City of Brampton

Urban Forest Management Plan (2022-2032)

About Brampton's Urban Forest Management Plan (UFMP)

FINAL

Prepared by:

Urban Forest Innovations Inc.
Beacon Environmental Ltd.
A. Kennedy Consulting Ltd.

Contents

Explanatory note: This document includes multiple references to Brampton as both a corporate entity (i.e., Brampton's government, administrative structure, staff and assets) and a geographic entity (i.e., lands within the geographic boundary of Brampton). These references may be distinguished by the use of the capitalized word "City", which denotes the corporate entity, and the lower-case word "city", which denotes the geographic entity.

About Brampton's Urban Forest Management Plan

The City of Brampton Urban Forest Management Plan (UFMP) outlines a strategy for the management of the urban forest in the city of Brampton, Ontario, over the next ten years (2022-2032).

Brampton's urban forest

Brampton's urban forest includes all trees and tree growing environments situated on public lands (such as parks and streetscapes) and private lands (such as residential or commercial properties) within the municipal boundaries of the city of Brampton.

Brampton's urban forest provides the city's residents and businesses with valuable environmental economic, and societal and health services–it is a vital community green infrastructure asset. This UFMP was developed to help the City and its partners in urban forest management respond to the many challenges that face the urban forest today and in the future, and to ensure that these important services are sustained and enhanced for future generations of Bramptonians.

Purpose

Brampton's UFMP is a comprehensive strategy to guide the management of the city's urban forest over the next 10 years. The UFMP guides urban forest policy and program development and implementation, resourcing, and priority-setting. It will help to ensure that decisions about the urban forest reflect the needs and values of the community, are based on a strong technical and scientific foundation, consider innovative and best practices, and are supported by adequate resources.

The strategies outlined in the UFMP address both the City-owned and privately managed portions of the urban forest and apply to both established communities and lands planned for future development. Therefore, while UFMP is primarily intended for use by City of Brampton staff, it can also serve as a technical and strategic resource and reference document for Council members, other governmental agencies, non-governmental organizations, private landowners, and any other members of the City of Brampton community who manage or make decisions related to any parts of the urban forest.

UFMP components

Brampton's UFMP consists of three parts, including:

1. **Background Review and Analysis report:** This component of the UFMP reviews the current status of Brampton's urban forest and approaches to its management. This review includes an assessment of gaps in current approaches; strengths, weaknesses, opportunities, and threats (SWOT); and strategic needs to be addressed through urban forest management. It is intended to serve as a foundation for the strategic and implementation elements of the UFMP. In relation to the urban forest and its management, this part of the UFMP answers the question, ***"Where is Brampton now?"***

2. **Strategic Framework:** The Strategic Framework of Brampton's UFMP outlines:

    - a long-term vision for Brampton's urban forest
    - a mission statement and guiding principles to inform urban forest management
    - strategic goals, objectives, and targets to be pursued during the planning horizon, and
    - guidance for monitoring the urban forest and applying adaptive management principles to urban forest management.

    In relation to the urban forest and its management, this component of the UFMP answers the question, ***"Where does Brampton need to be?"***

3. **Implementation Plan:** This component of the UFMP details the actions that will need to be undertaken by the City of Brampton and its urban forest partners to realize the vision for the city's urban forest. It provides detailed implementation guidance for 36 recommended action items that, if implemented, will lead to the successful realization of the urban forest vision. In relation to the urban forest and its management, this component of the UFMP answers the question, ***"How will Brampton get there?"***

UFMP focus areas

The Background Review and Analysis, Strategic Framework, and Implementation Plan components of the City of Brampton UFMP are structured around five urban forestry *focus areas*. The five UFMP focus areas include:

- **Brampton's urban forest:** which addresses the urban forest as a biological system, and the collection, management and usage of data and information about the urban forest.
- **Maintaining Brampton's urban forest:** which addresses urban forest maintenance operations,

- **Growing Brampton's urban forest:** which addresses tree establishment programs and practices,
- **Planning and Brampton's urban forest:** which addresses planning policies and practices, particularly in relation to protecting existing trees, and
- **Engagement and partnerships in Brampton's urban forest:** which addresses existing and potential partnerships and programs to engage the community through awareness and stewardship of the urban forest.

These focus areas correspond to the five strategic goals of the UFMP and their associated objectives and action items, which are outlined in the Strategic Framework and the Implementation Plan.

City of Brampton

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Background review and analysis

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1 Brampton's urban forest

1.1 The City of Brampton

Incorporated as a village in 1853, the City of Brampton is now Ontario's fourth-largest city by population. The administrative centre of Peel Region, Brampton is a fast-growing and culturally diverse municipality, and is projected to be home to nearly 812,000 residents by 2031 (up from some 594,000 in 2016).

Though much of Brampton is heavily urbanized, the city's landscape remains strongly influenced by the watercourse corridors of the Credit River, Etobicoke Creek, Mimico Creek, and the Humber River. Much of the city's remnant natural forest cover is found in these valleylands, which link the city with the Oak Ridges Moraine to the north and Lake Ontario to the south. Brampton straddles two significant physiographic regions – the clay soil-dominated Peel Plan in the southern and eastern parts of the city, and the variable but predominantly clay-loam soil South Slope region in much of the city's northern half.

People have inhabited the area that is now Brampton for millennia; archaeological evidence of camps and villages along the Credit and Humber Rivers dates from about 8000 B.C. The area has long been the home of Anishnabewaki, Attiwonderonk (Neutral), Haudenosaunee, Mississauga, and Huron-Wendat peoples. In early 1800s, the first large influx of Europeans settled in Brampton and, over time, much of the area's forest cover was cleared for agriculture and settlement. By the 1950s, automobile-dependent development shaped Brampton into "Canada's first satellite city" (City of Brampton, 2013). The suburban character of development has largely continued through to the present day, albeit with increasing recognition of the need for more compact and higher-density pedestrian- and transit-supportive development in both new and infill neighbourhoods.

Brampton - at a glance

Key statistics
Population (2016): 593,638
Population (2031, proj.): 811,990
Population (2041, proj.): 889,920
Land area: 266.36 km^2
Key industry sectors: corporate headquarters, automobile manufacturing, advanced manufacturing, food and beverage, health and life sciences, innovation and technology

Biophysical context
Canada plant hardiness zone: 6a
Forest regions: Deciduous (Carolinian) and Great Lakes-St. Lawrence
Ecozone: Mixedwood Plains
Ecoregion: 6E - Lake Simcoe-Rideau and 7E - Lake Erie-Lake Ontario
Urban forest canopy: 18% (4,902 ha), 2015 data
Leaf area: 145.2 km^2, 2008 data
Leaf Area Density: 0.54, 2008 data

Throughout Brampton's development history, trees have played an important role in shading and beautifying neighbourhoods and commercial districts. More recently, the vital role of the urban forest as municipal green infrastructure has gained increasing recognition, and awareness is growing about the valuable environmental, economic, and societal and health services provided by trees. As Brampton continues to grow and develop in both greenfield and built-up areas, these services will only become increasingly important for the city's residents and businesses. Fulfilling many of the key elements of Brampton's 2040 Vision – Living the Mosaic, will therefore require a concerted and strategic effort to maintain, protect, and enhance the city's urban forest, and to engage residents and other stakeholders in its stewardship.

