Applications and other development proposals, Development Application Review Committee, and interdepartmental meetings (as required). Some staff in Community Services, Planning and Building, and Transportation and Works request Forestry staff support on an "as-needed" basis.

Best Practices: Every municipality has a unique organizational framework and different mechanisms for coordinating tree-related planning, management and operational activities between departments. However, irrespective of the organizational framework, to be effective, trees and natural areas must be dealt with in a collaborative, multi-departmental way. This means breaking down the so-called 'silo effect', so that cooperation around shared tree issues can be achieved.

Rationale: Improved interdepartmental coordination and cooperation will enable knowledge transfer, ensure consistent application of municipal standards and adherence to policies, and provide opportunities for creative planning and problem solving in support of Urban Forest and Natural Heritage System objectives.

ACTION #4: DEVELOP CONSISTENT AND IMPROVED CITY-WIDE TREE PRESERVATION AND PLANTING SPECIFICATIONS AND GUIDELINES

Related NH&UFS Strategies: #14, #15

Implementation Guidance:

- Develop "made in Mississauga" tree preservation and tree planting standards, specifications and guidelines consistent with technical and scientific best practices and examples from neighbouring jurisdictions for city-wide use in public and private projects
    - For tree preservation specifications and standards, consider factors such as pre-construction care and maintenance, tree species, diameter-based tree protection zones, root zone compaction protection, post-construction inspection and maintenance
    - For tree hoarding/fencing, eliminate need for deep in-ground staking; instead provide two acceptable, minimally-invasive construction specifications (i.e., solid framed plywood hoarding and framed construction fencing).
    - For tree planting specifications and guidelines, consider factors such as tree species selection, stock sizing, density, soil quality/texture/volume, planting depth, post-planting maintenance.
    - Include an acceptable tree species list for different site types and apply to all projects Develop typologies for different tree growing environments, including engineered soil solutions (e.g., open planters, soil cells, etc.)
    - In specifications and standard drawing notes, include references to relevant City policies and by-laws
- Consult with the local Conservation Authorities on the development of these guidelines
- Implement new standards and specifications city-wide:
    - Ensure that in all internal tree-related resources (i.e., relevant Community Services, Planning and Building, and Transportation and Works policies, manuals and standard drawings) are consistent with new specifications and standards, or that new specifications and standards replace the existing ones.
    - Ensure that all external tree-related resources (web, manuals, etc.) include and/or are consistent with the new specifications and standards

Current Practices: Existing specifications and standards are available for public and private projects but are not comprehensive or consistent, and require updating to current and appropriate best practices (e.g., *Community Services Subdivision Requirements Manual* (2002), Development and Design and Forestry Section standards (2008)).

Best Practices: A number of municipalities have developed comprehensive tree preservation and planting specifications, standards and guidelines to help ensure consistent application of improved urban forestry practices. Some integrate many aspects of urban forestry in one document, while others focus on a single topic, such as tree establishment. Examples include: Palo Alto, California and in Ontario, Barrie, Markham, York Region, London, Toronto.

Rationale: Implementing updated tree preservation and tree planting specifications, standards and guidelines city-wide will improve protection of existing trees and support expansion of urban forest canopy, show the City is leading by example, and help ensure consistent approaches are followed.

ACTION #5: UPDATE THE INVENTORY OF CITY STREET AND PARK TREES, AND KEEP IT CURRENT

Related NH&UFS Strategy: #15

Implementation Guidance:

- Expand knowledge of the City's tree resources by improving and enhancing the street and park tree inventory
    - Maintain GIS integration to facilitate information sharing among City departments
    - Include additional inventory attributes including: 1) site type description, 2) maintenance requirements, 3) risk assessment, 4) pest/pathogen identification, and 5) species approximate age (not a range)
    - During scheduled street tree maintenance, utilize the City's current asset management software to update existing street tree inventory with enhanced inventory attributes
    - Expand inventory to actively-managed areas of municipal parks
- Utilize inventory to plan urban forest maintenance operations on streets as well as in parks, and to better manage tree-related risk on public lands

- Make the basic inventory information available to the public on the City's website so they can see what trees are on their streets and in their parks

Current Practices: The existing GIS-based tree inventory of 243,000-plus City trees is useful for knowing what species are where, and for sharing this information with other departments, but is missing key attributes that limit the inventory's use as an urban forest management planning tool.

Best Practices: To optimize its utility as an urban forest management tool, a tree inventory must be: 1) maintained and up-to-date, 2) user-friendly and integrated into municipal asset management systems and practices, and 3) sufficiently detailed to enable operational planning. A wide range of tree inventory options are available, and many jurisdictions have some type of municipal tree inventory, more commonly street tree management-oriented inventories, although inventories of trees in actively-managed parks are equally important. A high quality street tree inventory, such as in the one used in the City of Kitchener, can include a large number of inventory attributes, such as insect/disease signs and symptoms, site type, deadwood levels, structural condition, and, most importantly, maintenance requirements.

Rationale: Improved knowledge of the condition and maintenance requirements of street and park trees, if used effectively through a coordinated asset management program, will improve urban forest health and sustainability, reduce future operating costs as maintenance is undertaken in a proactive and planned manner and reduce the incidence of tree-related risk as potential issues are identified and addressed before they become problematic or difficult to manage.

8.2 TREE AND NATURAL AREA HEALTH AND RISK MANAGEMENT

ACTION #6: OPTIMIZE STREET AND PARK TREE MAINTENANCE CYCLES

Related NH&UFS Strategies: #15

Implementation Guidance:

- Retain maintenance frequency of street tree pruning cycle at once every eight years (maximum) and incorporate inspection in to this cycle
- Change program title from Street Tree Elevation Program to Street Tree Maintenance Program to reflect broader scope of pruning
- Establish a five-year inspection cycle for trees in actively-managed park areas (i.e., outside of City-owned Natural Areas), implementing maintenance on an as-needed basis

Current Practices: Current Street Tree Elevation Program pruning frequency is approximately eight years per tree. Current park tree maintenance is reactive or request-based.

Best Practices: Best practices suggest that a four to five-year pruning cycle optimally balances operation costs and maintained tree value. However, longer cycles can be effective if supported by more comprehensive urban forest management programs. Many urban foresters agree that a seven or eight-year street tree pruning cycle is optimal. Several cities with active urban forestry programs in Ontario such as Burlington, Hamilton, and Toronto, ON operate on seven to nine-year street tree pruning cycles.

In most municipalities, park tree maintenance tends to be largely reactive in nature. According to the 2000 ISA Ontario Municipal Arborists and Urban Foresters Committee *Best Management Practices for Ontario Municipalities*, trees in active parks should be visually inspected annually. However, this is likely unachievable in most jurisdictions due to resource constraints. The maximum inspection cycle considered acceptable is once every five years. However, this cycle is difficult to achieve for most municipalities. For example, in Burlington, ON park trees are visually inspected approximately once every seven years, and maintenance is carried out on an as-needed basis.

Rationale: Increased maintenance frequency will result in improved tree health, reduction in tree-related risk, improved identification and monitoring of urban forest pests/pathogens. In addition, a combination of cyclical inspection and as-needed maintenance for park trees will balance the City's duty/standard of care for tree health and risk management with available resources.

ACTION #7: IMPLEMENT A YOUNG STREET AND PARK TREE MAINTENANCE PROGRAM

Related NH&UFS Strategies: #15

Implementation Guidance:

- Using the City's tree asset management system, schedule every newly-planted caliper-sized City-owned tree for inspection/pruning 3 times within 10 years following planting. Undertake ground-based structural pruning, as needed, for each tree included in the program by City crews or contractors
    - Schedule future inspections/maintenance by trained arborists until young trees are fully established and trained for good future structure
- Consider utilizing part-time summer employees (students, etc.) to support program implementation
- Increase per-tree cost in General Fees and Charges by-law to fund improved young tree maintenance program and ensure regular review of this charge

Current Practices: Some young trees are structurally pruned, but the program is not comprehensive or formalized. Stake removal and other maintenance are undertaken for plantings under warranty, but active maintenance tapers off quickly after the warranty period expires (typically two years). Inspections of planted materials on private property at the end of the planning process are generally undertaken by Engineers or Landscape Architects.

Best Practices: A formal young tree pruning program can help to ensure the future development of healthy, large-statured and structurally stable trees. Best practices show that newly-planted caliper trees should be inspected and, if necessary, pruned at least three times in the first ten years following establishment. A formal program to track trees from establishment to maturity and schedule regular inspection and pruning is optimal.

If necessary due to resource constraints, the relatively non-technical task of young tree structural pruning can be undertaken by staff such as properly trained summer workers or even City-approved volunteers. Successful young tree pruning programs have been implemented in Calgary, Alberta, where young trees are inspected and pruned (if necessary) a minimum of three times in the first ten years, and New York, NY where a formalized "Citizen Tree Pruner" program has graduated more than 11,000 volunteers since inception and complements the City's staff-based neighbourhood pruning program which focuses on mature trees.

Rationale: Young tree maintenance is one of the most cost-effective ways to reduce incidence of tree-related risk, and improve future urban forest health and condition. Inspections by Forestry staff and/or qualified arborists will ensure proper planting/maintenance and assumption of good-quality trees for the future urban forest.

ACTION #8: DEVELOP AND IMPLEMENT A STREET AND PARK TREE RISK MANAGEMENT PROTOCOL

Related NH&UFS Strategies: #15

Implementation Guidance:

- Develop a tree risk management protocol or strategy that includes key considerations outlined in the UFMP
  - Balance need for conservation of large/old trees with risk issues
  - Utilize street tree inventory to prioritize areas for tree risk inspection (e.g., areas with predominantly larger and mid-sized trees)
- Implement proactive tree risk management for street trees, actively-managed park areas, and in proximity to formal woodland trails
- City-owned woodland risk tree management should be coordinated with Conservation Management Plans (see Action #20)
- Improve Forestry Section staff tree risk assessment training (e.g., International Society of Arboriculture Tree Risk Assessment Qualification program)

Current Practices: Tree risk assessment and management are largely reactive and/or request-based. Risk can sometimes be identified and/or managed during the course of regularly scheduled street tree maintenance. Recently, emerald ash borer management requirements have reduced ability for Forestry Inspectors to undertake woodland tree risk assessment/management activities.

Best Practices: Implementation of a tree risk policy, strategy or protocol that coordinates inspection, mitigation and proactive planning in order to improve safety and reduce risk, uncertainty and liability is a critical component of effective tree risk management. Recent advances in tree risk assessment have resulted in new levels of risk assessment training and qualification by bodies such as the International Society of Arboriculture (e.g., Tree Risk Assessor Qualification). Forestry staff and local arboriculture contractors should be encouraged to seek advanced tree risk assessment training and, ultimately, such qualifications should be required by the City.

Basic visual inspection of trees in actively managed and high-traffic locations (e.g., streetscapes, parks and along woodland trails) should be undertaken on a regularly scheduled cycle of sufficient frequency to demonstrate the City's fulfillment of its duty of care. Annual inspection is optimal but likely unachievable given resource constraints and fiscal realities. As such, higher-risk trees and locations should be prioritized for tree risk assessment and management, ideally through an up-to-date inventory and proactive tree maintenance program.

Rationale: Improved tree risk management protocol will reduce incidence of tree-related risk and associated costs, reduce the City's potential liability with respect to municipal trees, and will also improve Urban Forest health.

ACTION #9: DEVELOP AN URBAN FOREST PEST MANAGEMENT PLAN

Related NH&UFS Strategies: #15

Implementation Guidance:

- Address prioritized management of forest pests and pathogens in natural and developed areas
- Incorporate active management (e.g., removal, control) along with education and avoidance
- Build on the format and framework developed for dealing with emerald ash borer (EAB) and be used for future pest invasions as required

- Work with neighbouring municipalities, the Region of Peel, the Canadian Food Inspection Agency (CFIA) and other agencies to coordinate research, monitoring and management efforts.

Current Practices: There is an EAB management plan that was approved in 2012 and is now in effect. However, there is no City-wide invasive species management strategy, nor a framework for future pest management. In the past, awareness of urban forest pests in southern Ontario municipalities has been relatively limited. However, with the extensive damage it is causing to both public and privately owned trees, the current spread of EAB presents an excellent opportunity to engage the community on urban forest pest issues.

Best Practices: A comprehensive urban forest pest management approach is needed to strategically identify and prioritize potential threats, identify areas at greatest risk, and outline potential strategies to proactively control, mitigate and adapt to invasive tree pest and disease species.

Rationale: Improved urban forest pest management, if it is proactive and effective, can increase Urban Forest and Natural Heritage System resilience to other stressors. Improved public awareness of invasive pest issues can also be an opportunity to highlight the ecosystem services provided by the urban forest, improve public support of urban forest pest and other management activities, and foster engagement in local tree and woodland care.

ACTION #10: UNDERTAKE TARGETED INVASIVE PLANT MANAGEMENT IN THE NATURAL HERITAGE SYSTEM

Related NH&UFS Strategies: #12, #17

Implementation Guidance:

- Adopt the general principle of prioritizing management by addressing the invasive species that pose the greatest potential for impact to native vegetation, and which occur in the most valued Natural Areas in the Natural Heritage System ("flagship" areas)
- Implement invasive species control for the priority species and areas identified in the Invasive Species Management Plan (**Appendix C**)
- Ensure that management of high priority invasive species is integrated into the relevant Conservation Management Plans (see Action #20)
- Continue dialogue and development of cooperative initiatives for invasive species management with the local conservation authorities.
- Develop a program to educate landowners (corporate and residential) about the potential threat posed by non-native species, including domestic cats
- Identify safe and easily understood management techniques that can be implemented by volunteers
- Increase resource allocation to invasive species management in naturalized areas (including post-naturalization assessment and monitoring) and continue to leverage partnerships and funding opportunities to expand collaborative efforts.

Current Practices: Management of invasive plants in the City has been limited to some *ad hoc* work by City staff and stewardship activities. Exceptions are the relatively successful control of the noxious Giant Hogweed, at least in areas where it may come into contact with people, and EAB, which is the subject of a recently-implemented, multi-year control program. There have been other initiatives, primarily with volunteers, to control garlic mustard, but these projects have not been a result of a strategic program. Key challenges include the lack of resources to implement actual on-the-ground control and the lack of effective control strategies for some species, notably Dog-strangling Vine.

Best Practices: The negative impact of invasive plants and fauna on biological diversity is widely accepted, and is a widespread problem. Effective control programs elsewhere have been limited to specific areas. The main reason for this is the overwhelming magnitude of the issue compared to the resources available to address it. Prioritizing species and areas with the objective of maximizing the benefit to preservation of biological diversity; along with utilizing volunteer help and the expertise of partners (e.g., conservation authorities) is the best approach for addressing this management issue.

Rationale: Some invasive species, several of which occur commonly in Mississauga, have the capacity to significantly impact the biological diversity of natural heritage features. Some also pose a threat to people. For this reason, the problem should not be ignored. In addition to the positive impact on natural features, control initiatives that involve the community assist in garnering support for Natural Area protection, and raise the profile of management needs.

8.3 TREE ESTABLISHMENT, NATURALIZATION AND URBAN FOREST EXPANSION

ACTION #11: DEVELOP A TARGETED URBAN FOREST EXPANSION PLAN

Related NH&UFS Strategies: #11, #13

Implementation Guidance:

- Work with the Region of Peel and other partners to develop a GIS-based tool for prioritizing tree planting in the City (and the Region) based on a variety of considerations, including: biophysical (e.g., canopy cover), land use cover (e.g., paved versus open space), environmental (e.g., close to an existing watercourse or natural area), human health (e.g., within a poor air quality area), and social (within public open space where shade is lacking).
- In Mississauga priority areas for expansion should include consideration of:
    a. the City's Natural Heritage System data/mapping analysis
    b. gaps identified through the City's tree inventory (see Action #5)
    c. the *City of Mississauga Urban Forest Study* (2011) heat island mapping and preliminary Priority Planting Index (PPI)
    d. priority areas for reforestation identified through conservation authority subwatershed plans, as well as CVC's new Draft Natural Heritage System, Landscape Scale Analysis, and the current Lake Ontario Integrated Shoreline Strategy and Credit River Parks Strategy
    e. neighbourhoods with canopy cover well below the City's current average of 15%
    f. areas anticipated to be most heavily affected by emerald ash borer-caused tree mortality, and
    g. areas identified as having air quality issues (e.g., see the *Southwest GTA Oakville-Clarkson Airshed Action Plan*)
- Explicitly identify those areas of the Green System that are within the conservation authority natural heritage systems (but outside of the City's Natural Heritage System), and target them as high priority for restoration and stewardship initiatives in concert with the relevant conservation authority
- Confirm priority areas with key City staff and, where private lands are identified, work with private landowners and external stakeholders to pursue opportunities

Current Practices: Tree planting areas are identified based on the City's knowledge of known gaps and the interest of stakeholders and/or volunteers in undertaking plantings in a given area. Biophysical, environmental and social considerations related to ecosystem services are not necessarily considered.

Best Practices: A number of municipalities with active urban forestry programs have, as part of their programs, begun to identify and pursue targeted tree establishment based on a number of factors (e.g., available planting spaces, planning commitments, considerations for the urban heat island effect, opportunities adjacent or close to protected natural areas, etc.). However, few municipalities have developed strategic planting tools that incorporate a variety of biophysical, environmental and social parameters to identify priority tree planting areas. Recent projects in a several jurisdictions in the North America (e.g., Calgary, Cambridge, District of Columbia, Idaho and Virginia) have begun to develop and apply tools that prioritize tree planting locations based on consideration of various ecosystem services that would be provided. Areas for provision of various ecosystem services are identified using GIS-based tools that combine geospatial canopy cover and land use mapping with other criteria and/or variables that are used as surrogate measures for various services (e.g., a large park in a densely populated community would be a high priority for provision of health and social benefits to the community).