1.2 Defining the urban forest

Section 4.6.8 of Brampton's Official Plan (2006) defines the urban forest as:

"the mix of the remnants of native forest cover and planted trees and vegetation on all private and public lands in and around the built-up areas."

This Urban Forest Management Plan (UFMP) uses the same definition, with a specific focus on trees as the primary vegetation type that comprises the urban forest. For the purposes of Brampton's UFMP, the urban forest can be understood as all trees and their growing environments within Brampton's municipal boundaries.

Trees in the urban forest are owned and managed by both public agencies (including the City of Brampton, other levels of government, and Conservation Authorities) and by private landowners such as residents, businesses and institutions.

Examples of the public component of the urban forest include, among others:

- **Street trees:** trees in boulevards, medians, planters, and tree pits, and trees in the municipal right-of-way portion of front and side yards and laneways,
- **Park trees:** trees in all municipal parks, including trees in actively managed (e.g., mowed) park areas, along park edges, in park open spaces and natural areas, and at City sports and recreation facilities,
- **Facility trees:** trees on other City-owned and managed properties, such as the landscape areas of administrative buildings or operations facilities,
- **Woodlands:** trees in wooded natural areas, which may be owned and/or managed separately or jointly by the City, Peel Region, Credit Valley Conservation Authority (CVC), or Toronto and Region Conservation Authority (TRCA).

The private component of the urban forest includes individual trees on private residential properties or commercial and institutional lands, and trees in privately-owned woodlands and other natural areas.

1.3 Defining urban forest management

Urban forest management, or urban forestry, has been defined in various ways. The term was coined in the 1960s by Erik Jorgensen, commonly regarded as Canada's first urban forester. According to his definition, urban forestry:

"… is a specialized branch of forestry and has as its objectives the cultivation and management of trees for their present and potential contribution to the physiological, sociological and economic well-being of urban society. These contributions include the over-all ameliorating effect of trees on their environment, as well as their recreational and general amenity value."

Urban forestry is synonymous with terms such as urban forest management and community forestry. It embraces the management of trees and associated biotic (living) and abiotic (non-living) components in large and small communities alike. Most contemporary definitions of urban forestry acknowledge the importance of maintaining and enhancing the functional capacity of the urban forest to provide valuable environmental, economic, and societal and health services and benefits to communities.

Urban forest management entails multiple separate but interrelated management activities and is typically undertaken and influenced by a multitude of actors and stakeholders. In most Canadian municipalities, the municipal government is the owner and manager of the largest single share of the urban forest resource and is the primary driver behind policies and practices that shape the urban forest and its management. However, other stakeholders such as community residents, advocacy and interest groups, local businesses and institutions, and different levels of government, also manage and influence significant parts of the urban forest. Collectively these actors usually influence a greater proportion of a community's urban forest than the municipal government.

Core components of municipal urban forest management programs typically include:

- **Urban forest inventory and assessment:** municipalities may collect data through urban forest studies and/or tree inventories to inform planning and management.
- **Tree maintenance and risk management:** maintaining publicly owned trees in a reasonably safe and healthy condition is a minimum obligation for virtually any treed municipality.
- **Tree establishment:** municipalities may plant trees to replace dead and removed trees, maintain or increase urban forest canopy cover, and afforest (naturalize) suitable areas.
- **Pest/disease management:** municipalities may implement monitoring and control measures to protect trees against pests and diseases that threaten the urban forest.
- **Development planning:** municipalities may use land use and development planning as a tool to protect, replace and enhance the urban forest.

- **Natural areas/invasive species management:** municipalities may manage natural areas for ecological and other services and may prevent or control the establishment and spread of invasive plants and other species that may compromise the provision of those services.

- **Community engagement:** municipalities may deliver educational programs to promote awareness of the value of the urban forest and the importance of urban forest protection, and to encourage urban forest stewardship on private property. They may also facilitate community engagement through urban forest stewardship programs on public lands.

- **Resource and contract management:** municipalities must allocate and manage financial and human resources to various urban forest management activities, and typically also manage the provision of contracted urban forestry services.

- **Regulation and enforcement:** municipalities may, through policies, by-laws or other legislative or regulatory tools, regulate and enforce aspects of the urban forest and its management on public and/or private lands.

1.4 Brampton's urban forest

As defined in this plan, Brampton's urban forest includes all trees and tree growing environments situated on public and private lands within the boundaries of the City of Brampton.

Knowledge about the structure and function of the urban forest is necessary to develop an understanding of the value of urban forest services, to inform strategic target setting for various urban forest metrics, and to conduct daily urban forestry operations. An understanding of the urban forest as a biological system also underpins near- to long-term urban forest management strategies with a view to achieving the City's vision for both its urban forest and other strategic initiatives.

1.4.1 Urban forest data and monitoring

1.4.1.1 Data and information sources

Currently, information about the structure and function of Brampton's urban forest is relatively limited or dated. Available data sources and analyses about the structure and function of Brampton's urban forest include:

- **Tree inventory**: Action L12.7 of Brampton's Grow Green Environmental Master Plan (2014) recommends that the City "undertake and maintain an inventory of all street and park trees." Brampton is currently undertaking tree inventory data collection for an estimated 250,000 to 300,000 City-owned and intensively (i.e., individually) managed trees. The tree inventory project is partially completed, and the City ultimately plans to inventory all City-managed street trees, trees in actively managed park areas, and some trees in valley lands and woodlands. Preliminary tree inventory data are not publicly available.

Best practices - Detailed tree inventory attributes

Many municipalities have collected comprehensive inventories of their actively managed trees, which include attributes such as detailed condition ratings, standardized tree risk assessment ratings, and priority-based tree maintenance recommendations. Examples include Cambridge, ON; Charlottetown, PEI; Mississauga, ON; New Tecumseth, ON; Regina, SK, and Windsor, ON.

Best practices – Citizen science for tree inventory and neighbourhood-level planning

There is increasing recognition of the potential value of public participation in urban forest inventory data collection. This is known as citizen science or, if integrated with mapping, public participatory GIS (PPGIS) or volunteered geographic information (VGI). Potential citizen science opportunities include inventory of privately-owned trees, invasive species mapping, pest and disease identification, and others. Data can be submitted directly through municipality's web mapping applications or through third-party hosts such as ArcGIS Survey123, OpenTreeMap, Tree Plotter, or EDDMapS (for invasive species).