The need to be more strategic about tree planting (and follow-up maintenance) is also recognized by the Peel Urban Forest Working Group region-wide and at the local municipal scale in the urban forestry studies they have produced. Consequently, the Region of Peel will be developing a GIS-based tool for helping local area municipalities, agencies, and other stakeholders prioritize tree planting areas based on a variety of variables. The City of Mississauga will be an active partner in this project.

Rationale: Strategic prioritization and implementation of opportunities for urban forest expansion will accelerate the provision of urban forest benefits where they are most needed, and support achieving UFMP and NH&UFS objectives.

ACTION #12: IMPLEMENT A TARGETED URBAN FOREST EXPANSION PLAN

Related NH&UFS Strategies: #11, #13

Implementation Guidance:

- Use the GIS-based targeted tree planting prioritization tool (see Action #11) to identify areas to meet urban forest and natural heritage objectives
- Continue to identify and utilize currently unused street tree planting locations, improving soil conditions where required and possible
- Increase public promotion of and develop supporting materials for a request-based street tree planting program
- Through the One Million Trees Mississauga Program, implement a formalized tree establishment tracking program associated with all Urban Forest expansion (tree planting) activities, including streetscape and naturalization/restoration plantings

Current Practices: The Parks and Forestry Division co-ordinates numerous community-focused tree planting, naturalization and stewardship programs in the spring, summer and fall. These activities are often community-organized or conducted in conjunction with CVC, TRCA, local businesses, and other non-profit organizations. Tree planting locations are generally in response to community requests or requests from the conservation authorities, and do not necessarily consider other strategic objectives. As a result, some areas in the City that may be priorities for tree establishment (e.g., for health reasons) may be overlooked.

Mississauga residents can request street or other public tree planting, but the program is not well-publicized and utilized. The One Million Trees Mississauga Program was launched in April 2013 to expand naturalization and restoration plantings, and include tracking of trees planted both by the City and other groups who participate.

Best Practices: Request-based street tree planting is available for residents city-wide in Mississauga, helping promote citizen engagement in urban forest expansion and stewardship. City staff are currently working on the development of an online self-serve process whereby residents can email in service requests for forestry functions, and would be one of the first municipalities in southern Ontario to provide such a service. Hamilton and Toronto also have effective resident request tree planting programs, with promotional materials available online and as brochures. In Toronto, a species list accompanies the request form, helping residents to easily select trees suited for their site.

Several best practices can guide larger-scale planting programs, such as restoration or naturalization plantings. In New York, the MillionTreesNYC program reaches out to developers and large landowners and business improvement districts to develop long-term greening plans. About 70% of the trees will be planted in parks and other publicly-owned spaces, with the remainder coming from private organizations and homeowners through this program. Through the New Forest Creation aspect of the program, the City selects species best adapted to specific sites, using existing natural forests as references. This program includes monitoring and opportunities for corrective action as needed.

Rationale: Strategic prioritization and implementation of opportunities for Urban Forest expansion will accelerate the provision of Urban Forest benefits where they are most needed, and support achieving UFMP and NH&UFS objectives. In addition, the role of undeveloped open space in supporting natural heritage is especially important in urban areas where opportunities to create viable natural heritage systems are limited by existing development, and restoration or enhancement are the only mechanisms to increase system resilience.

ACTION #12: TRACK AND RECOGNIZE NATURALIZATION / STEWARDSHIP INITIATIVES ON PUBLIC AND PRIVATE LANDS

Related NH&UFS Strategies: #11, #13

Implementation Guidance:

- Complete the ongoing mapping of existing naturalization projects to create an inventory of naturalized sites throughout the city
- Formalize the selection process for City-supported naturalization projects so that naturalization in strategic locations to best support the Natural Heritage System (e.g., immediately adjacent to a Significant Natural Area or within a Special Management Area) can be prioritized
- Prioritize naturalization opportunities based on: (a) adjacency to the existing Natural Heritage System or connection between Natural Heritage System areas, (b) areas identified through conservation authority subwatershed plans, as well as Credit Valley Conservation's Draft Natural Heritage System, Landscape Scale Analysis (LSA), and (c) the current Lake Ontario Integrated Shoreline Strategy and Credit River Parks Strategy; and dovetail these priorities with known urban forest expansion opportunities (see Actions #10 and #11)
- Increase resource allocation to naturalization (including post-naturalization site assessment / monitoring), and continue to leverage partnership / funding opportunities so that collaborative naturalization / tree planting efforts on private lands can be expanded
- Communicate the extent and benefit of naturalization projects internally, to the public, and to outside agencies(see related Actions#24, #25, #26 and #27)
- Develop a mechanism for recognizing and tracking medium to large scale naturalization projects (e.g., more than 0.2 ha or 0.5 acres) in the city, particularly on private lands (possibly building on the existing annual review and update of the Natural Areas System database)

Current Practices: The City has been pursuing naturalization projects since the early 1990s, both independently and in collaboration with the local conservation authorities, and other local organizations and stakeholders. Naturalization projects, to date, have been undertaken largely in response to requests from community groups and the conservation authorities, as well as a limited number of areas identified by City staff. However, a proactive approach to prioritizing restoration and enhancement opportunities is limited by existing capacity. There has been some prioritization of projects based on considerations specific to the Natural Heritage System (e.g., proximity to a protected natural area, identification through the CVC's LSA study).

Some City naturalization projects have been evaluated as part of annual Natural Areas System updates to determine if these areas meet criteria for inclusion in the Natural Heritage System, but systematic mapping and tracking of these areas city-wide has been limited by available staffing resources.

Best Practices: In addition to Mississauga, a number of urban and urbanizing municipalities in southern Ontario have recognized the potential role of naturalization in supporting local natural heritage objectives, as well as the potential cost savings of shifting away from the traditional maintenance practices (e.g., mowing, planting beds of annuals, watering) towards the integration of naturalization zones where manicured lawns are not required to accommodate other active uses. The City of Guelph has had a naturalization program in place since 1991 that identifies portions of City parks suitable for naturalization using site-appropriate native species. Toronto Region Conservation has been working with the City of Toronto for many years to implement naturalization and tree planting in suitable areas. Priority areas have included Toronto's ravines, and public lands along the waterfront and City parks, and some projects have included significant educational components, such as the Humber Bay Butterfly Habitat. Both jurisdictions as well as Richmond Hill, Region of Peel, and the conservation authorities also have programs to encourage naturalization on private lands (which are available to residents and businesses in Mississauga) (see **Appendix E**).

Rationale: Naturalization (including tree planting in a naturalized context) supports the maintenance, enhancement and expansion of the Natural Heritage System and the Urban Forest. These activities, particularly when undertaken outside of the Natural Heritage System, help link the City's Natural Heritage System to the broader Green System both conceptually and on the ground, and can result in the creation of areas that, in time, will meet criteria for inclusion in the Natural Heritage System. Creating better links between the Green System and the Natural Heritage System / Urban Forest through naturalization and tree planting embodies a "total landscape" approach to natural heritage management in an urban landscape.

ACTION #12: IMPLEMENT AND ENFORCE IMPROVED TREE ESTABLISHMENT PRACTICES ON PUBLIC AND PRIVATE LANDS

Related NH&UFS Strategies: #15, #20

Implementation Guidance:

- Require implementation of Mississauga 'Stage One' Green Development Standards requirements for tree habitat, including minimum soil volumes and tree density requirements or alternate standards developed through revised and updated tree preservation and tree establishment specifications and standards
- Implement improved engineered tree growing environment solutions (e.g., open planters, structural cells, etc.) for all capital projects and, where appropriate, Site Plan and other controlled developments
- In conjunction with updated and revised tree planting specifications, standards and guidelines (see Action #4), ensure that all City forces and contractors involved in tree establishment implement improved practices
- Undertake species suitability trials for trees planted on public lands
- Provide training to Community Services, Planning and Building, and Transportation and Works staff involved in reviewing and overseeing implementation of planting specifications regarding tree establishment best practices (e.g., minimum soil volumes, soil quality parameters, how to assess if nursery stock is healthy, etc.)
- Ensure street tree plantings and maintenance works are inspected by a qualified Arborist and/or Forestry staff prior to final acceptance of planting of City-owned trees

Current Practices: City planting contractors are expected to adhere to existing standards, and site inspection of tree establishment is typically conducted in conjunction with inspection of other infrastructure elements. This inspection is not necessarily done by inspectors with specific knowledge of tree establishment requirements (e.g., stock quality, planting, depth, post-planting maintenance, etc.).

Best Practices: There is a wide range of best practices for tree establishment, which must be explored in detail through a comprehensive review and update of planting establishment practices, specifications, standards and guidelines. Required implementation of updated specifications, supported by effective inspection and compliance enforcement, will result in improved tree establishment practices.

Rationale: In the past, as development occurred in Mississauga, inadequate consideration has been given to soil volume or quality. If Urban Forest targets are to be achieved, there needs to be a dramatic shift in planting practices so that trees are provided with adequate space and viable soil conditions.

8.4 TREE PROTECTION AND NATURAL AREA MANAGEMENT

ACTION #15: UPDATE PUBLIC TREE PROTECTION BY-LAW

Related NH&UFS Strategies: #8

Implementation Guidance:

- In the updated Public Tree Protection by-law, ensure complete protection of all City-owned trees (street, park, natural areas, etc.) through:
    - clear definition of prohibited actions (injury, defacement, removal, tree protection zone encroachment etc.)
    - consistency with other tree protection policies (e.g., tree preservation standards)
    - sufficient penalties to act as a deterrent and to issue stop-work orders
- Ensure effective public and internal communication regarding by-law updates

Current Practices: The current Street Tree By-law in effect is outdated and is being reviewed by City staff.

Best Practices: Many municipalities have by-laws regulating the injury or destruction of publicly-owned trees. Key components of such by-laws include:

- Clearly defined parameters of tree ownership, especially in cases where trees straddle public and private property lines
- Requirements for compensation if trees must be removed for development
- Ability to levy fines and stop work orders to prevent damage to publicly-owned trees

An effective by-law program must be supported by financial and human resources, and must be adequately promoted internally and to the community to ensure adherence.

Rationale: An effective Public Tree Protection by-law will demonstrate the City is leading by example and show the City's commitment to the sustainability of its Urban Forest.

ACTION #16: UPDATE EROSION CONTROL, NUISANCE WEEDS AND ENCROACHMENT BY-LAWS

Related NH&UFS Strategies: #8

Implementation Guidance:

- For the Erosion Control By-law:
    - Change the permit exemption for topsoil removal from lands 1 ha and less to a smaller area (e.g., 0.2 ha)
    - Prohibit stockpiling of topsoil within the drip-line of any protected trees or vegetation
    - Provide more specific requirements for identification of vegetation on-site that identifies species, size and condition of all trees of 15 cm DBH or more, as well as more general identification (location, type) of other vegetation on site
    - Require that where more than two trees of 15 cm or more are being removed that they be replaced on site or compensated with cash in lieu (per the updated Private Tree Protection By-law)
    - Require that trees and vegetation being retained on site, as well as any potentially affected in adjacent lands, be protected with a clearly marked and fenced Tree Protection Zone
    - Require that an arborist report to be completed by a Certified Arborist retained for the duration of the project
- For the Nuisance Weeds by-law:
    - Incorporate flexibility to recognize naturalization benefits associated with vegetation greater than 30 cm in height, where appropriate.
    - Review 'Schedule A' to include a broader range of Nuisance Weeds, such as dog-strangling vine (*Cynanchum rossicum*), giant hogweed (*Heracleum mantegazzianum*) and others.
- For the Encroachment By-law:
    - No gaps have been identified in this by-law, but it should nonetheless be reviewed at least once over the 20 year period of the NH&UFS and supporting UFMP to ensure it continues to be an effective tool that is consistent with current legislation

Current Practices: The current Erosion Control By-law in effect is outdated and is being reviewed by City staff. It currently exempts top soil removal from lots 1 ha and less in area, except for removal adjacent (within 30 m) to water bodies, which requires a permit in all cases. As part of the permitting process,

applicants must provide the location and type of vegetative cover in the area to be affected; however, the by-law is not currently being used as a tool to support urban forestry or natural area objectives. The Nuisance Weeds By-law is not widely used, but could be interpreted to conflict with naturalization initiatives. The Encroachment By-law is being effectively used to keep and move unauthorized uses out of City-owned Natural Areas abutting private lands.

Best Practices: Many municipalities have, and enforce, erosion control and/or site alteration by-laws to address the removal or placement of topsoil within a jurisdiction. Examples of cities in southern Ontario with such by-laws include the City of Markham, City of London, City of Kingston, Town of Oakville, City of Hamilton, City of Guelph, and the City of Niagara Falls. Nuisance weed by-laws (often within broader property by-laws) are also common, and potential conflicts between regulations on plant heights and naturalization have been identified elsewhere (e.g., Richmond Hill, Guelph).

Mississauga was the first and is one of the few municipalities to have, and actively enforce, an Encroachment By-law that prohibits unapproved activities and land uses in public Natural Areas. These range from dumping waste to extending parking lots, and are common occurrences. Over the past nine years the City has reclaimed nearly 3.5 hectares.

Rationale: All City by-laws should be in-line with current legislation, consistent with broader City objectives and actively enforced if they are to be effective. Erosion Control By-laws or Site Alteration By-laws typically require the identification and description of all trees that may be impacted by the proposed grade changes, and therefore provide an opportunity for the identification of tree preservation, tree replacement and/or compensation for trees approved for removal. The benefit, from an urban forest perspective, of these by-laws is that they require permits for activities that may not be under the purview of the *Planning Act* or other City by-laws, and therefore enable identification of opportunities for tree protection and replacement that may otherwise be overlooked. In Mississauga, where future development will largely be infill and intensification, it will be important to have a size threshold of much less than 1 ha if most proposed works are to be captured and regulated.

ACTION #17: REVIEW THE PRIVATE TREE PROTECTION BY-LAW AND UPDATE AS NEEDED

Related NH&UFS Strategies: #8

Implementation Guidance:

- Monitor and assess the effectiveness of the recently revised by-law in regulating the removal and replacement of trees, particularly mature trees, on private property for the next four to eight years
- In four to eight years, consider further strengthening the by-law to include all trees above a certain diameter, and making any other updates in response to issues identified over the assessment period
- Consider the cost implications of further strengthening the by-law
- Undertake consultations with City staff, key stakeholders and the community as part of the by-law re-evaluation process

Current Practices: The current Private Tree Protection By-law (254-2012), which was updated over 2012 and enacted March 2013, regulates the removal of three or more healthy trees greater than 15 cm diameter per calendar year on any parcel of private property. It also establishes a replacement ratio for trees approved to be removed of 1:1 for trees between 15 and 49 cm diameter, and 2:1 for trees 50 cm in diameter or greater. If replacement trees cannot be planted on site due to space limitation or the owner's desire, the tree replacement securities will be applied to the Corporate Replacement Fund.

Best Practices: An increasing number of municipalities in southern Ontario have adopted private tree protection by-laws. In urban and area municipalities (as opposed to regions or counties), the by-laws tend to regulate the removal of individual trees, and tend to use diameter class. Regulated diameters range from 15 cm to more than 40 cm. Different municipalities also provide exemptions and exceptions that reflect their particular circumstances. In general, private tree by-laws are considered to be educational tools as much as they are regulatory tools, and are most effective when widely promoted and enforced when required.

Rationale: The remaining mature trees in the landscape play a significant role in sustaining the city's urban forest, and contributing to the ecosystem services provided by this asset. A restrictive private tree by-law ensures that only approved removals are permitted, and that appropriate compensation of approved removals is also provided.

ACTION #18: INCREASE EFFECTIVENESS OF TREE PRESERVATION AS PART OF PRIVATE PROJECTS

Related NH&UFS Strategies: #14, #18, #20

Implementation Guidance:

- Develop a transparent methodology and/or clear criteria for inclusion (or exclusion) of an area from the "Residential Woodlands" category in consultation with internal and external stakeholders
- Fast track (max. 3 days from receipt to final review) review of *Tree Injury or Destruction Questionnaire and Declaration* forms accompanying Building Permit, Pool Enclosure Permit and other development permit applications with legislated review and permit issuance requirements
- Enable Forestry Inspectors to conduct periodic 'spot inspections' of development sites to ensure compliance with tree protection policies
- Increase the value of securities held against tree preservation to tree amenity value (as determined using accepted valuation methodologies) and withhold Letters of Credit for minimum of two years for all protected trees which may be adversely impacted during site development
- Require development proponents to retain an Arborist prior to undertaking of site works and establish a schedule for regular inspection of tree preservation methods implemented on site, accompanied by reports submitted to Forestry Section and Planning and Building department

Current Practices: Through discussions with Forestry staff, several gaps in current practices were identified where opportunities for tree preservation and/or replacement could be identified:

- Residential Woodlands are identified as mapped in the Official Plan, but this mapping no longer reflects current conditions and should be updated using clear criteria
- Lack of adequate review and follow-up of 'Tree Declaration' forms means opportunities for tree preservation and/or replacement identified through Building Permit process may be overlooked. Because legislated permit issuance timelines severely constrain opportunities for review and follow-up, closing this gap will be challenging.
- Forestry requires Arborist reports and follow-up inspections, but adherence to these requirements is not strictly enforced, and site inspections are not always undertaken to ensure compliance with municipal requirements and policies

Best Practices: A wide range of practices can improve the effectiveness of tree preservation implementation during and following site development. Effective planning before development begins is critical to successful on-site outcomes, but does not guarantee effective implementation. However, the ability to impose conditions upon Site Plan and other development approvals or tree injury permits offers opportunities to promote tree preservation. For example, staff can require tree preservation measures such as root-sensitive excavation or root pruning as conditions of tree injury permits if construction is required within Tree Protection Zones. Similarly, regular Arborist inspection and reporting can ensure tree preservation is properly and effectively implemented.