Community associations and residents can also be engaged in neighbourhood-based urban forest planning and management through tree inventories and urban forest plans. Tree inventories should include a minimum one-half day training session for participants, apply a recognized protocol, and be compatible with the municipality's tree inventory system. The small Ontario towns of Elora and Mitchell have successfully used the *NeighbourWoods* volunteer tree training and inventory protocol to collect their municipal tree inventories. In Edmonton, residents can contribute urban forest data through the yegTreeMap database. Due to potential data quality issues, a volunteer-based urban forest inventory should be seen primarily as an engagement tool and its management utility should be a secondary function, subject to field verification by trained staff or contractors. It should not be used as a substitute for an appropriate tree risk management program.

- **Brampton Natural Areas Inventory (BNAI):** Commencing in 2007, Brampton partnered with the Credit Valley Conservation Authority (CVC), the Toronto and Region Conservation Authority (TRCA) and others to initiate the Brampton Natural Areas Inventory (BNAI) - a part of the CVC's broader Credit River Watershed and Region of Peel Natural Areas Inventory (CR-Peel NAI) project. The BNAI is intended to provide coverage of the City's natural and regenerating communities, and incorporates both field-collected data and information from ecological studies prepared for land use plans (e.g., Secondary or Block plans) and development applications. The latest BNAI summary report was prepared in 2013, although the City continues to work with CVC to identify and inventory priority sites, including areas that have already been subject to ecological restoration.

- **Natural Heritage System mapping:** In 2014, the City completed mapping of the Brampton Natural Heritage System (NHS) to support the development of the City's Natural Heritage and Environmental Management Strategy (NHEMS). The NHS

mapping project combined Conservation Authority data, updated aerial photography, Secondary Plan and Block Plan data, and additional data sources to develop a comprehensive map of natural heritage features in Brampton. NHS mapping supports the planning process in realizing Official Plan policies related to the City's Natural Heritage Features and Areas, and will inform future updates to the City's Official Plan and other policies in relation to Brampton's Natural Heritage System.

- **Canopy cover assessment:** In 2017, a consultant for Peel Region completed an analysis of 2015 geospatial data to determine various land cover metrics, including existing urban tree canopy, potential planting areas, and others. This study also estimated the value of ecosystem services provided by the urban forest on an annual basis.

- **Urban forest study:** In 2008, the Region of Peel, in partnership with CVC, TRCA, and member municipalities, undertook a comprehensive study of urban forest distribution, structure and function based on the i-Tree Eco assessment methodology and analysis model. Findings outlined in the study's 2011 technical report include quantified metrics of tree cover and leaf area (including by land use), tree size, tree species, urban forest structural value, carbon storage and sequestration, air pollution removal, residential energy savings, and hydrologic effects.

- **Region of Peel Tree Planting Prioritization Tool (TPPT):** In 2013, the Region of Peel and partners undertook the development of a GIS-based mapping tool to identify and prioritize areas within Peel's urban areas for tree planting to enhance the provision of urban forest benefits. The tool is based on 2007 urban tree canopy mapping for Peel, and identifies plantable space which includes areas of soil or vegetation and without tree cover, and excludes areas of paved surfaces or buildings. The project included the development of a user-editable area prioritization tool and a priority areas mapbook.

Key findings about the structure and function of Brampton's urban forest based on some of the above-referenced sources of information are outlined below.

1.4.1.2 Monitoring

Multiple characteristics of the urban forest and its management can and should be routinely monitored. The primary purposes of monitoring are to maintain situational awareness, inform day-to-day operations and strategic planning, and facilitate active adaptive management.

Urban forest monitoring tools and approaches undertaken in Brampton to date have included:

- 2010 and 2015 Urban Tree Canopy analyses
- 2011 Urban Forest Study (TRCA, 2011)
- Brampton Natural Areas Inventory (BNAI) program
- Street tree inventory (in development)
- Urban Forest: Tree Canopy metric (reports annual number of trees planted by the City via City Tree Tracker tool, data dashboard/GeoHub portal)
- 2017 *Measuring and Monitoring Report* for Region of Peel Official Plan (City in collaboration with Region of Peel as lead, reporting on Greenlands System, habitat restoration and urban tree canopy)
- Project-based monitoring and reporting (e.g., EAB management capital program, invasive species management)

Prior to the development of Brampton's Natural Heritage and Environmental Management Strategy Implementation Action Plan (NHEMS, 2015), environmental monitoring in Brampton was not coordinated or guided by a strategic framework. The NHEMS outlines a framework for tracking and monitoring the City's environmental features and management that encourages integration between the NHEMS and Environmental Master Plan (EMP) and requires, among other actions:

- Collection of baseline data and confirming/developing targets
- Clarifying departmental monitoring responsibilities
- Identifying staff and budget requirements on an annual basis
- Establishing data collection, analysis, and reporting protocols
- Annual and 5-year performance reporting

Although these actions are specified in relation to the City's broader Natural Heritage System, they are also directly applicable to urban forest monitoring. Despite this guiding framework, Brampton's efforts at urban forest monitoring outside of the Natural Heritage System remain generally incomplete, *ad hoc*, sporadic, and uncoordinated. As such, elements of the NHEMS monitoring framework should be integrated into the City's urban forest monitoring framework through the Urban Forest Management Plan.

The City's Natural Heritage System Restoration Plan (NHSRP) also provides guidance for some aspects of urban forest monitoring in Brampton. The Plan identifies the need to coordinate with NHEMS and EMP monitoring frameworks to assess three NHSRP-specific metrics, including reduction in moving, naturalization of parkland, and biodiversity restoration and enhancement. Performance will be tracked over time as the NHSRP continues to be implemented.

Best practices - Urban forest monitoring

Mississauga manages over 130 woodland areas. The City has implemented a Woodland Report Card (WRC) system to consistently organize, manage and display woodland data through an interactive online map and database. WRCs assist with developing and implementing Conservation Management Plans for City-owned woodlands, monitoring the state of the woodlands, and educating various stakeholder groups.

Richmond Hill has developed a restoration monitoring protocol for Community Stewardship Program and other Town-funded and partner-delivered restoration projects. The three-step monitoring protocol is implemented zero, two and five years after planting and tracks tree survival, maintenance requirements, and invasive plant species. Assessments can be carried out by staff, contractors, or experienced volunteers and results are used to track overall program performance and inform maintenance requirements.

Several municipalities, including Oakville, Regina, and Winnipeg, among others, publish periodic or annual 'State of the Urban Forest' reports, which summarize key urban forest monitoring findings and observed trends, and may include projections about nearer-term management priorities and resource requirements.

The Town of New Tecumseth engages contractors to undertake an annual update of one-fifth of its street tree inventory, thereby maintaining relatively current tree inventory data and facilitating urban forest monitoring and active adaptive management. With effective system integration and Information Technology systems, basic tree inventory data can also be updated by tree maintenance contractors as trees are inspected or maintained.

The Criteria and Indicators of Urban Forest Sustainability (C&I) framework can be a useful tool for urban forest monitoring. The performance indicators can be reassessed on a periodic basis to track whether the urban forest and its management are trending in a favourable direction (i.e., from lower to higher-ranked indicators), and to identify if management focus, strategies or resources need to be adjusted. This framework is integrated into the Vibrant Cities Lab Community Assessment and Goal-setting Tool used to benchmark the performance of Brampton's urban forest and its management in this UFMP.

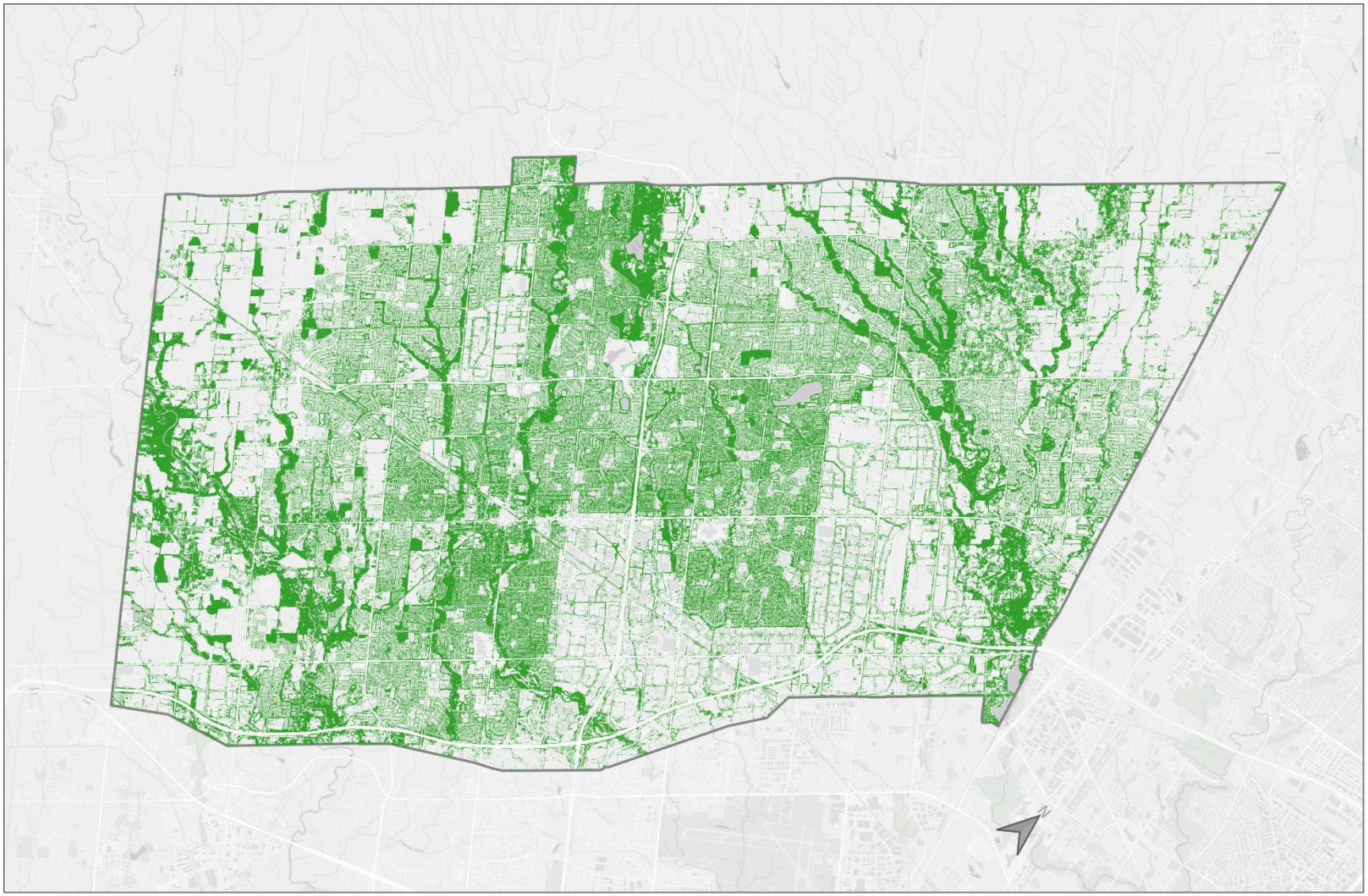


Figure 1: Brampton's urban forest canopy, based on 2017 analysis of 2015 geospatial data.

Canopy cover – key terms

UTC: Urban tree canopy – the area of land currently covered by existing tree canopy, viewed from a top-down perspective. Typically expressed on a percentage or area basis. Used interchangeably with urban forest cover, urban forest canopy, urban tree cover, canopy cover, tree canopy, and similar terms.

PTC: Possible tree canopy – the area of land that can theoretically support tree canopy and is not currently treed. Includes areas of vegetated cover or areas of impervious cover that could be converted to pervious tree cover, and excludes buildings, roads and areas of impervious cover than cannot be converted to tree cover. Like UTC, PTC is typically expressed on a percentage or area basis.

Maximum canopy cover: The combination of UTC and PTC – the theoretical maximum of urban forest canopy that could be supported in an area if all existing tree canopy (UTC) and possible tree canopy (PTC) area were in tree cover.

PPA: Potential plantable area – the subset of PTC that is actually feasible as long-term tree habitat, determined by excluding PTC area that is not suitable as long-term tree habitat and urban forest canopy cover growth due to competing existing and projected site uses and user values.

PCC: Potential canopy cover – the combination of UTC and PPA. The realistic maximum of urban forest canopy that could be supported in an area if all existing (UTC) and potential plantable area (PPA) were in tree cover.

RCC: Relative canopy cover – existing canopy cover (UTC) as a proportion of PTC or PCC.

1.4.2 Urban forest structure and canopy cover

1.4.2.1 Existing and possible tree canopy

The 2017 urban tree cover (UTC) analysis of 2015 geospatial data found 4,902 hectares of existing urban tree cover[1] in Brampton, representing approximately 18% of the City's land area. The same analysis classified an additional 11,316 ha as land that "could be used to increase the current extent of urban tree canopy", including 5,843 ha (22%) of lands with impervious cover and 5,473 ha (20%) of lands with pervious cover. These lands can be termed Possible Tree Canopy (PTC), although this specific terminology was not used in the 2015 study. Based on these metrics, Brampton has a theoretical maximum urban forest canopy cover of 60%. As such, Brampton's relative canopy cover (RCC), or the existing canopy cover as a portion of total possible canopy cover, is approximately 30% based on the 2015 data.

[1] The terms urban tree cover (UTC), urban forest canopy cover, canopy cover and tree cover are used interchangeably.