The Town of Oakville is a leading example of effective implementation of tree preservation during development. The Town's permitting processes and tree protection policies strongly encourage adherence, and are actively enforced as required. The Town's Tree Protection Audit process requires a minimum of three scheduled site inspections and written reports, which must include a number of factors including 'Tree Impact Evaluation', mitigation recommendations, soil amendments, and photographic records, as necessary.

Rationale: Increased preservation of trees during development will promote Urban Forest sustainability by maintaining existing trees. Working with landowners and the community to identify opportunities for tree preservation and replacement demonstrates the City's commitment to its Urban Forest targets, and also presents opportunities for increasing awareness and engagement.

ACTION #19: INCREASE EFFECTIVENESS OF TREE PRESERVATION AS PART OF MUNICIPAL OPERATIONS AND CAPITAL PROJECTS

Related NH&UFS Strategies: #14, #18, #20

Implementation Guidance:

- The Forestry Section should undertake a pre-planning review of municipal infrastructure works and other capital projects where opportunities for tree preservation and/or planting may exist, as well as a follow-up field visit where warranted
- A tree inventory and Arborist reporting should be required for municipal works (as it is for private developments) where opportunities for tree preservation and/or planting may exist
- Ensure that there is a financial mechanism to compensate for when trees (and other vegetation) identified for protection are damaged or removed. Possible mechanisms include:
    - Parks and Forestry Division hold securities for all infrastructure projects where street trees, or trees in greenbelt or park lands may be impacted by contractors, and securities are released only upon inspection (by an Arborist) of satisfactorily completed works
    - Contingency funding on capital projects for tree replacement
- Details of procedures to be worked out through the internal Urban Forest Working Group (see Action #3)

Current Practices: Currently, application of tree preservation during capital projects and other municipal works is not necessarily consistent with best practices. When tree preservation is implemented, either Parks Planning Landscape Architects or Transportation and Works technologists inspect. There is some pre-consultation with Forestry staff on capital projects or other municipal works, typically after the overall designs are approved.

Best Practices: Involvement of Forestry staff at the planning stages of capital projects would allow for alternative designs to be considered to accommodate tree preservation where warranted, and ensure that adequate space for planted trees is provided in the original designs. Municipalities, like the City of Toronto are increasingly realizing the benefits of interdepartmental coordination and cooperation when planning large-scale capital projects or smaller scale maintenance operations, and ensuring there is more regular on-site involvement and supervision by trained Arborists.

Rationale: Increased preservation of trees during municipal works, and creation of better plantable areas, will promote Urban Forest sustainability, show the City is leading by example, and avoid last minute retrofitting of designs to try and accommodate trees.

ACTION #20: DEVELOP AND IMPLEMENT CONSERVATION MANAGEMENT PLANS FOR CITY-OWNED SIGNIFICANT NATURAL AREAS

Related NH&UFS Strategy: #16

Implementation Guidance:

- Use a standard table of contents (provided in **Appendix D**) to develop short (5 to 10 page) Conservation Management Plans that focus on operational needs and are "go to" documents to guide the management requirements of City-owned or managed Significant Natural Areas
- Include a standard checklist of potential management categories for use in screening and prioritizing Significant Natural Areas and Natural Green Spaces (provided in **Appendix D**)
- Integrate conservation management needs into a single document for each Significant Natural Area, including invasive species management needs (see Action #10) and EAB management needs
- Develop Conservation Management Plans based on:
    - management needs and priorities based on an analysis of the Natural Areas database and reports (provided in **Appendix D**)

  - consideration of ecological data collected by the conservation authorities, where available
  - accessibility and safety assessments conducted in relation to human use, include risk tree assessments conducted along formalized trails
- Prioritize areas for the development and implementation of Conservation Management Plans based on both ecological considerations (e.g., area size, quality of vegetation) and human use considerations (e.g., level of use, extent of documented use-related impacts, presence of potential safety hazards)
- Prioritize management within each Conservation Management Plan
- Identify opportunities for outreach and engagement in each area by:
  - flagging unique opportunities for interpretation and/or education (e.g., presence of an unusual or representative species or features, examples of ecological processes or functions, examples of encroachment and/or misuse)
  - flagging management activities suitable for volunteers and/or local user groups
  - ensuring opportunities for low impact, passive recreation (e.g., fishing, hiking) are permitted and encouraged where appropriate

Current Practices: The need for area-specific Conservation Plans was identified in the 1996 Natural Areas Survey report. Several have been produced over the intervening years (e.g., GT-2, Cawthra Woods, Frank McKenchie Park, Creditview Wetland) and many, but not all, of the recommendations in those plans have been implemented, with some work underway to update the implementation section of at least one plan. However, the majority of identified Natural Areas in the city do not have Conservation Management Plans to guide site-specific management needs.

There is already regular data collection in most of the publicly owned Natural Areas being undertaken by the City (as part of its ongoing Natural Areas updates) as well as Credit Valley Conservation (as part of their natural areas monitoring program). There is also additional data being collected on ash trees related to the implementation of the City's Emerald Ash Borer Strategy (2012).

Best Practices: Resolution of management issues requires recognition of needs at the operation level. This is best accomplished through management plans developed on a site-specific basis. Municipalities rarely have the resources to undertake these for all natural areas, although several have developed "Conservation Master Plans" (e.g., City of London) or "Management Plans" (e.g., Huron Natural Area in the City of Kitchener, Hungry Hollow in the Town of Halton Hills, Crother's Woods in the City of Toronto) for selected City-owned natural areas to prioritize and guide their management needs. Other agencies that have a prime mandate to manage natural areas also typically develop and implement such plans (e.g., conservation authorities, Ontario Parks and Parks Canada). In a number of cases these plans have actively, and successfully, engaged local user groups (e.g., mountain bikers, cross-country skiers, anglers) who have a vested interest in the preservation of these places.

Rationale: Conservation Management Plans will provide a formal mechanism for building on existing information to develop operational plans that identify and prioritize key management requirements for all public Natural Areas. As the population of Mississauga grows, more people will want to visit its Natural Areas, therefore there is a need to keep these areas safe for public use, and to manage the level and types of use so the ecological value of these areas is not eroded. Mississauga is in the unique position of having current inventory and management needs identified for almost all of the City-owned woodlands, greatly facilitating translation into site-specific operational plans.

8.5 PROMOTION, EDUCATION, STEWARDSHIP AND PARTNERSHIPS

ACTION #21: CREATE, POST AND PROMOTE SHORT VIDEO CLIPS ON TOPICS AND ISSUES RELATED TO THE NATURAL HERITAGE SYSTEM AND URBAN FOREST

Related NH&UFS Strategies: #19, #22

Implementation Guidance:

- Develop a series of short videos on key topics designed to engage and educate a cross-section of Mississauga's community. Key topics could include:
  - Ecosystem services provided by the City's trees and Natural Heritage System (with an emphasis on the systems approach)
  - How to plant a tree and/or naturalize your garden
  - How to care for your tree / naturalized garden
  - How to pick the right species
  - How to enjoy and respect the City's public natural areas
- Videos should be short (i.e., about 2 minutes), be illustrative, be in plain (non-technical) language, and if possible made available in languages other than English spoken by large sectors of the community
- Videos could be designed, posted and promoted through the One Million Trees program launched in April 2013, and could also be featured on the City's main webpage, and advertised through the City's social media

Current Practices: The City recently updated the Urban Forestry sections of its website and developed a creative stand alone website for the One Million Trees campaign, but does not have any video clips posted.

Best Practices: Although an increasing number of municipalities are building social media outreach into their day to day service, few have developed and posted video clips, particularly related to urban forest topics. The City of Calgary is one of the few that has posted videos on how to plant a tree, as has the non-profit Toronto-based organization LEAF.

Rationale: Short video clips are an excellent tool to engage people of all ages who may not be so inclined to pick up a brochure or download a PDF pamphlet on-line. These can also be posted and shared in a variety of locations and through a variety of media.

ACTION #22: MAKE THE CITY'S TREE INVENTORY PUBLICLY ACCESSIBLE TO SUPPORT OUTREACH, EDUCATION AND STEWARDSHIP

Related NH&UFS Strategies: #19

Implementation Guidance:

- The City's tree inventory should, at least in part, be made available to the public in a readily usable on-line format that is compatible with the City's asset management system for trees so that residents (and other interested parties) can (a) identify the location and species of the trees in the inventory, and (b) submit on-line service requests if needed, and verify the status of those requests on-line

Current Practices: The City's tree inventory, which includes about 243,000 street trees as well as some park trees, is fairly comprehensive but requires updating, and is currently only used by and available to City staff.

Best Practices: A growing number of municipalities with active urban forestry programs are putting their municipal tree inventories on-line for use by City staff in other departments and the public. The City of London and Town of Oakville have had their inventories on-line for several years. The City of Ottawa recently launched their on-line tree inventory.

Rationale: Having the City's tree inventory (at least in part) on-line is a good way to keep people informed about the trees in their neighbourhoods, and illustrate how the City is tracking and managing its treed assets. A further use of this tool could be to facilitate the work order request system related to City trees by allowing people to submit requests on-line and potentially check the status of their request, rather than calling City staff to inquire.

ACTION #23: IMPROVE AND MAINTAIN AWARENESS AMONG ABOUT CURRENT NATURAL HERITAGE SYSTEM AND URBAN FOREST POLICIES, BY-LAWS AND TECHNICAL GUIDELINES

Related NH&UFS Strategies: #1, #20

Implementation Guidance:

- Target groups should include local arborists, local developers, private open space users, and youth
- Activities should include but not be limited to:
  - information sessions for local arborists and the development community
  - workshops in neighbourhood community centres and places of worship
  - meetings with large open space land owners/managers
  - incorporating outreach tools developed for the public and tailored to the target group (e.g., short reference documents focused on key topics developed as "take-away" resources for participants)

Current Practices: Information is provided to stakeholders and the general public through pamphlets (available on-line and at community centres), and is provided to proponents and contractors when they submit applications for permits or other planning related activities. Information is also conveyed to landowners who are being warned or charged with an infraction to a natural heritage or urban forest-related by-law. In addition, the Forestry Section holds open houses on "hot topics" (such as emerald ash borer). However, there is not a proactive and targeted outreach program or plan to keep proponents, and the community informed about current practices, policies and legislation.

Best Practices: Most municipalities do not currently engage in targeted outreach programs that focus on informing local developers, and their contractors, about the relevant urban forest and natural heritage policies, by-laws and guidelines. However, it is increasingly recognized that proactive outreach can be a very effective way to ensure that natural heritage and urban forest requirements are respected through the planning process. Best practices identified to date include: taking presentations and workshops to the venues where the target audience meets (rather than asking them to come to the City facilities), presenting the materials in a positive (rather than a punitive) context (e.g., this is the new way of doing business in Mississauga, incorporation of green elements will benefit everyone, etc.), and identifying incentives for cooperation (e.g., faster application processing, the possibility of receiving some type of recognition). Proactively approaching those involved at the outset of the process – rather than identifying issues and concerns later – can also facilitate the process.

Rationale: Trees and natural areas in urban settings must, by their very nature, be considered from various perspectives if they are to be successfully integrated into an urban setting. Trying to genuinely achieve this integration while still ensuring all the other needs and requirements are met (e.g., servicing, safety, accessibility, parking, etc.) is a real challenge for all municipalities. However, this integration cannot happen until proponents (and their contractors) are aware of and willing to respect the policies, by-laws and guidelines in place.

ACTION #24: CONTINUE TO SUPPORT AND EXPAND TARGETED ENGAGEMENT OF LOCAL BUSINESS AND UTILITY LANDS

Related NH&UFS Strategies: #21

Implementation Guidance:

- Build on the success of Partners in Project Green and other stewardship initiatives with local businesses, and continue to collaborate with Credit Valley Conservation (e.g., Greening Corporate Grounds), Toronto Region Conservation and non-profits to encourage tree planting and naturalization on corporate business grounds, in industrial parks and in commercial plazas
- Expand relationships with the various local utilities and transportation companies (e.g., Hydro One, Ministry of Transportation, Canadian National Rail, Canadian Pacific Rail, Enbridge, etc.)
- Approach businesses interested in "greening" their image to sponsor or support various natural heritage and/or urban forest projects or events (e.g. design and development of the Arboretum/Memorial Forest) in exchange for formal recognition
- Develop a directory of corporations with lands in the Green System who could be approached to undertake naturalization
- Use the One Million Trees Program as a platform for expanding and recognizing stewardship
- Expand stewardship resources in the Forestry Section to help organize and implement the wide range of stewardship activities in partnership with other agencies and non-profits

Current Practices: The City, with the local conservation authorities, over the past decade or more, has been gradually building partnerships with some local businesses (e.g., businesses around the airport through Partners in Project Green). These partners have undertaken tree planting and naturalization projects on their lands, often with the support of employee volunteers. The City has worked with local utility companies in several locations to identify opportunities to incorporate naturalization without compromising safety.

Best Practices: The substantial opportunities for naturalization and tree establishment in Mississauga (as in other municipalities) in business parks and on commercial and industrial properties is recognized by the City, as well as the agencies and non-profit groups (e.g., in Mississauga - the conservation authorities and Evergreen) who have programs specifically targeting this group (see **Appendix E**). Additional opportunities exist along utility corridors and right-of-ways, but require better communication between the utility and transit companies and the City to ensure opportunities that do not compromise safety considerations are identified.

Rationale: Properties associated with various businesses, particularly in business parks, as well as utility corridors and right-of-ways, present substantial opportunities for naturalization and forestation in Mississauga. These activities can also engage employees of these businesses in looking at the landscape in a different way. If Mississauga is to achieve its Urban Forest and Natural Heritage System targets, it will require the commitment and active stewardship of lands beyond those under the City's control.

ACTION #25: CONTINUE TO SUPPORT AND EXPAND TARGETED ENGAGEMENT OF YOUTH AND STEWARDSHIP OF SCHOOL GROUNDS

Related NH&UFS Strategies: #21

Implementation Guidance:

- Continue to work with the conservation authorities (e.g., Credit Valley Conservation's Conservation Youth Corps), Evergreen and others on the greening of school grounds (see **Appendix E**)
- Identify potential partnerships with different school boards, and private schools as well as local youth groups (e.g., Peel Environmental Youth Alliance - PEYA, Mississauga's Mayor Youth Advisory Committee - MYAC)
- Explore opportunities to coordinate with local groups with interest in working with youth (such as ACER)
- Provide support for school-led funding applications for natural heritage or urban forest projects, as well as resource support if possible
- Use the One Million Trees Program as a platform for expanding and recognizing stewardship
- Identify liaisons with all local school boards and private schools responsible for environmental education, and:
    - encourage the incorporation of existing Toronto Region Conservation, Credit Valley Conservation and Conservation Halton school-directed programs into their curricula
    - explore opportunities for school grounds greening (and explore funding opportunities if there is interest)
    - explore options for local schools to "adopt" nearby City-owned Natural Areas
    - explore opportunities for older (e.g., high school students) to become involved in local monitoring activities
- Expand stewardship resources in the Forestry Section to help organize and implement the wide range of stewardship activities in partnership with other agencies and non-profits

Current Practices: The City, with the local conservation authorities, over the past decade or more, has been gradually building partnerships with a few schools (e.g., Erindale) to support stewardship initiatives on their properties.

Best Practices: The substantial opportunities for naturalization and forestation in Mississauga (as in other municipalities) on school grounds is recognized by the agencies and non-profit groups who have programs specifically targeting these two groups (see **Appendix E**). At the consultations held as part of the NH&UFS, the importance of actively engaging the City's youth through meaningful stewardship initiatives was expressed very strongly by a number of participants, and by the City's Environmental Advisory Committee (which includes several youth representatives).

Rationale: School grounds present substantial opportunities for naturalization and forestation in Mississauga, and youth stewardship engages the future stewards of the Urban Forest and the Natural Heritage System. Connections made with nature early on stay with a person for life.

ACTION #26: CONTINUE TO SUPPORT AND EXPAND TARGETED ENGAGEMENT OF RESIDENTS AND COMMUNITY GROUPS, AND STEWARDSHIP OF RESIDENTIAL LANDS

Related NH&UFS Strategies: #21

Implementation Guidance:

- Continue to work with the conservation authorities, LEAF and others on the greening of residential lands (see **Appendix E**)
- Continue to promote and build on the existing Significant Tree Program, as well as the existing street tree replacement program
- Continue to build the existing directory of local residents and community groups interested in being involved in stewardship
- Continue to try and align stewardship efforts with the interest of the particular group, and identify management tasks that are appropriate for volunteers
- Use the One Million Trees Program as a platform for expanding and a recognizing stewardship
- Expand stewardship resources in the Forestry Section to help organize and implement the wide range of stewardship activities in partnership with other agencies and non-profits

Current Practices: There are currently several programs targeted to tree planting and/or naturalization of residential lands in the City sponsored by the Region (e.g., Fusion Landscaping) and the conservation authorities (e.g., yard greening programs) (see **Appendix E**), as well as resources available on-line. The City has partnered with these agencies, and other organizations and programs to support stewardship of residential properties.

Best Practices: Municipalities with progressive natural heritage and/or urban forest agendas are recognizing that stewardship by the community and local stakeholders is key to natural heritage and urban forest sustainability. The City of Guelph and Town of Richmond Hill both have municipal programs that provide: (a) information and education on how residents can naturalize their lawns and gardens with native species, (b) plants and/or advice at a discount or free. The Toronto-based non-profit organization LEAF continues to provide a range of urban forestry services focussed on supporting tree planting and care in residential yards in the Greater Toronto Area and beyond.