Contrary to trends in many North American municipalities, preliminary analysis at the ward level suggests that canopy cover distribution in Brampton does not appear to be significantly correlated with average household income. For example, according to the 2017 Urban Forest Study, canopy cover is highest in Ward 2 (29%), which has the second-highest average household income in the city (2016 census data), yet is second-highest in Ward 1 (24%), which has the lowest average household income.

1.4.2.2 Possible tree canopy versus potential canopy cover

With the exception of agricultural fields and active recreation areas, which were excluded from the analysis of potential plantable areas, the 2015 assessment described above did not distinguish between a site's tree habitat suitability (*is the site physically capable of sustaining trees?*) and feasibility (*are existing and projected site uses and user values amenable to sustaining trees on the site for the long term?*). In Brampton, as in other communities, it is likely that much of the area classified as possible tree canopy (PTC) is not actually suitable as long-term tree habitat for urban forest canopy cover growth, due to competing site uses and user values (e.g., recreational use of open space, development, aesthetics, etc.) As such, the extent of the city's actual potential canopy cover (PCC), as determined by the combination of existing urban tree cover and the extent of potential plantable area (PPA - or existing PTC that is feasible as long-term tree habitat), is likely considerably lower than the PTC metric of 42% presented in the 2015 tree canopy assessment.

Best practice - Potential canopy cover

If established by any municipality, urban forest canopy cover targets should be supported by assessment of potential plantable area and canopy cover (PPA/PCC) – the area's actual capacity for canopy cover based on an understanding of the available space for long-term tree growth, suitable locations for planting, and potential constraints to canopy cover growth (American Forests, 2017). It must also be recognized that canopy cover is just one of multiple measures of the success of urban forest management.

Examples of jurisdictions that have undertaken potential canopy cover/plantable area analyses to support canopy cover goal-setting include Mississauga, Oakville and Richmond Hill, ON, among many others.

Best practice – Function-based canopy cover targets

The Town of Richmond Hill, ON recently completed a comprehensive Urban Tree Canopy (UTC) and Potential Plantable Area (PPA) study as part of its strategic Urban Forest Management Plan (in development). The study mapped the Town's existing urban forest canopy cover and identified areas that are suitable sites for expanding the urban forest. The project also included the development of a tool that allows users to weigh the importance of different urban forest services and identify areas most suitable for tree establishment to achieve desired functional outcomes. Potential considerations for function-based canopy cover targets include heat island mitigation, increasing walkability through sidewalk shading, protecting water quality, or promoting energy conservation, among others. Other examples of jurisdictions that have undertaken similar studies include Grand Rapids, MI; Indianapolis, IN; Miami, FL and Peel Region, ON (including Brampton), through the Tree Planting Prioritization Tool (TPPT) project. Brampton's 2011 Urban Forest Study includes a Priority Planting Index (PPI), which ranks Small Geographic Units (SGUs) for planting priority based upon consideration of existing canopy cover and population density.

Best practice: Land use or site-level canopy cover requirements

In a novel and unique approach, the Town of Oakville requires a Canopy Cover Plan for all proposed new and infill developments to help the Town achieve its canopy cover targets. The Town has established land use-based canopy cover targets (e.g., 40% overall, 20% residential, 25% institutional, etc.). The Canopy Cover Plan must project future canopy for trees to be planted in accordance with Town guidelines, and can incorporate a canopy cover bonus of 1.5 times the existing canopy of trees to be preserved. A similar approach is used in Wycombe, United Kingdom, and few other comparable approaches are known to currently exist.

Through the Sustainability Metrics tool, Brampton encourages applicants to provide tree canopy over sidewalks and walkways. This requirement is considerably more limited than in Oakville.

1.4.2.3 Trees and leaf area

According to the 2011 Urban Forest Study (UFS) i-Tree Eco model results, Brampton's urban forest is composed of 3.6 million trees (S_E 776,000 trees) with a structural replacement value of $778 million. This equates to approximately 8.3 trees per capita or 134 trees per hectare – lower than figures in many comparable municipalities. Overall, nearly one-third (28%) of the city's tree cover, which provides 145 km^2 of total leaf area, was found to be situated within residential land uses. This suggests that homeowners and tenants control and influence the largest proportion of Brampton's urban forest. This pattern is expected to increase as more agricultural land is projected to be developed into residential land uses over time.

Both tree density and leaf area are most highly concentrated in the Open Space and Natural Cover land use categories, which represent only 5 percent of the city's total land area. Tree density and leaf area are relatively low in all other land use categories, suggesting that the services and benefits provided by the urban forest may be more limited for residents who lack proximity or access to open spaces and natural areas.

1.4.3 Tree species/genus composition

Data for tree species and genus composition in Brampton's urban forest are available from two sources – the 2011 Urban Forest Study (UFS) and the partially-completed street tree inventory.

1.4.3.1 Urban forest

Urban forest tree species and genus composition can be reported by multiple metrics and at different spatial scales. The City of Brampton Urban Forest Study measured species composition by leaf area and stem count (Figure 2), and reported findings primarily by land use category. Key findings of the study include:

- Species richness and diversity are highest in residential land uses, likely due to the presence of exotic ornamental and horticultural species. High species diversity in these areas should not necessarily be viewed as indicative of ecosystem health or resilience, as some species may be invasive or poorly adapted to local environmental conditions.

- The high rate of natural regeneration, particularly in vacant land, golf courses, agricultural land and transportation zones, likely reflects the establishment of invasive species across the municipality, as common invasive species have by far the highest rates of natural regeneration in Brampton. European buckthorn is abundant in all land use categories, suggesting it is established across the city.

- The genera maple (*Acer*), spruce (*Picea*) and ash (*Fraxinus*) were found to represent nearly half of total leaf area in the urban forest (47%). This high abundance of a small number of genera (i.e., low diversity) suggests that the urban forest may be highly vulnerable to a wide range of stressors. This was evidenced by the loss of most ash trees in Brampton due to the 2013 ice storm and emerald ash borer (EAB) infestation in the years following the 2011 urban forest study.

- Between one-third to over one-half of all trees in Brampton are considered susceptible to Asian longhorned beetle, which represents perhaps the most significant pest threat to the city's urban forest. Twenty-three percent of trees (by stem count) are susceptible to LDD moth, while eight percent are susceptible to emerald ash borer. *It should be noted that since the time of publication of the 2011 Urban Forest Study report, most actively managed ash trees in Brampton have been removed due to ice storm damage or EAB.*

In regard to tree species and genus composition, the UFS recommended that the City enhance urban forest diversity by working to establish a 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 total tree population both city-wide and at the neighbourhood level." The study also recommended assessing pest vulnerability when selecting species for tree and shrub planting, and provided recommendations for invasive species management and the use of native planting stock grown from locally adapted seed sources.