Rationale: Many of the remaining opportunities for urban forest expansion, and naturalization, exist on lands not owned by the City or the conservation authorities. Furthermore, the activities of people in the City impact the local Natural Areas and Urban Forest. Therefore building on existing partnerships and supporting stewardship on lands not owned by the City is crucial.

ACTION #27: CONTINUE TO WORK WITH VARIOUS PARTNERS TO UNDERTAKE STEWARDSHIP ON PUBLIC LANDS

Related NH&UFS Strategies: #21

Implementation Guidance:

- Continue to develop and expand partnerships with the Region (e.g. Peel's Fusion Landscape Program) and conservation authorities to deliver a range of stewardship programming (see **Appendix E**)
- Try to align stewardship activities with priority areas identified through either natural heritage and/or urban forest expansion priorities (see Action #12)
- Align stewardship efforts with the interest of the particular group (e.g., planting, management, trail maintenance, interpretive elements, etc.), and
- Identify management tasks that can be realistically undertaken by volunteers
- Pursue and/or support joint funding opportunities for *stewardship* (see Appendix F in the NH&UFS)
- Continue to build the existing directory of local stakeholders interested in being involved in stewardship activities
- Expand stewardship resources in the Forestry Section to help organize and implement the wide range of stewardship activities in partnership with other agencies and non-profits

Current Practices: The City, over the past decade or so, has been gradually building partnerships with some local community and environmental organizations to support and expand naturalization and reforestation efforts, primarily on public lands. Groups such as the Credit River Anglers Association, Riverwood Conservancy, and others have been active partners in a number of stewardship projects. The City maintains a database of these partners to keep interested parties aware of future events.

Best Practices: No municipality has enough resources to undertake all the potential naturalization and/or tree planting and/or care that is required to fully sustain and expand the urban forest and natural heritage areas. Therefore, many municipalities work to leverage partnerships with local agencies and non-profits. Where these activities are recognized as a high priority, some municipalities have created a full or part-time position dedicated to coordinating various stewardship activities (e.g., City of Kitchener, City of Guelph, City of Toronto).

Rationale: If Mississauga is to achieve its Urban Forest and Natural Heritage System targets, it will require the support of the community and local groups and agencies on a range of stewardship of private landowners. This can be facilitated by having active leadership activities. The City can show leadership and initiative by demonstrating good stewardship on lands under its jurisdiction.

ACTION #28: DESIGN AND OPERATE A CITY ARBORETUM / MEMORIAL FOREST FOR THE COMMUNITY THAT PROVIDES A PLACE FOR SPIRITUAL CONNECTIONS TO NATURE

Related NH&UFS Strategies: #21

Implementation Guidance:

- Select a suitable City property using transparent criteria that include accessibility via public transit, size to accommodate multiple uses, ability to support natural heritage and urban forest objectives
- Be the first municipality in Canada to establish its own Arboretum / Memorial Forest that provides a place for commemoration, education, research and stewardship
- Develop a design for and operate an arboretum and memorial forest that:
    - Provides a central location for non-denominational commemoration of persons through tree planting
    - Serves as a demonstration arboretum of the range of native tree (and shrub) species that can thrive in Mississauga, as well as some of the habitat types
    - Provides opportunities for learning and stewardship, as well as research

Current Practices: The City currently has a Commemorative Tree program that is administered through the Forestry Section, in conjunction with the Commemorative Bench program. The purpose of the existing program is to provide members of the public with a way to recognize or commemorate others through a lasting and tangible contribution. With the future creation of a "Memorial Forest" or Arboretum, all future commemorative trees would be planted in one central location instead of various sites across the City.

Best Practices: Many municipalities have commemorative tree and/or bench programs, and some larger municipalities also have arboreta (typically associated with an academic institution), however very few have commemorative programs tied to a central, municipally-owned arboretum that also serves as an educational and research centre. An example of a native tree arboretum is the Louise Pearson Memorial Arboretum in Tennessee. Other notable arboreta focused on educational and research objectives include Missouri Botanical Gardens in St. Louis and the Louise Kreher Forest Ecology Preserve. Closer to Mississauga are the Royal Botanical Gardens in Hamilton, and the University of Guelph Arboretum, which both have memorial components but are primarily focused on educational and research objectives.

Rationale: This is a unique pursuit in the City of Mississauga that will fulfill social, education and research needs related to natural heritage and the Urban Forest while also contributing their enhancement.

ACTION #29: PARTNER WITH LOCAL AGENCIES AND INSTITUTIONS TO PURSUE SHARED RESEARCH AND MONITORING OBJECTIVES

Related NH&UFS Strategies: #23

Implementation Guidance:

- Engage in discussions with University of Toronto in Mississauga, the non-profit group ACER, conservation authorities and others about undertaking joint research projects that would inform the City's urban forestry program
- Engage in discussions with other non-profit organizations and agencies (e.g., EAB injection trials with the Canadian Food Inspection Agency), as well as the Region, to explore opportunities to pursue joint research projects
- Consider providing places on City lands to conduct research trials, and helping to establish study plots in exchange for the development of study design, data collection, analysis and reporting of results
- Potential projects could include:
    - responses of different native tree species to different soil types and conditions in the city
    - evaluation of the use of structural soils, subsurface cells and other enhanced rooting environment techniques for street trees
    - working with local growers to diversify stock and reduce reliance on clones
    - development of a seed collection program for native ash species (to bank the genetic stock) in partnership with TRCA, CVC and the National Tree Seed Centre

Current Practices: The City was recently involved in the collection and analysis of urban forestry data to support the Peel Region and City of Mississauga urban forest studies undertaken through the Peel Urban Forest Working Group. Although the City is interested in pursuing additional joint research and monitoring projects, it is currently a challenge to meet all the requirements of undertaking the day-to-day operations, management and outreach, and there is little to no time left for pursuing joint research projects.

Best Practices: The USDA Forest Service, in collaboration with the University of Vermont, has been an excellent source of urban forest information and have worked with many municipalities (including Peel Region) in the U.S. and Canada to develop and undertake urban forest canopy assessments using the latest tools and technologies. In Canada, there is no comparable government body dedicated to urban forest issues, and therefore research collaborations are often the by-product of a keen municipal staff person who pursues particular areas or interest. An Arboretum in the City of Mississauga, as recommended in Action #28, presents a good potential place to support such collaborations.

Rationale: Urban forestry is still a relatively "young" practice and there are still many unanswered questions about how best to undertake different operational and management practices. Working with local agencies and institutions to try and answer questions of joint interest can help better inform day-to-day urban forest activities, provide opportunities for educating and engaging youth and the community, and support active adaptive management.

ACTION #30: BUILD ON EXISTING PARTNERSHIPS WITH THE REGION OF PEEL AND NEARBY MUNICIPALITIES TO FACILITATE INFORMATION SHARING AND COORDINATED RESPONSES

Related NH&UFS Strategies: #23

Implementation Guidance

- Maintain and build on working relationship with the existing Peel Region Urban Forest Working Group[27] by:
  - Remaining actively involved in working group meetings
  - Continuing to partner on data sharing and analysis related to canopy cover assessment and monitoring
  - Working together to pursue funding and/or other forms of support from the Provincial and/or federal governments regarding urban forest issues
  - Continuing to seek or provide assistance from/to the group on urban forest planning or management tasks as appropriate
- Broaden and formalize the collaboration to include other nearby municipal and agency partners to engage in:
  - Information sharing on mutual urban forest issues (e.g., invasive pest management, responses to climate change)
  - Joint and coordinated responses to environmental threats related to the urban forest (e.g., invasive pests, air quality management)
  - Pooling resources regarding monitoring of key environmental stressors, and joint responses to them
  - Pursuing support (financial and other) for urban forestry initiatives

Best Practices: Urban forestry has not been recognized as a core activity, or responsibility, of municipalities in Canada until relatively recently, and it could be argued it is still not nearly well enough recognized. Nonetheless, there are several local examples of effective inter-jurisdictional collaboration on urban forestry issues, a couple of which are listed below.

The Canadian Food Inspection Agency (CFIA) has worked with Mississauga and other municipalities (i.e., Toronto and Vaughan) to control the spread of Asian long-horned beetle (which affects a broad range of deciduous tree species) over the past decade.

Toronto Region Conservation Authority has also been very active with municipalities across the GTA (including Mississauga) in providing technical assistance in terms of conducting urban forest plot data collection, data analysis (based on both field plots and aerial imagery), report development and, in some cases, facilitating stakeholder consultations.

Current Practices: Mississauga has collaborated with the Region on urban forest issues since 2009 and has been a member of the Peel Region Urban Forest Working Group, along with Conservation Authority (CVC, TRCA), Brampton and Caledon staff, since its inception in 2011. To date this collaboration has resulted in the production of the *Peel Region Urban Forest Strategy* (2011) and *Mississauga Urban Forest Study* (2011), and has also allowed for ongoing information exchange and discussion between municipalities.

Mississauga has also collaborated with the CFIA (on the assessment and monitoring of high priority key pests, as well as the implementation of some targeted pest management activities), and keeps in touch with the urban foresters in other nearby municipalities on an informal basis.

Rationale: Continuation of the current working relationship with the Region and the Peel Region Urban Forest Working Group will be of mutual benefit, and facilitate future studies and planning exercises, as well as help ensure consistency and conformance with Regional planning objectives and policies. Broadening this collaboration in a more formal way with other nearby municipalities (and agencies where appropriate) will facilitate the exchange of best practices and other information, which will help improve urban forest management and planning, and may also provide more leverage for urban forest-related requests to higher levels of government.

[27] The PUFWG currently consists of staff active in urban forest planning and management from the Region of Peel, Town of Caledon, City of Brampton, City of Mississauga, Credit Valley Conservation and Toronto Region Conservation Authority.

9 IMPLEMENTATION GUIDANCE

A total of 30 Actions have been identified through the City of Mississauga's UFMP to provide technical and operational support for many of the 26 Strategies identified in the broader NH&UFS.

A stand alone Implementation Guide for the UFMP has been developed that is designed to facilitate implementation by:

- providing recommended timing for implementation
- identifying City department or division(s) that will lead the implementation
- listing the key implementation components
- identifying which Actions require new City resources for their implementation, and
- indicating which groups or organizations could provide potential partnerships and/or resources and/or funding.

Actions are not listed according to their priority (which is reflected in the timing for implementation column), but rather organized under the same five themes which this UFMP includes:

(1) urban forest program administration,
(2) tree health and risk management
(3) tree establishment and urban forest expansion
(4) tree protection and urban forest preservation, and
(5) promotion, education, stewardship & partnerships.

These themes reflect the topics discussed in this UFMP, which provide the context and rationale for the Actions.

Although the UFMP is a stand-alone document, it is closely related to the NH&UFS and is best understood within the broader context provided by that document, and so it is suggested that the two be read together. The links between specific UFMP Actions and NH&UFS Strategies are identified in each document's Implementation Guides.

The Implementation Guide for the UFMP is provided separately from the UFMP so that it can remain a working document for the entire 20 years of the Plan and be more easily updated. The UFMP itself is intended to be more of a static document that will continue to provide a vision, objectives and guiding principles, as well as targets, that will endure over the 20 year period of the Plan.

The new resource requirements identified through this UFMP Implementation Guide amount to $2,866,970 including resources for two seasonal staff and two students to support expanded stewardship efforts starting in the second four year period (i.e., 2018). The resource requirements are spread across the 20 year period of the Plan as follows:

- 2014 – 2017: $915,000
- 2018 – 2021: $291,710
- 2022 – 2025: $603,420
- 2026 – 2029: $453,420
- 2030 – 2033: $603,420

URBAN FOREST PROGRAM ADMINISTRATION (ACTIONS #1 TO #5):
About 37% of the new resources identified through the UFMP are required to update and maintain the City's street tree and park tree inventory. The usefulness of this tool is critical to moving the City towards more proactive and effective management of its treed assets. It is also an excellent potential outreach and education tool for the public. Some new funds are also identified for the development of consolidated City-wide tree protection and planting guidelines and specifications, another key tool for ensuring that trees identified for protection are properly protected, and that trees are planted with adequate space and soil quality to ensure their ability to grow to maturity.

The work and resources associated with monitoring and reviewing the UFMP and NH&UFS (as per the framework provided in the **Appendix A**) is anticipated to be undertaken with existing resources, and in partnership with the Region and local conservation authorities. Regular review (i.e., once every four years) of these documents, and the state of the assets themselves will facilitate the implementation of active adaptive management approaches if required. The four-year review cycle also aligns with the City's budgetary cycles to facilitate planning tied to available budgets and current priorities, and will allow for targeted budget requests that correspond to advancing specific strategies within these four year windows.

The cost related to the publication of an overview document once every four years that summarizes the state of the Natural Heritage System and Urban Forest, as well as highlights related to these areas over the four year period, is identified in the NH&UFS.

TREE AND NATURAL AREA HEALTH AND RISK MANAGEMENT (ACTIONS #6 TO #10):
Many of the improvements in the maintenance of street and park trees identified through the UFMP are anticipated to be possible within budgets that have already been identified. However, some new resources will be required to develop a City-wide invasive tree pest / disease management plan (1.4% of the new resource request), and to undertake targeted invasive plant management in some of the City's public Natural Areas (11.3% of the new resource request). Investments made up front to manage these problems can result in substantial future savings.

TREE ESTABLISHMENT, NATURALIZATION AND URBAN FOREST EXPANSION (ACTIONS #11 TO #14):
No new costs are expected to be required to implement the Actions associated with improved tree establishment and naturalization efforts. Support from the Planning and Building Department in terms of enforcing existing policies and by-laws is expected to facilitate implementation.

PROMOTION, EDUCATION, STEWARDSHIP AND PARTNERSHIPS (ACTIONS #21 TO #30):
The costs associated with expanding outreach and education to a wide range of stakeholders and the community at large are identified in the NH&UFS. However, the additional new costs associated with expanded stewardship are identified in the UFMP Implementation Guide. These are associated with: (a) the identified need for two seasonal staff and two students to support implementation of Actions #24 through #27, which accounts for about 35% of the new resources required to implement the UFMP, and (b) design and operation of City Memorial Arboretum, which accounts for 14% of the new resource request.

Although the NH&UFS and UFMP are each stand-alone documents with their own Implementation Guides, effective implementation of this UFMP will require coordination with implementation of the NH&UFS, as well as adequate resource allocation. This allocation of funds is a cost-effective and necessary investment into Mississauga's sustainability. This investment recognizes that the City's continued growth and economic development are reliant on and enhanced by a healthy Natural Heritage System and Urban Forest within the city, and beyond, and will help ensure the physical and mental well-being of the community, while also helping Mississauga mitigate and adapt to climate change.

10 GLOSSARY OF TECHNICAL TERMS

Adaptive Management: A systematic process for continuously improving management policies and practices by learning from the outcomes of previously employed policies and practices. In active adaptive management, management is treated as a deliberate experiment for the purpose of learning.

Atmospheric Carbon: Carbon dioxide gas (CO^2) suspended in the Earth's atmosphere. A greenhouse gas, atmospheric carbon dioxide is known to be a primary contributor to climate change.

Boundary Tree: "Every tree whose trunk is growing on the boundary between adjoining lands is the common property of the owners of the adjoining lands," as defined by the *Forestry Act, 1990.*

Canopy Cover: The proportion of land area that lies directly beneath the crown or canopy of trees and tall shrubs. The extent of urban forest canopy cover is typically expressed as a percentage of land area. It is generally recognized that increasing canopy cover is an objective of urban forest management.

Ecosystem Goods: This term is used for products provided by nature such food, fibre, timber and medicines that are readily valued as recognizable products that can be bought and sold, unlike ecosystem services which are harder to value and in our current market economy are considered "free".

Ecosystem Services: This term is used to describe the processes of nature needed to support the health and survival of humans. Ecological services are required and used by all living organisms, but the term typically refers to their direct value (quantified or not) to humans. Ecosystem services include processes such as air and water purification, flood and drought mitigation, waste detoxification and decomposition, pollination of crops and other vegetation, carbon storage and sequestration, and maintenance of biodiversity. Less tangible services that have also been associated with natural areas and green spaces include the provision of mental health and spiritual well-being.

Enhanced Rooting Environment Technology: Methods and materials implemented and installed to provide urban trees with greater soil volumes and higher quality soils than used in most current practices, with the objective of promoting improved root growth and urban tree health.

Evapotranspiration: The combined process of water evaporation and plant transpiration, whereby liquid water is converted into water vapour. The process of evapotranspiration is beneficial in urban areas for its cooling effects.

Family: For plants, the family includes plants with many botanical features in common and is the highest classification normally used. Modern botanical classification assigns a type plant to each family, which has the distinguishing characteristics of this group of plants, and names the family after this plant.

Genetic Potential: A tree's inherent potential to reach a maximum size, form and vigour. Achievement of maximum genetic potential enables a tree to provide the greatest number and extent of benefits possible. Urban trees are frequently unable to reach their genetic potential.

Genus: For plants, the genus is the taxonomic group containing one or more species. For example, all maples are part of the genus called *"Acer"* and their Latin or scientific names reflect this (e.g. Sugar maple is called *Acer saccharum*, while Black maple is called *Acer nigrum*).

Green Infrastructure: A concept originating in the mid-1990s that highlights the contributions made by natural areas to providing important municipal services that would cost money to replace. These include storm water management, filtration of air pollution and provision of shade.

Grid Pruning: The maintenance and inspection of municipally owned trees at regularly scheduled intervals. This type of management is often planned on a grid-based pattern for ease of implementation.

Invasive Species: A plant, animal or pathogen that has been introduced to an environment where it is not native may become a nuisance through rapid spread and increase in numbers, often to the detriment of native species.

Native Species: A species that occurs naturally in a given geographic region that may be present in a given region only through natural processes and with no required human intervention.

Qualified Arborist: A person who maintains his or her certification through the International Society of Arboriculture and/or the American Society of Consulting Arborists as a competent practitioner of the art and science of arboriculture.