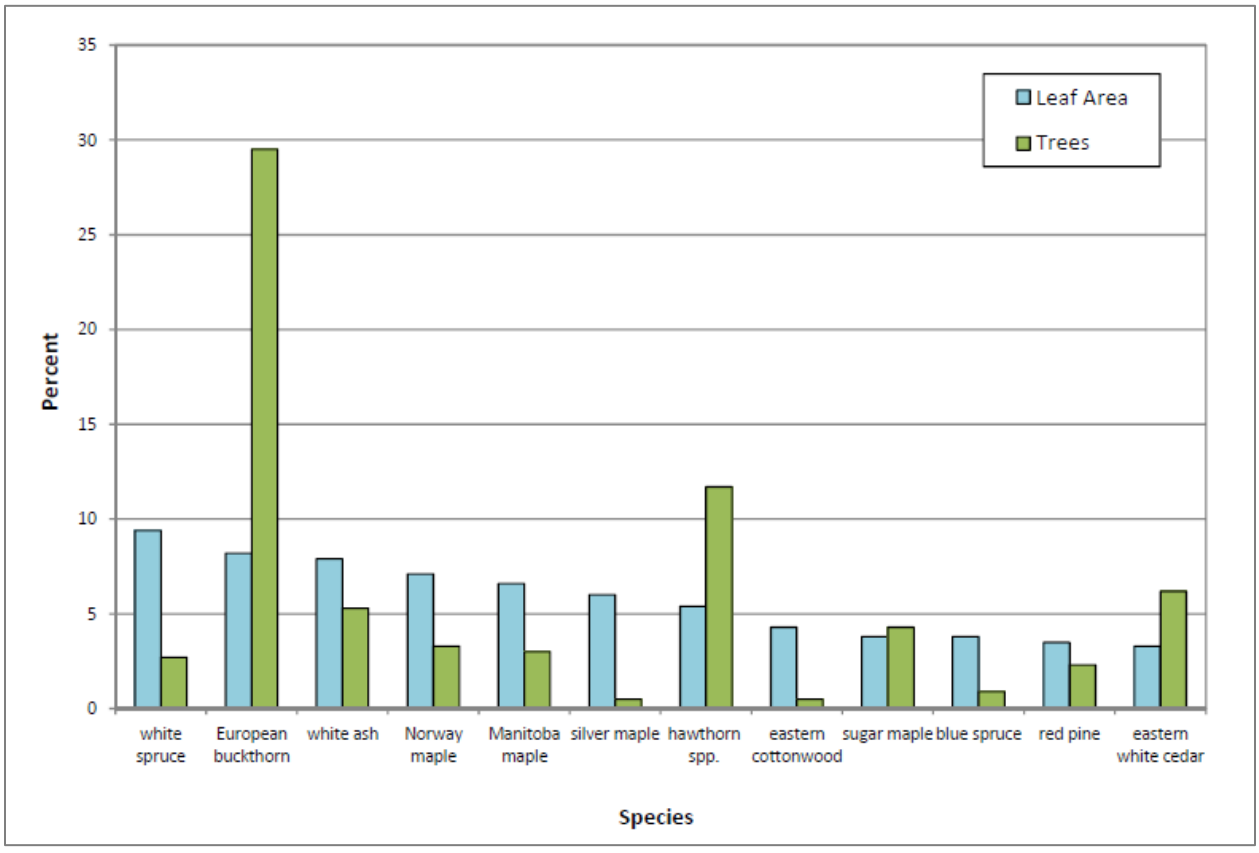


Figure 2: Tree species composition across the entire urban forest, expressed as a percentage of total leaf area (blue) and percentage of total stems (green), City of Brampton. Source: TRCA, Brampton Urban Forest Study Technical Report, 2011. 2008 data.

1.4.3.2 Street trees

Brampton's street tree inventory is currently incomplete, and is limited to only a portion of the City-managed residential street tree population. The inventory, which included data for 83,861 trees as of November 2019, provides some preliminary insight into the species and genus composition of this part of the urban forest. Selected preliminary findings are presented in Figures 3 and 4, below.

Findings demonstrate that species diversity of Brampton's inventoried street tree population is low, with just three species (Norway maple, littleleaf linden and honey locust) comprising 42% of the population. Genus diversity is also low – *Acer* (maple), *Tilia* (linden) and *Gleditsia* (honey locust) account for over half (52%) of the inventoried population. These trends are perhaps not surprising, as these species have been among the most frequently planted trees in relatively newer subdivision communities due to their urban tolerance and hardiness. They do suggest, however, that the City and its partners should work to enhance street tree diversity through the establishment of a significantly wider selection of tree species and genera.

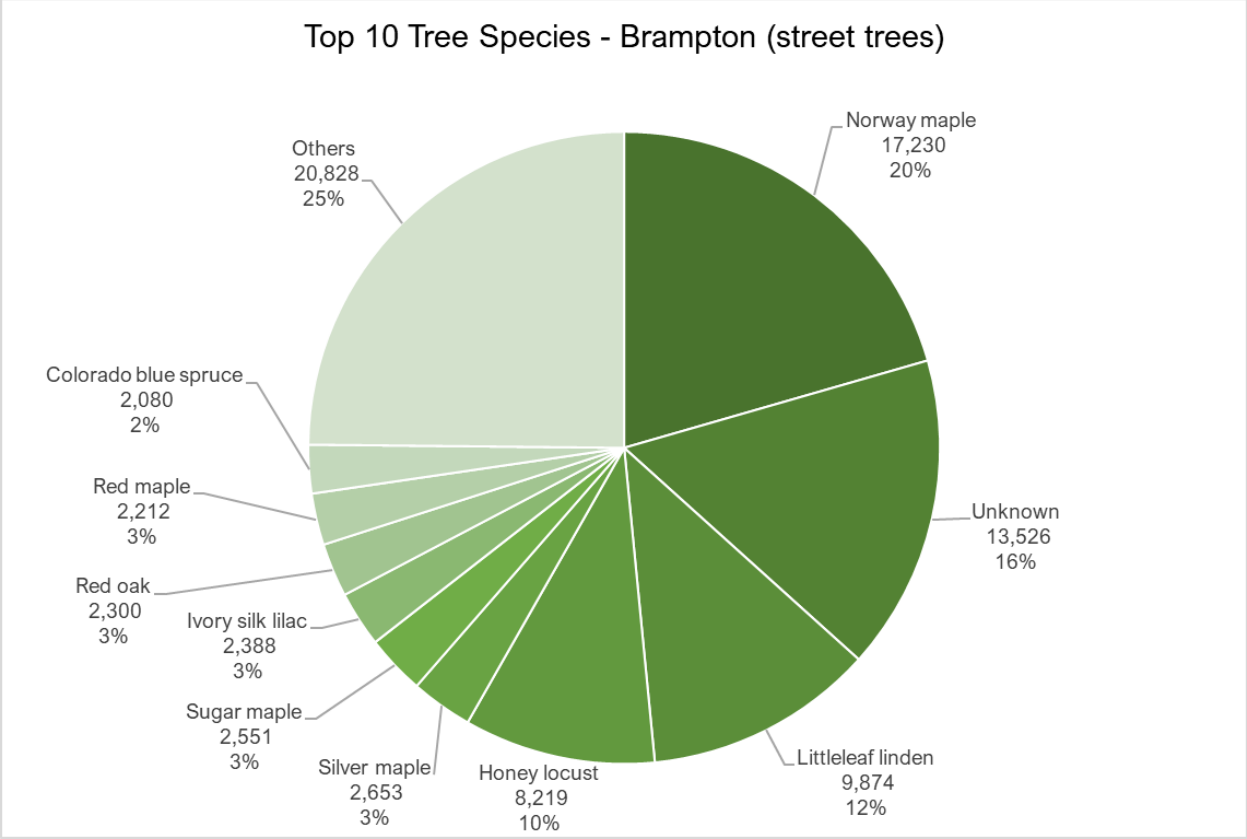


Figure 3: Top ten inventoried street tree species in Brampton, based on partially complete tree inventory (2019 data).

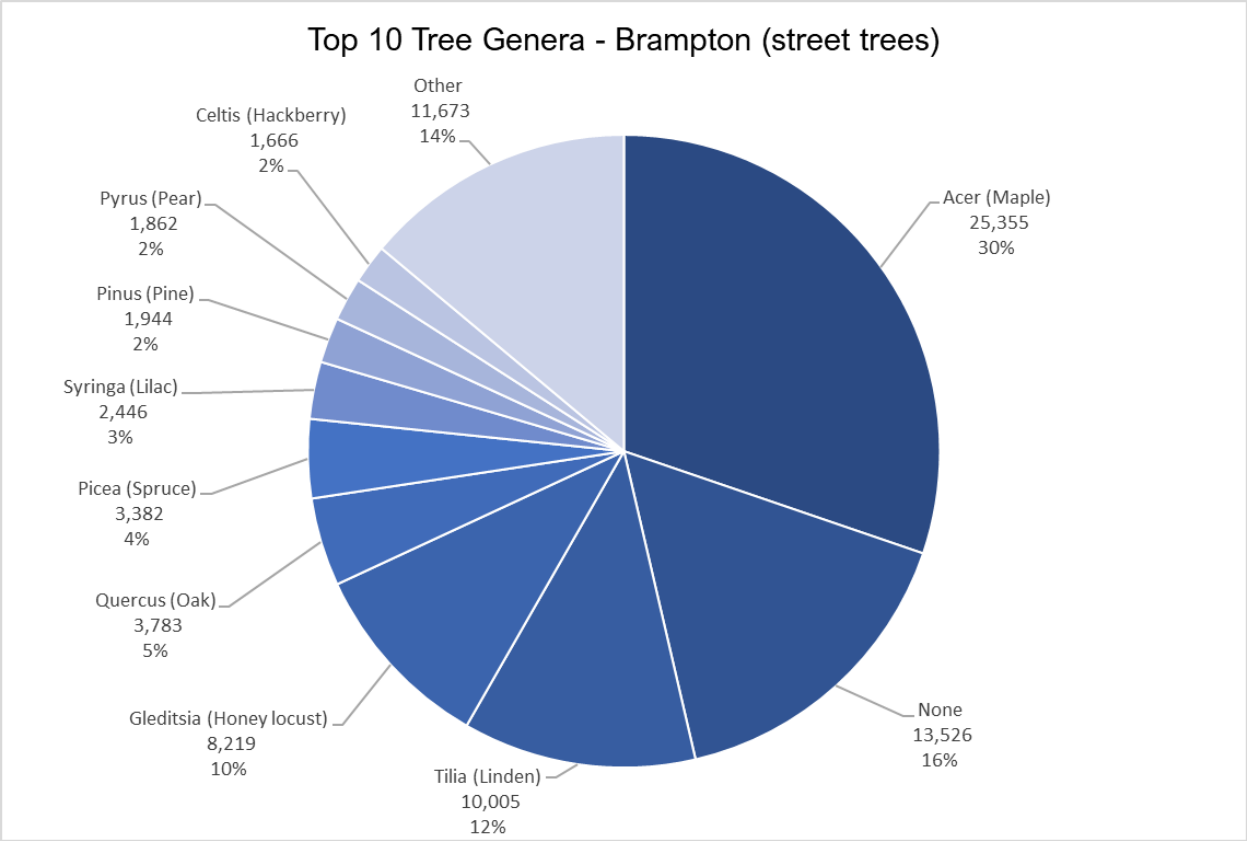


Figure 4: Top ten inventoried street tree genera in Brampton, based on partially complete tree inventory (2019 data).

Best practices – Detailed tree inventory attributes

Many municipalities have collected comprehensive inventories of their actively managed trees, which include attributes such as detailed condition ratings, standardized tree risk assessment ratings, and priority-based tree maintenance recommendations. Examples include Cambridge, ON; Charlottetown, PEI; Mississauga, ON; New Tecumseth, ON; Regina, SK; Windsor, ON; and many other communities. A detailed description of best practices for tree inventory attributes can be found in Appendix 1.

Best practice – Private tree inventory

The City of Red Deer, AB has an inventory of over 4,600 privately-owned trees, including ash, elm and other pest and disease-susceptible trees with significant representation in the urban forest. Private tree inventory data were collected as part of an urban forest pest vulnerability assessment, and only trees visible from municipal property were included.

Best practices – Urban forest diversity

There is no universally agreed-upon optimum level of urban forest diversity. A commonly cited rule is the '10-20-30 rule' (Santamour, 1990) whereby no species represents more than 10% of the population, no genus represents more than 20% of the population, and no family represents more than 30% (by stem count). This level of diversity may not be attainable in many jurisdictions, including Brampton, especially at multiple spatial scales.

Ambrose (2016) found that increasing genus-level diversity (instead of species or family) is likely the most effective strategy to build urban forest resilience against pests, diseases and other stressors, and there is increasing consideration of a genus limit rule (e.g., 5%-10%), which may be more appropriate and effective, but remains difficult to attain (Ball, 2015).

Cities should also consider functional diversity – the ability of the urban forest to provide various functions – and plan tree establishment according to where different species and genera can provide the most-needed services most effectively (e.g., planting dense-canopied trees where shade is required or planting conifers where windbreaks are most beneficial). This requires site-based analysis of needs and the selection of a range of appropriate species.

1.4.4 Tree size/age class composition

The importance of large trees in Brampton

According to the 2011 Brampton Urban Forest Study, an individual tree in Brampton in the diameter class of 61.6-68.6 cm removes approximately 10 times more pollution and stores 75 times more carbon than a tree in the diameter class of 7.7-15.2 cm. Should the proportion of large trees in Brampton's urban forest be increased, the total volume of pollution removed and carbon stored and sequestered would be expected to increase as well.

Tree size, as represented by diameter at breast height (dbh)[2], can be used as a proxy for tree age because trees increase in trunk diameter as they grow over time.