Replacement Value: A monetary appraisal of the cost to replace one or more trees, as described by the Council of Tree and Landscape Appraisers.

Right-of-Way: A portion of land granted through an easement or other legal mechanism for transportation purposes, such as for a rail line, highway or roadway. A right-of-way is reserved for the purposes of maintenance or expansion of existing services. Rights-of-way may also be granted to utility companies to permit the laying of utilities such as electric power transmission lines (hydro wires) or natural gas pipelines.

Street Trees: Municipally owned trees, typically found within the road right-of-way along roadsides and in boulevards, tree planters (pits) and front yards.

Tree Protection Zone (TPZ): An area within which works such as excavation, grading and materials storage are generally forbidden. The size of a TPZ is generally based upon the diameter or drip-line of the subject tree.

Urban Forest: All trees, shrubs and understorey plants, as well as the soils that sustain them, located on public and private property within a given jurisdiction. This includes trees in natural areas as well as trees in more manicured settings such as parks, yards and boulevards.

APPENDIX A
NATURAL HERITAGE AND URBAN FOREST MONITORING FRAMEWORK

The criteria, indicators and objectives in this table have been adapted from Kenney *et al.* (2011)[28] and revised extensively to (a) incorporate measures for the Natural Heritage System, (b) incorporate targets developed for the Natural Heritage System and urban forest the City of Mississauga to be achieved over the next 20 years, and (c) be tailored for the City of Mississauga. This framework is intended to be used as a basis for monitoring the status of the city's natural heritage and urban forest assets, as well as the status of planning and management for these assets, and the level of engagement and partnerships related to stewardship of these assets.

Where known, the "level" which the City of Mississauga is at for each indicator as of the date of the finalization of this Plan is shaded. In a few cases more than one box is shaded indicating the City's current status is between the two levels identified.

As described in the UFMP, the criteria in this table are intended to be reviewed every four years (with a few of the more resource intensive criteria being assessed every eight years). It is also intended that where no movement, or movement in the wrong direction, is detected for indicators that the need for active adaptive management be considered. It is also possible that in some cases targets may need to be revised in response to unexpected circumstances or changes in conditions.

Criteria and Indicators for assessing Mississauga's Natural Heritage System (NHS) and Urban Forest (UF).

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
1. NHS Size	The existing NHS cover equals less than 50% of the potential.	The existing NHS cover equals 50% to 74% of the potential.	The existing NHS cover equals 75% to 90% of the potential.	The existing NHS cover equals 90 to 100% of the potential.	OBJECTIVE: To maintain and expand total NHS cover across the city to improve the system's ecological functions and maximize the ecosystem services it provides. RELATED NH&UFS STRATEGIES: 4, 7, 8, 10, 11, 17, 18	TARGET: 12% to 14% NHS cover by 2033 (14% is considered close to the City's potential in the current land use context) APPROACH & RESPONSIBLE PARTY(IES): Based on GIS mapping completed as part of annual Natural Areas Survey updates undertaken by the City.
2. NHS Connectivity: Aquatic	Less than 60% of the city's watercourses have at least 30 m of vegetation on both sides.	Between 60% and 74% of the city's watercourses have at least 30 m of vegetation on both sides.	Between 75% to 85% of the city's watercourses have at least 30 m of vegetation on both sides.	More than 85% of the city's watercourses have at least 30 m if vegetation on both sides.	OBJECTIVE: To maintain and improve the ecological functions of the city's watercourses, including their primary functions as ecological corridors. RELATED NH&UFS STRATEGIES: 5, 16	TARGET: 75% of the watercourses have vegetation for at least 30 m on both sides APPROACH & RESPONSIBLE PARTY(IES): To be assessed via desktop with data from CVC (and TRCA) as part of their ongoing watershed monitoring activities.

[28] Kenney, W.A., van Wassenaer, P.J. and A. Satel. 2011. Criteria and Indicators for Strategic Urban Forest Planning and Management. Arboriculture & Urban Forestry 37(3): 108-117

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
3. NHS Connectivity: Terrestrial	Less than 50% of Significant Natural Areas are linked through the City's NHS or other Green System components.	Between 50% and 74% of Significant Natural Areas are linked through the City's NHS or other Green System components.	Between 75% and 85% of Significant Natural Areas are linked through the City's NHS or other Green System components***.	More than 85% of Significant Natural Areas are linked through the City's NHS or other Green System components.	OBJECTIVE: To maintain and improve the ecological connectivity between the City's Significant Natural Areas, including recognition of the supporting role open green spaces outside the Natural Heritage System can play. RELATED NH&UFS STRATEGIES: 5, 12	TARGET: 85% of Significant Natural Areas are linked through the NHS or other Green System components APPROACH & RESPONSIBLE PARTY(IES): To be assessed remotely using current aerial photography and GIS by the City as part of their ongoing Natural Areas Survey (i.e. terrestrial monitoring).
4. NHS Quality	Overall terrestrial and aquatic quality across the city has declined since 2013.	Overall terrestrial and aquatic quality across the city has remained more or less the same since 2013.	Overall terrestrial and aquatic quality across the city has *improved somewhat* since 2013. *More specific indicators to be developed pending further discussion and review of available data with CVC.*	Overall terrestrial and aquatic quality across the city has *improved substantially* since 2013. *More specific indicators to be developed pending further discussion and review of available data with CVC.*	OBJECTIVE: To track changes in the quality of the city's terrestrial and aquatic ecosystems using data from a representative sample of sites that focus on community structure, composition and function (e.g., water quality, fisheries, macroinvertebrates, forest integrity, wetland integrity). RELATED NH&UFS STRATEGIES: 11, 12, 16	TARGET: Substantially improve overall terrestrial and aquatic quality across the city using 2013 as a baseline. *Quantitative targets may be established pending further discussion and review of available data with CVC.* APPROACH & RESPONSIBLE PARTY(IES): Based on data collected from terrestrial and aquatic monitoring plots by CVC and analyses done through updates to CVC's Landscape Scale Analysis and Integrated Watershed Monitoring Program for Mississauga. Note: 2013 is to be used as the "baseline" moving forward.
5. UF Canopy Cover	The existing UF cover equals 50% of the potential.	The existing UF cover equals 50% to 74% of the potential.	The existing UF cover equals 75% to 84% of the potential.	The existing UF cover equals more than 85% of the potential.	OBJECTIVE: To maintain and expand total UF cover across the city to improve the system's sustainability and maximize the ecosystem services it provides. RELATED NH&UFS STRATEGIES: 6, 7, 8, 9, 13, 14, 18, 21	TARGET: 15% to 20% UF cover by 2033; potential UF cover is currently unknown APPROACH & RESPONSIBLE PARTY(IES): Based on canopy cover assessments undertaken jointly through the Peel Urban Forest Working Group (with support from the USDA Forest Service) every ~ eight years.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
6. UF Canopy Cover Distribution Across the City	Canopy cover is at least 15% (the City's current average) in up to 50% of residential areas, and in less than 25% of other land uses city-wide.	Canopy cover is at least 15% (the City's current average) in 50% to 74% of residential areas, and in 25% to 49% other land uses city-wide.	Canopy cover is at least 15% (the City's current average) in 75% to 94% of residential areas, and in 50% to 74% other land uses city-wide.	Canopy cover is at least 15% (the City's current average) in 95% to 100% of residential areas, and 75% or more of other land uses city-wide.	OBJECTIVE: The current (2011) City-wide average canopy cover is 15%. The key objective is to ensure canopy cover is at least equivalent to the city-wide average in all residential areas, and most other land uses, recognizing there are some areas where it must remain low for safety reasons (e.g., the industrial airport lands). RELATED NH&UFS STRATEGIES: 13, 21	TARGET: Canopy cover meets or exceeds 15% (i.e., the current city-wide average) in all (100%) of the City's residential areas and in 50% to 75% of the city's other land use categories. APPROACH & RESPONSIBLE PARTY(IES): Land use-based canopy cover analyses remain to be done. A Tree Planting Priority study to be undertaken jointly through the Peel Urban Forest Working Group over 2014 will help complete this analysis and prioritize tree planting needs in Mississauga and throughout the Region's urban areas.
7. Size distribution of City Street and Park Trees	Any size (i.e., DBH) class represents more than 75% of the street and park tree population.	Any size class represents between 50% and 75% of the street and park tree population.	No size class represents more than 50% of the street and park tree population.	Approximately 25% of the tree population is in each of four size classes.	OBJECTIVE: Size, generally considered a surrogate for age, should be relatively evenly distributed among street and park trees to ensure a balanced cycle of regeneration. RELATED NH&UFS STRATEGIES: 14, 15, 18	TARGET: Gradual shift to "moderate" performance, but may not be possible by 2033. APPROACH & RESPONSIBLE PARTY(IES): To be assessed from the street and park tree inventory by City staff (Forestry Division).
8. City Street and Park Tree Species Diversity	Fewer than 7 species dominate the entire street and park tree population city-wide.	No species represents more than 20% of the entire street and park tree population city-wide.	No species represents more than 10% of the entire tree population city-wide or 30% on a given street or park.	No species represents more than 5% of the entire street or park tree population city-wide or more than 20% on a given street or park.	OBJECTIVE: Establish a genetically diverse street and park tree population city-wide , excluding invasive non-native species, as well as at the neighbourhood level that is more resilient to climate change, species-specific tree pests and other stressors. RELATED NH&UFS STRATEGIES: 14, 15, 18	TARGET: No tree species represents more than 5% of the tree population City-wide or more than 20% on a given street by 2033. APPROACH & RESPONSIBLE PARTY(IES): To be assessed from the street and park tree inventory by City staff (Forestry Division).

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
9. Species Suitability of City Street and Park Trees	Invasive tree species represent more than 15% of the street and park tree population.	Invasive tree species represent between 10% and 14% of the street and park tree population.	Invasive tree species represent between 5% and 9% of the street and park tree population.	Invasive tree species represent less than 5% of the street and park tree population.	OBJECTIVE: Reduce the proportion of City street and park trees that are invasive to limit the ecological impacts and management costs associated with these species. RELATED NH&UFS STRATEGIES: 14, 15, 18	TARGET: Invasive tree species represent less than 8% of the street and park tree population. APPROACH & RESPONSIBLE PARTY(IES): To be assessed from the street and park tree inventory by City staff (Forestry Division). To be undertaken gradually as opportunities arise through mature tree demise, development, etc.).
10. Condition of City Street and Park Trees	Less than 25% of street and park trees are in good or excellent condition.	Between 25% and 49% of street and park trees are in good or excellent condition.	Between 50% and 74% of street and park trees are in good or excellent condition.	More than 75% of street and park trees are in good or excellent condition.	OBJECTIVE: To improve the condition and minimize the risk potential of all publicly- owned trees. RELATED NH&UFS STRATEGIES: 14, 15	TARGET: *Cannot be developed until the City's public tree inventory is updated and expanded to provide baseline assessment* APPROACH & RESPONSIBLE PARTY(IES): To be assessed from the street and park tree inventory by City staff (Forestry Division).
11. Condition of Publicly-owned Natural Areas	Publicly-owned Natural Areas have an average site ecological integrity of less than XX%. *Quantitative indicators to be established pending further discussion and review of available data.*	Publicly-owned Natural Areas have an average site ecological integrity of XX % to XX %. *Quantitative indicators to be established pending further discussion and review of available data.*	Publicly-owned Natural Areas have an average site ecological integrity of XX % to XX %. *Quantitative indicators to be established pending further discussion and review of available data.*	Publicly-owned Natural Areas have an average site ecological integrity of more than XX %. *Quantitative indicators to be established pending further discussion and review of available data.*	OBJECTIVE: Measuring changes in the ecological structure and function of publicly-owned Natural Areas through assessments of key structural elements (e.g., tree health and dead wood in forested habitats), plant and vegetation community diversity, and wildlife populations (primarily birds). RELATED NH&UFS STRATEGIES: 15, 16	TARGET: Improve the average ecological integrity of publicly-owned Natural Areas. *Quantitative targets to be established pending further discussion and review of available data with CVC.* APPROACH & RESPONSIBLE PARTY(IES): Based on data collected from terrestrial monitoring of a sub-set of the City's Natural Areas by CVC and analyses done through updates to CVC's Terrestrial Monitoring Program.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
12. Natural Heritage & Urban Forest Strategy (and supporting Urban Forest Management Plan) Implementation	Less than 25% of recommended NH&UFS Strategies (and supporting UFMP Actions) implemented.	Between 25% and 49% of recommended NH&UFS Strategies (and supporting UFMP Actions) implemented.	Between 50% and 74% of recommended NH&UFS Strategies (and supporting UFMP Actions) implemented.	Between 75% and 100% of recommended NH&UFS Strategies (and supporting UFMP Actions) implemented.	OBJECTIVE: Most or all NH&UFS Strategies (and supporting UFMP Actions) need to be implemented to ensure that Mississauga's natural heritage and urban forest assets are sustained for the long term and continue to sustain the community. RELATED NH&UFS STRATEGIES: 26	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (in various departments) through their program review.
13. Canopy Cover Assessment	No assessment	Visual assessment	Sampling of tree cover using aerial photographs or satellite imagery.	Sampling of tree cover using aerial photographs or satellite imagery included in jurisdiction-wide GIS.	OBJECTIVE: High resolution assessments of the existing and potential canopy cover for the entire community. RELATED NH&UFS STRATEGIES: 13, 26	TARGET: Maintain "optimal" status over the period of this Plan. APPROACH & RESPONSIBLE PARTY(IES): Assessment done in 2011 to be re-assessed periodically using the best available tools through the Peel Urban Forest Working Group and partners.
14. Natural Heritage System Policies and Enforcement	Natural Heritage System policies are not consistent with the basic Provincial and Regional requirements.	Natural Heritage System policies are consistent with the basic Provincial and Regional requirements.	Natural Heritage System policies are consistent with the basic Provincial and Regional requirements, and include consideration of local conditions and issues.	Natural Heritage System policies are consistent with the basic Provincial and Regional requirements, and support locally-developed targets.	OBJECTIVE: The Natural Heritage System is afforded a high level of protection and local natural heritage objectives and targets are supported. RELATED NH&UFS STRATEGIES: 3, 4, 18	TARGET: Achieve "optimal" status by 2033, or sooner. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (in Planning and Building) through their program review.
15. Tree Protection Policy Development and Enforcement	No tree protection policies are in place for trees on public or private lands.	Policies (including Official Plan policies, guidelines and by-laws) are in place to protect public trees.	Policies (including Official Plan policies, guidelines and by-laws) are in place to protect public and private trees with some enforcement. Replacement for trees removed is encouraged.	Policies that ensure the protection of trees on public and private land are consistently enforced and supported by an educational program. Replacement and/or compensation for trees removed is required.	OBJECTIVE: Trees on both public and private lands are afforded a high level of protection through policies in the Official Plan and supporting policies, guidelines and by-laws. Where protection is not feasible, replacement and/or compensation is required. RELATED NH&UFS STRATEGIES: 6, 8, 18	TARGET: Achieve "optimal" status by 2033, or sooner. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (in various departments) through their program review.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
16. Publicly-owned Natural Areas Management Planning and Implementation	No Conservation Plans developed or in effect. Limited management / stewardship undertaken.	Conservation Plans developed and in effect for some high priority publicly-owned Natural Areas.	Conservation Plans developed and in effect for all high priority publicly-owned Natural Areas.	Conservation Plans developed and in effect for all publicly-owned Natural Areas, and for high-quality privately-owned natural areas where opportunities arise.	OBJECTIVE: To ensure the ecological structure and function of all publicly-owned Natural Areas is protected and, where needed, enhanced, while still accommodating safe and appropriate public uses. RELATED NH&UFS STRATEGIES: 10, 11, 16	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review.
17. Publicly-owned Street and Park Tree Inventory	No inventory	Sample-based inventory of publicly-owned street and park trees	Complete inventory of publicly-owned street and park trees in some type of management system and GIS	Complete inventory of publicly-owned street and park trees in some type of management system and GIS that is current and actively maintained	OBJECTIVE: Complete inventory of the City's street and park trees to facilitate and direct their proactive management. This includes: age distribution, species mix, tree condition, and risk assessment. RELATED NH&UFS STRATEGIES: 15, 26	TARGET: Achieve "optimal" status well by 2016. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review. Note the City's current inventory includes mainly street – not park – trees and is almost five years out of date,
18. Native Plant Species Management	No program or policies for native plant species are in place.	Voluntary use of site-appropriate native plant species on publicly and privately-owned lands occurs.	The use of site-appropriate native plant species is *encouraged* on a project-appropriate basis in both intensively and extensively managed areas.	The use of site-appropriate native plant species is *required* on a project-appropriate basis in both intensively and extensively managed areas. Hardy non-native, non-invasive tree species may be accepted in harsh sites where trees are required.	OBJECTIVE: Preservation and enhancement of local natural biodiversity by increasing the proportion and population of site-appropriate native plant species through policies, guidelines, management and stewardship. RELATED NH&UFS STRATEGIES: 15, 16	TARGET: Achieve "optimal" statuswell before 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review. Note CVC has comprehensive native plant species selection guidelines on their website to assist with implementation.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
19. Invasive Plant Species Management	No program or policies for invasive plant species are in place.	Risks associated with invasive plant species are promoted. Ad hoc management of invasive plants is undertaken as resources permit.	The use of invasive plant species is *discouraged* on a project-appropriate basis in both intensively and extensively managed areas. A targeted program for management of high priority areas for invasive species is in place.	The use of invasive plant species is *prohibited* on a project-appropriate basis in both intensively and extensively managed areas. A targeted program for management of high priority areas for invasive species is in place and being implemented.	OBJECTIVE: Preservation and enhancement of local natural biodiversity by reducing the proportion and population of non-native and invasive plant species, particularly in high quality Natural Areas. RELATED NH&UFS STRATEGIES: 5, 15, 18	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review.
20. Tree Establishment Planning and Implementation	Tree establishment is *ad hoc.*	Tree establishment occurs on an annual basis on public lands and is encouraged on private lands.	Tree establishment is directed by needs derived from a tree inventory (on public lands) and is supported on private lands as resources permit.	Tree establishment is directed by needs derived from a tree inventory (on public lands) and by a jurisdiction wide prioritization study on private lands. There are dedicated resources committed to planting (and follow-up maintenance) on both public and private lands.	OBJECTIVE: UF renewal is ensured through a comprehensive tree establishment program driven by a range of biophysical and community-based considerations. RELATED NH&UFS STRATEGIES: 15, 18	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review.
21. Tree Habitat Suitability	Trees are planted without consideration for site conditions.	Tree species are considered in planting site selection.	Community-wide guidelines are in place for the improvement of planting sites and the selection of suitable species.	All trees are planted in compliance with established community-wide guidelines and best practices.	OBJECTIVE: All trees are planted in habitats which will maximize current and future benefits provided in sites with adequate soil quality and quantity, and growing space to achieve their genetic potential. RELATED NH&UFS STRATEGIES: 15, 18	TARGET: Achieve "good" or "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (in various departments) through their program review. Note CVC has comprehensive native plant species selection guidelines on their website to assist with implementation.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
22. Maintenance of Publicly-Owned Street and Park Trees	No maintenance of publicly-owned trees.	Publicly-owned trees are maintained on a request/reactive basis. No systematic (block) pruning.	All publicly-owned street and park trees are systematically maintained on a cycle longer than 8 years.	All mature publicly-owned street and park trees are maintained on a 5 to 8-year cycle. All immature trees are structurally pruned.	OBJECTIVE: All publicly-owned trees are maintained to maximize current and future benefits, and reduce longer-term maintenance costs and associated risks. RELATED NH&UFS STRATEGIES: 14, 15	TARGET: Achieve or "optimal" status in full by 2033, or before. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review.
23. Tree Risk Management	No tree risk assessment/ remediation program is in place. Request based/reactive system.	Sample-based tree inventory which includes general tree risk information has been completed. Request based/reactive risk abatement program is in place.	Complete tree inventory, which includes detailed tree failure risk ratings, is in place. Risk abatement program is in effect eliminating hazards within a maximum of one month from confirmation of hazard potential.	Complete tree inventory, which includes detailed tree failure risk ratings, is in place and maintained. Risk abatement program is in effect eliminating hazards within a maximum of one week from confirmation of hazard potential.	OBJECTIVE: Risk related to publicly owned trees is minimized to the greatest extent possible through appropriate policies and procedures. RELATED NH&UFS STRATEGIES: 15	TARGET: Achieve "good" or "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their program review. Note comprehensive risk assessment will take place as part of the updated tree inventory.
24. Cooperation and support among City departments	There is no collaboration between departments on NHS or UF issues.	There is some informal collaboration between departments on NHS or UF issues.	There is some formal collaboration between departments on NHS or UF issues.	Key staff from all departments involved in NHS and UF issues meet regularly to pursue shared goals.	OBJECTIVE: The level of cooperation among municipal departments involved in NHS and UF issues is increased to maximize opportunities for resource sharing and pursuit of NHS and UF objectives. RELATED NH&UFS STRATEGIES: 1, 18, 20, 25	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (various departments) through their program review.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
25. Success in improving awareness of the Natural Heritage System and urban forest as community assets	Community surveys indicate that natural heritage and the urban forest are generally seen as of limited value.	Community surveys indicate that natural heritage and the urban forest are recognized as having value by a minority.	Community surveys indicate that natural heritage and the urban forest are recognized as having value by between 50% and 74%.	Community surveys indicate that natural heritage and the urban forest are recognized as vital to the community's environmental, social and economic well-being by more than 75%	OBJECTIVE: All sectors of the community recognize that the natural heritage and urban forest assets within the City are key contributors to quality of life and provide a wide range of ecological services that are difficult, costly or impossible to replace. RELATED NH&UFS STRATEGIES: 19, 20, 22	TARGET: Achieve "good" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): To be assessed through targeted surveys conducted by City staff, or possibly university students, once every four to eight years over the course of this Strategy.
26. Outreach to large private and institutional landholders	Large private landholders are not engaged on natural heritage or urban forest issues.	Educational materials and advice available to landholders who are interested.	Educational materials, advice, technical support and incentives are available to landholders who are interested.	The City (and other agencies) are actively working with large landowners to share available educational materials, advice, technical support and incentives.	OBJECTIVE: Large private landholders embrace city-wide goals and objectives through specific resource management plans and/or ongoing naturalization / reforestation activities on their properties. RELATED NH&UFS STRATEGIES: 21, 25	TARGET: Maintain "good" to "optimal" status to 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their outreach and stewardship program review, and the Million Trees Program.
27. "Green" and Building Industry Cooperation	Limited cooperation from segments of the "green" industry (nurseries, tree care companies, etc.), builders and developers in supporting NH&UFS and UFMP objectives.	The "green" industry, builders and developers generally comply with established policies, guidelines and by-laws.	The "green" industry, builders and developers comply with established policies, guidelines and by-laws	The "green" industry, builders and developers comply with and sometimes go beyond established policies, guidelines and by-laws, and work with the City to integrate green development tools and approaches.	OBJECTIVE: "Green" industry, builders and developers operate with high professional standards, are committed to respecting established policies, guidelines, and by-laws and working with the City to support natural heritage and urban forest objectives by integrating green development tools and approaches. RELATED NH&UFS STRATEGIES: 18, 20, 21, 25	TARGET: Achieve "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Planning and Building, Forestry Division).

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
28. Involvement of Neighbourhoods and Community Groups	Neighbourhoods and community groups are not involved in natural heritage or urban forest activities or programs.	A few neighbourhoods and community groups are involved in natural heritage and/or urban forest activities or programs.	Many neighbourhoods and community groups are involved in natural heritage and/or urban forest activities or programs.	Representatives from neighbourhoods and community groups across the city are involved in natural heritage and/or urban forest activities or programs.	OBJECTIVE: Active involvement of neighbourhoods and community groups from across the City in natural heritage and urban forest stewardship fosters a connection with these community assets, and a sense of responsibility for their well-being. RELATED NH&UFS STRATEGIES: 21, 24, 25	TARGET: Achieve "good" or "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their outreach and stewardship program review, and the Million Trees Program. Priority areas to be identified through Strategy 13 (Action #11).
29. Involvement of Local Businesses and Development Organizations	Local businesses and development organizations are not involved in natural heritage or urban forest activities or programs.	A few local businesses and development organizations are involved in natural heritage and/or urban forest activities or programs.	Many local businesses and development organizations are involved in natural heritage and/or urban forest activities or programs.	Representatives from local businesses and development organizations across the city are involved in natural heritage and/or urban forest activities or programs.	OBJECTIVE: Active involvement of local businesses and development organizations from across the City in natural heritage and urban forest stewardship provides leadership by example in the city and beyond. RELATED NH&UFS STRATEGIES: 18, 21, 25	TARGET: Achieve "good" or "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their outreach and stewardship program review, and the Million Trees Program.
30. Involvement of Local Schools and Academic Institutions	Local schools and academic institutions are not involved in natural heritage or urban forest activities or programs.	A few local schools and academic institutions are involved in natural heritage and/or urban forest activities or programs.	Many local schools and academic institutions are involved in natural heritage and/or urban forest activities or programs.	Representatives local schools and academic institutions across the city are involved in natural heritage and/or urban forest activities or programs.	OBJECTIVE: Active involvement of local schools and academic institutions from across the City in natural heritage and urban forest stewardship instills the value of these assets in the future leaders, and provides opportunities for leveraging existing programs to collect data and undertake research. RELATED NH&UFS STRATEGIES: 21, 23	TARGET: Achieve "good" or "optimal" status by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Forestry Division) through their outreach and stewardship program review, and the Million Trees Program.

Criteria	Performance Indicators				Key Objectives and Related Strategies*	Targets**, Approach and Responsible Party(ies)
	Low	Moderate	Good	Optimal		
31. Regional Cooperation	The City, the Region and local conservation authorities rarely cooperate on matters of urban forestry or natural heritage.	The City, the Region and local conservation authorities cooperate on matters of urban forestry and natural heritage on an ad hoc basis. .	The City, the Region and local conservation authorities cooperate on matters of urban forestry and natural heritage on a regular, formalized basis.	The City, the Region and local conservation authorities work together to develop and implement urban forest strategies and natural heritage planning.	OBJECTIVE: Together, the City, the Region and local conservation authorities are able to address issues and pursue larger-scale natural heritage and urban forest objectives in an integrated and cost-effective manner. RELATED NH&UFS STRATEGIES: 3, 10, 23	TARGET: Maintain "optimal" status to 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Planning and Building, Forestry Division) and key staff at the Region, Credit Valley Conservation and Toronto Region Conservation.
32. Provincial and Federal Cooperation and Support	The Provincial and Federal governments cooperate on matters of urban forestry or natural heritage on a limited basis.	The Provincial and Federal governments cooperate on matters of urban forestry or natural heritage on a regular basis.	The Provincial and Federal governments cooperate on matters of urban forestry or natural heritage on a regular basis, and provide support to municipal governments.	The Provincial and Federal governments provide dedicated technical and funding support to municipal governments on urban forestry and natural heritage matters.	OBJECTIVE: Together, the City, the Region and local conservation authorities are able to obtain greater levels of support (both policy-based and resource-based) from higher levels of government, particularly for urban forestry initiatives. RELATED NH&UFS STRATEGIES: 23, 24, 25	TARGET: Try to solicit "moderate" to "good" performance by 2033. APPROACH & RESPONSIBLE PARTY(IES): As assessed by City staff (Planning and Building, Forestry Division) and key staff at the Region, Credit Valley Conservation and Toronto Region Conservation.

* All of the criteria and indicators are linked to specific Strategies identified through the Natural Heritage & Urban Forest Strategy (NH&UFS) as well as related Actions identified through this UFMP, which supports implementation of the NH&UFS. Related NH&UFS Strategies listed in this table also, by default, include UFMP Actions supporting those Strategies (as identified in Section 8 of this UFMP and the stand-alone Implementation Guides for both the NH&UFS and UFMP).

** All established targets are to be achieved over the 20 year period of this Plan and of the overarching Natural Heritage & Urban Forest Strategy (i.e., by 2033).

*** Connectivity was assessed through analyses provided in the NH&UFS Background Report (Dec. 2013) and can be re-assessed as part of the Natural Areas Survey Updates once every four years.

APPENDIX B

Summary of how the 27 recommendations from the *City of Mississauga Urban Forest Study* (2011)[29] have been addressed through this Urban Forest Management Plan and the broader Natural Heritage & Urban Forest Strategy

Mississauga Urban Forest Study (2011) Recommendation	Relationship to Mississauga's Urban Forest Management Plan (UFMP) and broader Natural Heritage Urban Forest Strategy (NH&UFS)
1. Neighbourhoods identified by the Priority Planting Index should be targeted for strategic action that will increase tree cover and leaf area in these areas.	Incorporated into NH&UFS Strategies #11 and #13, as well as supporting UFMP Actions #11 and #12.
2. Use the parcel-based TC metrics together with the City's GIS database to identify and prioritize contiguous parcels that maintain a high proportion of impervious cover and a low percent canopy cover.	Incorporated into NH&UFS Strategy #13, as well as supporting UFMP Action #11.
3. Increase leaf area in canopied areas by planting suitable tree and shrub species under existing tree cover. Planting efforts should be focused in areas where mature and aging trees are over-represented, including the older residential neighbourhoods located south of the Queensway. Neighbourhoods in these areas that maintain a high proportion of ash species should be prioritized.	Incorporated into NH&UFS Strategy #13, as well as supporting UFMP Actions #11 and #12.
4. Utilize the Pest Vulnerability Matrix during species selection for municipal tree and shrub planting.	Evaluation of local pest priorities is incorporated into NH&UFS Strategy #15 and supporting UFMP Action #19.
5. Establish a diverse tree population in which no single species represents more than 5 percent of the tree population, no genus represents more than 10 percent of the tree population, and no family represents more than 20 percent of the intensively managed tree population both city-wide and the neighbourhood level.	Increasing street and park tree diversity is addressed through UFMP Target #5 and is also Incorporated into NH&UFS Strategy #16 and supporting UFMP Action #9.
6. In collaboration with the Toronto Region Conservation Authority and Credit Valley Conservation, develop and implement an invasive species management strategy that will comprehensively address existing infestations as well as future threats posed by invasive insect pests, diseases and exotic plants.	Invasive plant management is incorporated into NH&UFS Strategy #15 and supporting UFMP Action #10; invasive tree pest management is incorporated into NH&UFS Strategy #15 and supporting UFMP Action #9.
7. Utilize native planting stock grown from locally adapted seed sources in both intensively and extensively managed areas.	The broader use of native planting stock is to be implemented through Strategy #15 and supporting UFMP Action #4.
8. Evaluate and develop the strategic steps necessary to increase the proportion of large, mature trees in the urban forest. Focus must be placed on long-term tree maintenance and by-law enforcement to ensure that healthy specimens can reach their genetic growth potential. The value of the services provided by mature trees must be effectively communicated to all residents.	A number of strategies and actions are designed to support the preservation of mature trees in the City. These include: NH&UFS Strategies #4, #6, #7, #8 (and supporting Actions #15, #16 and #17), Strategy #14 (and related Action #17), Strategy #15 (and supporting Actions #6 and #8), Strategy #20 (and supporting Actions #4, #6 and #9).

[29] This study was led by Toronto Region conservation with support from the Region of Peel, the three area municipalities (Mississauga, Brampton and Caledon) and Credit Valley Conservation.

Mississauga Urban Forest Study (2011) Recommendation	Relationship to Mississauga's Urban Forest Management Plan (UFMP) and broader Natural Heritage Urban Forest Strategy (NH&UFS)
9. Determine the relative DBH of the tree population in Mississauga; consider utilizing relative DBH as an indicator of urban forest health.	This recommendation is not being pursued through the UFMP or NH&UFS.
10. Conduct an assessment of municipal urban forest maintenance activities (e.g. pruning, tree planting) to determine areas where a reduction in fossil fuel use can be achieved.	An analysis of municipal urban forest maintenance practices was done through the UFMP, but efficiencies related to fossil fuel use were not specifically identified, although the increasing shift towards proactive management is intended to ensure that more work is done in fewer trips to the same location.
11. Reduce energy consumption and associated carbon emissions by providing direction and assistance to residents and businesses for strategic tree planting and establishment around buildings.	Direction and assistance to residents and businesses in terms of planting to maximize the cooling benefits of trees on their properties is provided through various sources under the One Million Trees Program, as per NH&UFS Strategy #21 (and related Actions #24 and #26).
12. Focus tree planting and establishment in "hot-spots" identified by thermal mapping analysis.	Consideration for the hot spot data is incorporated into NH&UFS Strategy #13 and supporting UFMP Action #11.
13. Review and enhance the Tree Permit By-law 474-05 to include the protection all trees that are 20 cm or greater in diameter at breast height.	The City's Private Tree Protection By-law was recently updated. As discussed under Action#17, it is recommended it be reviewed again in four to eight years.
14. Develop a comprehensive Public Tree By-law that provides protection to all trees on publically owned and managed lands.	As per Action #15, the City is currently in the process of updating its Street Tree By-law to be a more comprehensive Public Tree By-law.
15. Develop a Tree Protection Policy that outlines enforceable guidelines for tree protection zones and other protection measures to be undertaken for all publically and privately owned trees	Action #4 recommends the development, and implementation, of improved city-wide tree protection and planting specifications for trees on public and private lands.
16. Allocate additional funding to the Urban Forestry Unit for the resources necessary to ensure full public compliance with Urban Forestry By-laws and policies.	Resource requirements above and beyond what is currently approved for the various Actions are identified through the NH&UFS and UFMP Implementation Guides under separate cover
17. Create a Community Animator Program that assists residents and groups acting at the neighbourhood scale in launching local conservation initiatives.	Although a Community animator is not specifically recommended through this Plan, a number of engagement strategies and actions are identified through the NH&UFS and the UFMP.
18. Conduct a detailed assessment of opportunities to enhance urban forest stewardship through public outreach programs that utilize community-based social marketing.	As assessment of stewardship opportunities has been completed through the NH&UFS and UFMP (see **Appendix E**), and recommendations to build on these programs and incorporate social marketing are made through Strategy #19, and supporting Actions #21 and #22.
19. Develop and implement a comprehensive municipal staff training program as well as information sharing sessions that target all departments and employees that are stakeholders in sustainable urban forest management.	The importance of and need for internal training and education is identified though Strategy #1, and supporting Action #3.
20. Increase genetic diversity in the urban forest by working with local growers to diversify stock and reduce reliance on clones.	Identified in Action #29 as a potential project.

Mississauga Urban Forest Study (2011) Recommendation	Relationship to Mississauga's Urban Forest Management Plan (UFMP) and broader Natural Heritage Urban Forest Strategy (NH&UFS)
21. Utilize the UTC analysis together with natural cover mapping to identify priority planting and restoration areas within the urban matrix.	Consideration for the canopy cover analysis done is incorporated into NH&UFS Strategy #13 and supporting UFMP Action #11.
22. Implement the target natural heritage system in the Etobicoke and Mimico Creeks Watersheds; work with CVC to identify and implement the target natural heritage system in the Credit Valley Watershed.	The CVC and TRCA watershed target Natural Heritage Systems have been considered in the identification of potential expansion areas identified and recommended through Strategy #13, and should continue to be considered in future identification of expansion areas, as well as in the identification of future acquisition areas (Strategy #16).
23. Develop and implement an urban forest monitoring program that tracks trends in the structure and distribution of the urban forest using the i-Tree Eco analysis and Urban Tree Canopy analysis. The structure and distribution of the urban forest should be comprehensively evaluated at regular 5-year intervals and reported on publically.	Urban forest monitoring is recommended through Strategy #26, and supporting Actions #1 and #2, and is to utilize established criteria and indicators.
24. Develop a seed collection program for native ash species in partnership with TRCA, CVC and National Tree Seed Centre.	Identified in Action #29 as a potential project.
25. Develop municipal guidelines and regulations for sustainable streetscape and subdivision design that 1) ensure adequate soil quality and quantity for tree establishment and 2) eliminate conflict between natural and grey infrastructure.	This recommendation is to be implemented through Strategy #14 and supporting UFMP Action #4.
26. Apply and monitor the use of structural soils, subsurface cells and other enhanced rooting environment techniques for street trees. Utilizing these technologies at selected test-sites in the short-term may provide a cost-effective means of integrating these systems into the municipal budget.	Assessment of the use of structural soils identified in Action #29 as a potential research project.
27. Utilize the criteria and performance indicators developed by Kenney et al. (2011) to guide the creation of a strategic management plan and to assess the progress made towards sustainable urban forest management and planning.	Urban forest monitoring is recommended through Strategy #26, and supporting Actions #1 and #2, and is to utilize established criteria and indicators framework by Kenney at al. (2011).

APPENDIX C
INVASIVE SPECIES MANAGEMENT PLAN

1.0 INTRODUCTION TO INVASIVE SPECIES IN MISSISSAUGA

Invasive species pose great challenges to ecological integrity in Natural Areas in the City of Mississauga. Invasive species are usually non-native species that displace some or most of the native components of the community (White *et al.* 1993). They include plants, insects, fish and animals, particularly domestic pets. Effective invasive species management should consider a wide range of factors, including but not limited to: prevention of invasions, identification and mapping of invasive populations, prioritization of species and areas for management, control measures, community partnerships, funding, and public education and awareness.

Credit Valley Conservation (CVC) has developed a draft *Invasive Species Strategy* (CVC 2009) that provides a lot of information on invasive plant and animal species including priority for removal and a summary of removal techniques. Given that majority of the City is in the CVC watershed, this strategy is highly relevant and should be consulted for guidance. It is relied on heavily in this report for suggesting priority species, with some refinements based on specific knowledge of Mississauga. Moreover, the CVC has been involved in invasive species control for several years, including some priority sites in Mississauga in collaboration with City staff. Initiatives for invasive species control should be coordinated with the CVC as appropriate.

Invasive species occur in aquatic and terrestrial environments, and management expertise and techniques for species in these two environments are very different. Given CVC's focus on aquatic and wetland systems, it is suggested that they would be better suited to taking the lead on management of aquatic organisms, although it is recognized that there is a strong inter-relationship between the aquatic and terrestrial habitats, and cooperative initiatives can be beneficial.

The City is currently involved in the management of invasive species, however, the approach is generally *ad hoc* and in reaction to immediate needs, or is opportunistic in response to specific requests or initiatives from stewardship groups. The main purpose of this Plan is to identify priority species and areas so that limited City resources can be used with the greatest effect.

2.0 CONSIDERATIONS FOR INVASIVE SPECIES MANAGMENT

Invasive species are prevalent within the City and as such require management in order to maintain and/or improve the ecological diversity and function of the City's ecosystems. Mechanisms that allow non-native invasive species to out-compete native species for resources and space include, but are not limited to:

- ability to rapidly colonize after disturbance
- absence of natural predators
- changes in limiting factors (e.g., climate, species competition)
- tolerance to changing environmental condition (e.g. drought)
- high reproductive rates
- easy dispersal by wind, water, wildlife, and humans
- ability to inhibit growth or establishment of other species by predation or the release of toxins (allelopathy)
- ability to kill native species (as in several forest pathogens), and
- hybridization (genetic contamination).

Increasing temperatures due to climate change has facilitated the spread of some invasive species that were otherwise unable to survive through the winter months. Changes in precipitation patterns may also contribute to the spread of invasive species. As native species which are adapted to our "normal" climate become stressed and extirpated from local habitats due to climate change, more tolerant invasive species may spread and dominate remnant natural sites.

In rare cases (so far), some native species may also take on the characteristics of invasive exotics when climate change (and other factors) allow their populations to increase "abnormally", for example Mountain Pine Beetle (*Dendroctonus ponderosae* Hopkins) in British Columbia and Alberta.

2.1 Prevention, Eradication, and Control

Prevention, eradication and control are the major approaches to managing non-native invasive species. Prevention is preferable, both economically and to prevent further degradation of natural areas and their native biodiversity, however, prevention is rarely possible owing to lack of knowledge of how species will behave when they establish (i.e., will they be invasive or not), and the inability

to control dispersion. For practical purposes, eradication is the next preferred option, followed by implementing a control program, if an eradication program is not feasible owing to the inability to completely remove species or because of constant re-introduction.

2.2 Education and Outreach

Part of any comprehensive invasive species management plan is the prevention of the spread of invasive species into natural areas. Some invasive species originate from adjacent lands, often as escaped horticultural plantings. Thus educating the community about the importance of native species, the potential impact of non-native invasive species, and how they can help to prevent the spread of invasive species is important. Similarly, it is often important to involve the community in the management of neighbouring natural areas as these communities then feel a sense of connection and appreciation for the natural areas and how they should be managed.

In terms of involving the public in invasive species management, there may be certain natural areas and invasive species which are suitable to be managed by the general public. Species that can be controlled through hand-pulling and are easily recognizable are generally most suitable for management with volunteers. However, with instruction provided by knowledgeable individuals, more involved eradication methods (e.g., levers for pulling small trees and shrubs) and more difficult to recognize species can also be tackled by volunteers. Safety is another aspect to consider with certain invasive species. Any invasive species which is a human health risk (e.g. Giant Hogweed, *Heracleum mantegazzianum*) is not appropriate for community management due to the high level of risk to their health. Also, any activities involving chemical control should be carried out by a licensed professional.

2.3 Taking a Comprehensive Approach

It is essential to the success of eradication and control programs that a comprehensive approach to invasive species management be taken. A comprehensive approach includes:

- proactive searches for invasive species,
- successive years of species removal and monitoring, and
- native plantings to replace invasive species.

Pro-active searches

The presence of invasive species in the City's natural areas is relatively well known as a result of many years of inventory associated with annual Natural Area Survey (NAS) updates. It is suggested that a map of the City's Significant Natural Areas be created that highlights those areas that support invasive species and that are a high priority for management.

Multiple Years of Management

Many species cannot be eradicated in a single management treatment because they will: 1) germinate out of the seed bank that has established while the species has been growing at the site; 2) sprout from roots not completely removed; and/or 3) re-establish from other locations. The first and second concerns will require that each area be monitored for a period of about five years following removal to undertake further treatment as required. The level of effort can be expected to diminish as the seed bank is exhausted and/or remnant root fragments are removed. The third concern will require long term monitoring which can be undertaken through the annual NAS updates.

Planting with Native Species

Restoration of sites where invasive species have been removed may not always be necessary, but in most cases will enhance biodiversity and could inhibit the re-establishment of invasive species. Where management involves the removal of trees in a woodland environment (for example with Norway Maple or Emerald Ash Borer), planting with native trees would be important as they are critical for maintaining the continuous forest canopy needed to sustain woodland plants and animals. Likewise, planting will be important if there is a large area of invasive species removed and limited opportunity for native plants to colonize spontaneously. However, in cases where invasive removal is localized and there is a healthy native plant assemblage present, it is recommended that re-colonization be allowed to occur naturally. Replanting should always be restricted

to species that occur at the site (or at least are typical of the City's Natural Areas) and should be procured from local seed sources (as opposed to being imported from the United States).

2.4 Integrating with other Programs

The program for controlling non-native species should be integrated with other City initiatives so it becomes part of a more comprehensive program for Natural Area management. Invasive species control, including species and control techniques, should be identified in the Conservation Plans for each of the high priority Significant Natural Areas. Control efforts can then be implemented with consideration for other management needs (such as trail creation/ maintenance/ closure, education programming, arboricultural prescriptions, restoration or enhancement) to achieve efficiencies.

Invasive species control should also be integrated with education and stewardship programs to highlight the importance of the issue and encourage volunteers to support control efforts.

2.5 Selecting an Appropriate Management Technique

Articulating the various techniques for management for specific species is beyond the scope of this document and since techniques are being refined on an ongoing basis, would soon be out of date. The CVC's Invasive Species Strategy (2009), Appendices 4 and 5, provide a discussion of various techniques and a summary of techniques for several of the priority species identified in this report. Also, the website for the Ontario Invasive Species Council (http://www.ontarioinvasiveplants.ca) provides comprehensive information on control techniques, as well as links to other publications and organizations. If it has not been done already, the City should consider membership on the Council.

3.0 FRAMEWORK FOR DETERMINING PRIORITIES

All areas within the City's Natural Heritage System (NHS) have some non-native invasive species present. In some cases their extent is minimal, and if the site is relatively large and in good condition (i.e., has little disturbance), the invasive species may not pose a huge threat. However, degradation from invasive plants is a substantial threat in a high proportion of areas in the NHS. Because of this, and the high cost to provide adequate invasive species management in all sites where it is a problem, sites and species must be prioritized for management such that **the most invasive species are managed in the areas where there is the potential for the greatest success.**

A key consideration in developing this framework is recognition of the relatively limited resources that can be devoted to invasive species management in comparison to the magnitude of the problem. For this reason, the following principles for establishing priority management are recommended:

1) That management focus on the species with the greatest potential to impact natural areas
2) That a few flagship Significant Natural Areas be targeted for thorough management (as opposed to doing a small amount in many Natural Areas)
3) That there be a focus on species that pose a potential threat to human health, and
4) Notwithstanding the preceding principles, the City be opportunistic and provide encouragement and assistance to community groups who wish to undertake management in particular areas.

Natural Areas that have the greatest ecological significance and provide the best opportunity for preserving high quality ecological structure and function in the long term should have the highest priority for management. Successful management is generally difficult to accomplish in smaller sites as they are influenced by the surrounding landscape to a larger degree. For example, focussing efforts in small isolated woodlands that are dominated by Common Buckthorn and Garlic Mustard may not be the best use of effort and funds as there is a high probability of invasive species re-introduction, and the potential quality of the site may not justify on-going management. Of course this may be different if the site provides some important function, such as habitat for a valued species. Another factor to consider is the willingness of community groups to work in their neighbourhood Natural Area.

3.1 Determination of Species for Management

To assist in setting priorities for species management, a list of invasive species and the degree of their invasiveness are provided in Appendices 1-3 of CVC's Invasive Species Strategy (2009). Appendix 1 addresses invasive plants and categorizes them based on their degree of threat. We recommend that all plant species listed in Categories 1 and 2 be candidates for management in the City. However, those two categories include 47 species, which is overwhelming in terms of management effort. To further prioritize which species should be

addressed first, those which are the perceived to be greatest threat to the best sites in Mississauga are identified below. This selection is based on years of experience evaluating Significant Natural Areas as part of annual NAS updates.

- Black Swallowort (*Cynanchum nigrum)*
- Common Buckthorn
- Dog-strangling vine (*Cynanchum rossicum*)
- Giant Hogweed
- Garlic Mustard
- Japanese Knotweed
- Non-native Honeysuckles (including: *Lonicera japonica, L. maakii, L. tatarica, L. x belli* and *L. xylosteum*)
- Purple Loostrife
- Common Reed (*Phragmites* sp.)

The City currently has a management methodology for Giant Hogweed. However, due to limited staff resources, it relies on City staff, consultants, and residents to report locations of the plant. To date, the management approach has been quite effective, however the management of this species could benefit from a more proactive approach that seeks to map the locations where this species occurs throughout the City. Other species are managed on a relatively *ad hoc* basis, largely in response to opportunities presented by volunteer groups.

Appendices 2 and 3 in the CVC report address aquatic species and forest pathogens. Emerald Ash Borer and Asian Long Horn Beetle are already, and should continue to be, identified as priorities for management. The management approach for Emerald Ash Borer is somewhat different from other species in that there is no completely effective control method for eradicating this lethal pest. The goal in the case of Emerald Ash Borer is to slow the inevitable mortality of ash trees such that all ash trees are not eliminated from the canopy at the same time. By extending the period over which mortality occurs, the cost of planting and establishing replacement canopy trees can be spread over several years and the impact of substantial canopy loss at one time can be mitigated. A small number of significant ash trees may be preserved indefinitely through repeated injections. This is the approach which has been approved in the City's current Emerald Ash Borer Management Plan (2012).

The only other priority invasive species recommended for management is domestic cat. Domestic cats kill millions of birds across North America each year and have a devastating effect on ground-nesting bird species. Management of this species will rely on education to inform pet-owners of the impact that free-roaming cats have on the environment. This should be supplemented by a cat control by-law. Although such by-laws are difficult to enforce, they do provide a mechanism for control and allow animal control officials and the humane society to respond to complaints and possibly be involved in control in "flagship" Significant Natural Areas.

3.2 Determination of Areas for Management

As noted above, initiatives for managing invasive species should focus on the natural areas that have the highest overall value within the Natural Heritage System, referred to here as "flagship" natural areas. Characteristics of flagship natural areas include:

- Excellent or good condition as provided in evaluations from annual NAS updates
- Designated as Significant Natural Area
- Presence of Provincially Threatened or Endangered species

- Environmental Significant Area (ESA), Area of Natural or Scientific Interest (ANSI), or Provincially Significant Wetland (PSW) designations
- High Floristic Quality Index (FQI), and
- Large size.

It is recommended that the FQI be used as a metric for determining the quality of an area as it integrates many of these characteristics. In Mississauga, Natural Areas with a high FQI tend to be large, have little disturbance, and are subsequently often designated as Significant Natural Areas and/or ESAs, ANSIs or PSWs.

One challenge with this approach is that many (if not most) of the flagship Natural Areas are, at least in part, on privately owned lands. The City should proceed with management on publically owned lands, and instigate landowner contact to explore opportunities for management on privately owned lands.
As outlined in the framework above, we recommend that the sites with the highest FQI scores be targeted as first priority for invasive species management. The Significant Natural Areas that are rated as having "High" quality (i.e., an FQI > 40) are listed at the end of this Appendix (**Table C-2**). Generally, priority for management should be according to FQI rank. However, **it is recommended that within this list of 40 Significant Natural Areas, the following sites, all of which have FQI scores of over 60, receive the highest priority for management**.

1. **Rattray Marsh (CL9)**
2. **Riverwood (CRR10)**
3. **Erindale (CRR6)**
4. **Cawthra Woods (LV7)**
5. **Loyalist Creek Hollow (CRR7)**
6. **Unnamed (CRR8)**
7. **Sawmill Valley Trail (EM4)**
8. **Tecumseh (CL24)**
9. **Whiteoaks (CL39)**

All of these sites have some publicly owned lands where the City should be able to implement control measures. The privately owned portions of these sites will need to involve land-owner contact programs. In the case of the two golf course sites, the site managers should be approached to see if invasive species control can be integrated into their management protocols. This would be especially beneficial if either site was seeking Audubon certification.

3.3 Target Plant Species Occurring in Priority Sites Significant Natural Areas

Table C-1 indicates which of the priority invasive plant species occur in each of the nine high priority Significant Natural Areas. This information is based on the NAS database and should be updated as inventory information is refined for each site through annual updates.

4.0 RECOMMENDATIONS

1. Continue dialogue and development of cooperative initiatives for invasive species management with the CVC.
2. Adopt the general principle of prioritizing management by addressing the invasive species that pose the greatest potential for impact to native vegetation, and which occur in the most valued natural areas in the Natural Heritage System (i.e., "flagship" natural areas").
3. Develop a landowner contact program to educate landowners about the potential threat posed by non-native species, including pets.
4. Identify safe and easily understood management techniques that can be implemented by volunteers.
5. Implement invasive species control for the priority species and areas identified (as identified in **Tables C-1** and **C-2**).

5.0 REFERENCES

Credit Valley Conservation. 2009. Invasive Species Strategy. Draft. 73 pp.

White, D.J., E. Haber and C. Keddy. 1993. Invasive plants of natural habitats in Canada. An integrated review of wetland and upland species and legislation governing their control. Prepared for the Canadian Wildlife Service and Environment Canada. Ottawa, Ontario. pp. 76-77.

Table C-1. Top Nine Priority Natural Areas for Invasive Species Management

	CL9 Rattray Marsh	CRR10 Riverwood	CRR6 Erindale	LV7 Cawthra Woods	CRR7 Loyalist Cr. Hollow	CRR8 unamed	EM4 Sawmill Valley Trail	CL24 Tecumseh	CL39 Whiteoaks
Black Swallowort		x	x	x	x		x	x	
Common Buckthorn	x	x	x	x	x	x	x	x	x
Giant Hogweed		x			x	x	x	x	
Garlic Mustard	x	x	x	x	x	x	x	x	x
Japanese Knotweed		x		x	x	x	x		x
Non-native Honeysuckles	x	x	x	x	x	x	x	x	x
Purple Loosestrife	x	x	x	x	x	x	x	x	x
Common Reed	x	x	x	x	x	x			x

*Non-native Honeysuckles include *Lonicera japonica*, *L. maakii*, *L. tatarica*, *L. x belli*, and *L. xylosteum*.

Table C-2. Natural Areas within the City of Mississauga's Natural Heritage System ranked as "High" with Floristic Quality Index (FQI) scores greater than 40 (listed in decreasing quality)

Natural Areas System	Native FQI
Rattray Marsh (CL9)	83.64
Riverwood (CRR10)	71.49
Erindale (CRR6)	70.79
Cawthra Woods (LV7)	66.71
Loyalist Creek Hollow (CRR7)	65.92
Not Yet Named (CRR8)	65.09
Sawmill Valley Trail (EM4)	63.67
Tecumseh (CL24)	61.86
Whiteoaks (CL39)	60.31
Fletcher's Flats (MV2)	58.33
Levis Valley (MV19)	57.42
Edward L. Scarlett & Red Oak Plan & Not To Be Named (ET03)	57.20
Willowvale Fields & Creditview Wetlands (EC13)	56.53
Meadowvale C.A. (CRR1)	55.97
Garnetwood (ET04)	55.73
Credit Meadows (CRR2)	52.61
Britannia Woods (H09)	52.40
Not Yet Named (GT4)	51.03
Birch Glen (CL21)	48.45
Jack Darling Park (CL16)	48.40
Not Yet Named (CRR11)	46.34
Erin Wood (CE10)	45.62
Mississauga Valley (MY1)	45.24
Mary Fix (MI17)	45.09
Turtle Glen (CL43)	44.18
Not Yet Named (NE4)	43.62
Totoredaca (MB6)	43.40
Richard Jones (CV12)	42.83
Not Yet Named (LV1)	42.61
Fairbirch (CL22)	42.24
Wildwood (NE9)	42.21
Not To Be Named (CV2)	42.15
Credit River Flats (MI7)	42.00
Not Yet Named (SD1)	41.92
Not Yet Named (MV12)	41.83
Bishopstoke Walk (CC1)	41.15
Not Yet Named (SP3)	41.02
Orchard Heights (ET08)	40.80
Not Yet Named (SP1)	40.53

APPENDIX D
GUIDANCE FOR NATURAL AREAS CONSERVATION MANAGEMENT PLANS

The purpose of the Conservation Management Plans is to provide guidance for management activities and a record of what actions were taken, when and by whom. Other information, such as the number and type of vegetation communities that occur, species richness, etc. is all available on the Fact Sheets completed for each area as well as the NAS database and need not be repeated here. The Conservation Management Plans are intended to compliment the NAS Fact Sheets and Database and vice versa. Conservation Management Plans should be reviewed prior to annual updates so that management actions can be evaluated. Fact Sheets and the database should be readily available to managers and supervisors who should review them when determining and planning management prescriptions.

It is assumed that the management protocols for various issues are documented elsewhere. For example, the protocols for removing Giant Hogweed and trees infected by Emerald Ash Borer are established, and they do not need to be repeated in each Conservation Management Plan. Protocols for common issues (e.g., closing trails, addressing encroachment, etc.) should be formalized, if not done already. Some sites may have unique management issues, in which case the protocol for addressing it could be provided in more detail in the related Conservation Management Plan.

It is recommended that a Conservation Management Plan template be created following internal discussion of the suggested contents, so that they are all organized the same way and contain the same information, thus promoting ease of use. The final format, content and configuration of these plans will depend on internal considerations and should be tailored to work well with current operation practices.

It is proposed that the Conservation Management Plans be treated as living files that are updated an modified as management is undertaken, as new issues are identified, and in response to new techniques and approaches to management.

Suggested Table of Contents

Name and Designation of Area: e.g. Riverwood, CRR10, Significant Natural Area

Map of Area: map(s) should show:

- boundaries
- ownership
- Conservation Authority regulated areas and owned lands
- abutting land uses
- vegetation communities (as per the Ecological Land Classification system)
- location of noxious and/or significant species
- trails (if known) including unsanctioned trails
- water features (wetlands and watercourses)
- location of management need (e.g., approximate extent of invasive species, location of unsanctioned trail to be removed, etc.)

Ownership
List names and contact information of lands in private ownership

Community Groups and Other Agencies
List any relevant community groups (e.g., Friends of …) or agencies (e.g., CVC) that may wish to be informed, or be involved with management activities.

History of Past Management (if any)
Provide a brief summary of any management that has been undertaken in the past.

Issues to be Aware of When undertaking Management

- Presence of Noxious Plants:
  - Names:
  - Locations (mapped where possible; if widespread, then note "throughout"):
- Presence of Significant Species (plants and/or animals) – in particular Species-at-Risk:
  - Names:
  - Locations (mapped where possible):
- Presence of Candidate Significant Wildlife Habitat
- Water features (e.g., wetland, seeps, watercourse etc.)
- Gas pipelines or other utilities

Checklist of Management Issues (note occurrence and priority from annual updates)
We suggest that the priority for management could be established as part of annual updates. However, they could also be undertaken or updated by Community Services. Rather than establishing criteria for "high", "medium", or "low" priorities, it is suggested that the issues at each site be ranked, so that the most urgent criteria in a particular area gets top priority. The urgency of management may vary from one site to another (e.g., unsanctioned bike trails may be most critical at one site and removal of garlic mustard most critical at another). The annual update field sheets should be modified to reflect the final checklist of issues, so information can be easily transferred from annual updates to the Conservation Management Plans.

☐ Invasive species
☐ Noxious species (e.g., Giant Hogweed)
☐ Forest management (e.g., potential hazard trees)
☐ EAB or other forest pathogens
☐ Excessive windthrow
☐ Trail management (e.g. maintaining safe trails, removal of unsanctioned trails)
☐ Management of inappropriate activities (e.g., forts, BMX/mountain bike use, motorized vehicle use, campfires, dumping of refuse, illicit cutting or plant removal)
☐ Vandalism (e.g.. tree-carving, urban graffiti, arson (fire))
☐ Encroachment

- ☐ Naturalization, enhancement and/or restoration opportunities (including riparian areas of watercourses, creation of amphibian habitat, expansion of future forested areas)
- ☐ Management of soil erosion and/or compaction (including bank stabilization, trail misuse)
- ☐ Special Concerns (e.g., endangered/threatened species management, unique/rare species or communities, fish habitat management)
- ☐ Educational opportunities
- ☐ Stewardship opportunities

Summary of Management Issues and Record of Management (fictitious examples provided)

MANAGEMENT ACTIVITY	**DATE**	**LOCATION**	**PARTICPANTS** (note staff, other agency or volunteer)	**COMMENTS** (including new management considerations)
Giant Hogweed removal per city protocol	July 15, 2015	East bank of Credit River, south of Chappell Cr. – see sketch	J. Day (City staff)	Completed extent of patch s. of Chappell Cr, additional plants north of Chappell Cr. still need to be treated
Continuation of Giant Hogweed control	July 20, 2015	East bank of Credit R., north of Chappell Cr. – see sketch	J. Day (city staff) D. Smith (CVC)	Area north of Chappell Cr. Completed
Trail Removal	August 15	See sketch	J. Day (city staff)	Trail blocked off with brush and replanted, signage erected
Restoration of meadow				Area planted up with native species – see appended list.

Additional Notes

Space should be provided to allow recording any observations made by field crews or others (e.g., volunteers, citizen groups, etc.).

APPENDIX E
OVERVIEW OF STEWARDSHIP OPPORTUNITIES IN MISSISSAUGA

Program Name	Program Sponsor(s)	Target Group(s)	Target Land Ownership	Brief Program Description	Associated Resources	Contact / More Information
One Million Trees Program	City of Mississauga with CVC, TRCA, Evergreen and Credit River Anglers Association	ALL	ALL	Umbrella program designed to engage a wide range of individuals, businesses, schools, homeowners or community groups in Mississauga in the planting of and care for trees. The target is to plant 1 million trees between 2012 and 2032.	Website providing links to all available programs providing technical and resource support for tree planting and maintenance, as well as on-line resources	Call 3-1-1, or 905-615-4311 if outside city limits http://onemilliontrees.ca
Partners in Project Green (PPG)	Toronto Pearson with CVC, TRCA, Region of Peel, City of Mississauga, City of Brampton	Businesses around the Pearson Airport	Corporate lands around the Pearson Airport	Promotes a wide range of sustainable businesses practices in support of the Pearson Eco-zone. Includes a corporate tree planting program that engages company staff.	• Website • Access to various Eco-zone resources and networking • Recognition on project website	admin@partnersinprojectgreen.com http://partnersinprojectgreen.com
Greening Corporate Grounds	CVC with TRCA, Evergreen	Businesses and institutions in the CVC and TRCA watersheds	Corporate and institutional properties in the Region of Peel	Experts work with participants on landscaping and storm water management projects on the company's grounds. Program includes provision various resources and technical support. Participants are also recognized on CVC's website, get a sign, and are eligible for awards.	Support includes: • Site concept plan • Technical advice • Assistance with planting / maintenance events • Workshops & presentations and educational resources • Program recognition (sign, web listings and eligibility for awards)	Deborah Kenley Greening Corporate Grounds Program Coordinator, Credit Valley Conservation phone: (905) 670-1615 ext. 439 email: dkenley@creditvalleyca.ca http://www.creditvalleyca.ca/your-land-water/green-cities/greening-corporate-grounds/
CVC Private Landowner Invasive Plant Removal Services	CVC	Landowners	Private	A program to provide technical and resource assistance to private landowners to help manage invasive species on their property.	CVC's Invasive Plant Removal Services includes: • Site assessment of your invasive plant problem • Development of your Invasive	Zoltan Kovacs Forester zkovacs@creditvalleyca.ca 905-838-1832

					Plant Removal Plan • Invasive plant, tree, and shrub removal using an Integrated Pest Management approach • Replanting or restoration of the site	
CVC Private Landowners Aquatic Planting Program	CVC	Landowners with pond or wetland with 6 – 13 meters square of planting area	Private	Low cost aquatic planting service providing on-site consultation, preparation of planting plans, choice of four aquatic plant species and installation.	• On-site consultation • Preparation of planting plans • Choice of four aquatic plant species • Installation	Paul Biscaia Restoration Technician pbiscaia@creditvalleyca.ca 905-670-1615 ext. 427
CVC Aquatic Restoration Services	CVC	Landowners	All	CVC has knowledgeable staff that can provide a free consultation on wetlands, streams, ponds or dams and assess opportunities for projects that benefit the natural environment.	• Stream rehabilitation • Wetland creation and rehabilitation • Making dams more fish and environmentally friendly • Pond management • Buffer plantings • Invasive aquatic plant management	Kate Hayes Manager, Ecological Restoration khayes@creditvalleyca.ca 905-670-1615 ext. 428
Caring for the Credit Corporate Volunteering Program	CVC	Businesses in the CVC watershed	Public parks, natural and open space areas in the CVC watershed	CVC works with local businesses to organize a "greening" event on public lands as part of a volunteer, team building activity. Participants have included the Co-operators, Enersource, UPS and Samsung.	• Coordination of the event • Native plant materials • Tree planting guidance	Annabel Krupp Program Coordinator – Volunteers 905-670-1615 x446 akrupp@creditvalleyca.ca http://www.creditvalleyca.ca/learn-and-get-involved/volunteer/corporate-volunteering/
Volunteer Tree Planting Program	City of Mississauga with Evergreen, CVC, TRCA	All	Public parks, natural and open space areas in Mississauga	The City organizes various tree planting and maintenance events in the spring and fall (listed on the City's website). Registration is required.	• Coordination of the event • Native trees • Tree planting guidance	Call 3-1-1, or 905-615-4311 if outside city limits http://www.mississauga.ca/portal/residents/urbanforestry
Credit River Watershed Volunteer Tree Planting	CVC	Groups in the Credit River	Public parks, natural and open space	A range of events such as tree planting and invasive species management work days in the	• All events are free	Annabel Krupp Program Coordinator – Volunteers 905-670-1615 x446 akrupp@creditvalleyca.ca

Program		watershed	in the Credit River watershed	Credit River watershed.		http://www.creditvalleyca.ca/ volunteering/
Grow Your Green Yard Program	CVC	Residents in urban areas of the CVC watershed	Residential properties in the CVC watershed	CVC provides workshops and planting assistance to residents in Mississauga and elsewhere in the CVC watershed. A planting program for urban neighbours. Specialists provide advice on planting plans and materials; discounts on plant materials, free delivery of up to 80 plants, maintenance instruction.	• Free Native Plants (one per participant) • Fact Sheets • Native Woodland Gardens for Homes Guide	Sara Maedel, Urban Outreach Assistant Program Coordinator Sara.maedel@creditvalleyca.ca www.creditvalleyca.ca/gygy http://www.creditvalleyca.ca/your-land-water/green-cities/your-green-yard/
Healthy Yards Program	TRCA	Residents in urban areas of the TRCA watershed	Residential properties in the TRCA watershed	Provides workshops and planting assistance to residents in Mississauga and elsewhere in the TRCA watershed	• Website resources • Free workshops • Demonstration gardens	http://www.trca.on.ca/yards/
Conservation Youth Corps	CVC	Youth in the CVC watershed	Public parks, natural and open space areas in the CVC watershed	Provides learning and volunteer opportunities in environmental stewardship and conservation for youth through week-long work terms and field trip opportunities.	• Bus to and from site for conservation work terms, plus any related equipment or tools	http://www.creditvalleyca.ca/cyc/
Private Landowner Reforestation / Naturalization Program	CVC	Larger landowners in the CVC watershed	Larger private properties in the CVC watershed	Provides a planting plan as well as the planting of seedlings for properties of at least 2 acres that can accommodate at least 1500 seedlings. The majority of reforestation projects are eligible for the Provincial Managed Forest Tax Incentive Program (MFTIP) utilized by landowners to reduce property taxes.	• bare root seedlings • free site visit • technical support • customized planting plan • delivery and installation of plant stock	Brain Boyd creditvalleyca.ca/forestry forestry@creditvalleyca.ca http://www.creditvalleyca.ca/your-land-water/countryside-living/your-trees-and-forests/cvc-tree-planting-programs/reforestation-planting-program/
CVC Private Landowner Aquatic Planting	CVC	Landowners with ponds and/or	Private lands with ponds	Provides a planting plan, aquatic plants, and installation of plants. Must have a pond or wetland with 6 – 13 metres	• Access to four aquatic plant species • Free site visit • Technical support • Delivery and installation	Paul Biscaia Restoration Technician pbiscaia@creditvalleyca.ca creditvalleyca.ca/aquaticplanting

Program		wetlands		squared of planting area. Minimum of 50 plants per order.	included	
CVC Multi-cultural Outreach Program	CVC	New Canadians		Education Program (contact Andrew for more detail)	• Various	Andrew Kett, Manger, Education akett@creditvalleyca.ca creditvalleyca.ca/education
Etobicoke & Mimico Creeks Watersheds Volunteer Plantings	TRCA	Individuals and groups in the TRCA watershed	Public parks, natural and open space areas in the TRCA watershed	A range of events (e.g., presentations, workshops, plays, invasive species management) and planting opportunities in the Etobicoke and Mimico Creeks Watersheds.	• All events are free	http://trca.on.ca/the-living-city/watersheds/etobicoke-mimico-creek/index.dot
Credit River Anglers Conservation Works	Credit River Anglers Association (CRAA)	Members of CRAA and volunteers	Lands adjacent to the Credit River	Works over the past two decades have included reforestation in the river's riparian areas as well as other forms of riparian area stabilization with funding from the Ontario Trillium Fund, EcoAction, City of Mississauga, and OMNR.	• seedlings • labour • acknowledgement sign	info@craa.on.ca http://www.craa.on.ca/fishing_craateam.shtml
School Greening	CVC	Youth in the CVC watershed	School grounds in the CVC watershed	CVC will assist schools with naturalizing school grounds if the school arranges the appropriate permissions and develops a plan. CVC will also work with one school every year to create a landscape plan for their school grounds.	• coordination of planting event • possible provision of some seedlings • landscape plan (for one school per year)	(905) 670-1615 or 1-800-668-5557 Fax: (905) 670-2210 education@creditvalleyca.ca
Watershed on Wheels	TRCA with CVC	Youth in TRCA and CVC watersheds	N/A	Provision of half-day programs designed to meet the grades 1 to 8 Ontario Science and Technology Curriculum expectations.	• Website with resources for teachers • Half-day school programs • Training for teachers	http://www.trca.on.ca/school-programs/facilities-and-programs/watershed-on-wheels/
School Grounds Greening	Evergreen	Youth	Schools across Canada	Provision of funding, consultant expertise and workshops to support greening of school grounds.	• Funding of $500 to $3500 • Resources for teachers (e.g., Native Plant Database) • Training for teachers	http://www.evergreen.ca/en/programs/schools/index.sn
Planting for	ACER (Association	Youth /	Schools	ACER helps classes create a schoolyard planting site that acts as	• Technical support and guidance / training	Alice Casselman Unit 44, 3665 Flamewood Drive

Change (P4C)	for Canadian Educational Resources)	students		a mini-climate change outdoor classroom/lab that serves as an easily accessible teaching tool to complement curriculum relating to climate change.	• Supervision of plantings • Data collection, analysis and reporting	Mississauga, Ontario L4Y 3P5 T: (905) 275-7685 F: (905) 275-9420 alice.casselman@acer-acre.ca
Youth Stewardship Program	ACER (Association for Canadian Educational Resources)	Youth / students	Public natural areas	The goals for the project are to train students to remove invasive species in a selected area, to carry out a base line inventory of remaining native trees and to lead a community restoration planting. The area chosen has native trees that could thrive with reduced competition.	• Coordination of work done, as well as partners • Training for youth workers	Alice Casselman Unit 44, 3665 Flamewood Drive Mississauga, Ontario L4Y 3P5 T: (905) 275-7685 F: (905) 275-9420 alice.casselman@acer-acre.ca
Riverwood Conservancy	City of Mississauga	Individuals and groups in the Mississauga watershed	Public	Not a formal program but organized volunteer planting and maintenance in the Riverwood area (e.g., Rattray Marsh)	N/A	
Sierra Club Ontario	City of Mississauga / CVC	Individuals and groups in the Mississauga watershed	Public	Do volunteer recruitment for tree plantings on City property coordinated by CVC	N/A	