An "optimal" urban forest tree size class distribution, proposed by Richards (1983), is shown relative to the size class distribution of Brampton's urban forest in Figure 5 (based on 2008 data). The 2011 Brampton Urban Forest Study found that, "the proportion of large, mature trees (if diameter class is used as a proxy for age class) is very low" (pg. 40) in the city, and, consequently, that the proportion of small trees is significantly higher than recommended. Although not addressed in the 2011 study, a major contributing factor to the size class distribution of Brampton's urban forest is the relatively recent development of many of the city's neighbourhoods over the past two decades, which are largely populated by relatively young trees which have not yet grown to large stature and maturity. The study stated that it is necessary to provide adequate tree habitat in the initial stages of urban planning if trees are to reach large stature and maturity, particularly in newly developing residential communities.

[2] Diameter at breast height, abbreviated dbh, is a forestry and arboricultural standard method of expressing tree size. It is the measurement of tree trunk diameter taken at 1.37 m above grade.

These findings also highlight the need to ensure that existing trees are effectively maintained and protected so that they can grow to reach their full genetic potential for size and function.

Best practices – Optimal tree size/age class distribution

Defining an optimal age-class distribution in an urban forest is challenging, particularly given the variation in natural regeneration between land uses. In classical forestry, an 'inverse-J' curve of size class distribution shows a mixed-age population dominated by younger trees, which is considered desirable to ensure succession as larger and older trees decline or are removed and replaced. In urban forest management the same size class distribution pattern suggests that larger and older trees are under-represented, as smaller-stature trees provide fewer environmental, economic and societal and health services. However, young replacement trees should be planted in areas where mature trees are dominant to ensure succession and continuation of functional service provision by trees. One study (Richards, 1983) proposed what is commonly regarded as the optimal size/age class structure for urban forests.

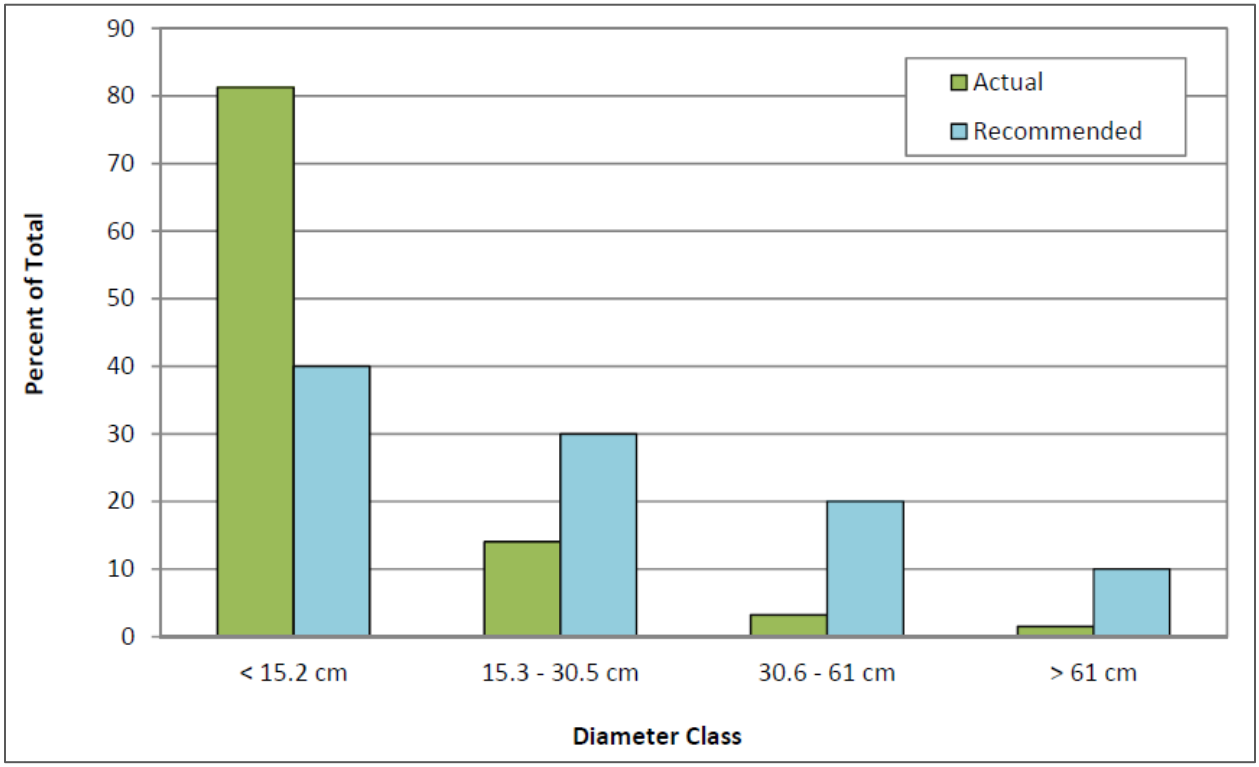


Figure 5: Guidelines for recommended tree diameter class distribution (in green, adapted from Richards, 1983 and City of Davis) and actual diameter class distribution in Brampton (in blue). Source: TRCA, Brampton Urban Forest Study Technical Report, 2011. 2008 data.

1.4.5 Health and condition

The 2011 Urban Forest Study (2008 data) estimated that approximately 47% of trees in Brampton's urban forest were in excellent or good condition, based on the proportion of crown dieback (just one of several metrics of tree health). The condition ratings did not consider stem or root condition, which are also important in the assessment of tree condition. In recent years, Brampton's urban forest has suffered significant damage due to the combined effects of the emerald ash borer (EAB) infestation and the 2013 ice storm, which will ultimately necessitate the removal of some 50,000 trees (including up to an estimated 28,000 ash trees).

1.5 The value of Brampton's urban forest

The urban forest is a critical component of Brampton's 'green infrastructure'. Green infrastructure is defined by the Green Infrastructure Ontario Coalition (2015) as, "the natural vegetation and vegetative technologies that collectively provide society with a broad array of products and services for healthy living." An ever-growing body of scientific and technical literature demonstrates that trees and green spaces in urban areas provide direct services and secondary benefits to human health, and can enhance multiple metrics of economic performance, social health and well-being, and environmental function and quality.

As trees grow in size and leaf area, the amount, value and positive effects of the services and benefits they provide increases (Kenney, 2000) (Figure 6). In fact, the urban forest may be the only category of municipal infrastructure asset that actually increases in value and performance as it ages. As such, a key objective of urban forest management must be to sustain or increase leaf area by growing the urban forest as a whole, and by enabling individual trees to reach maturity and large stature.

The 2017 Peel Region urban tree canopy cover assessment of 2015 data estimated that Brampton's urban forest provides approximately $9.5 million in pollution removal and carbon sequestration services alone. This study did not account for the wide range of other valuable services provided by the city's urban forest.

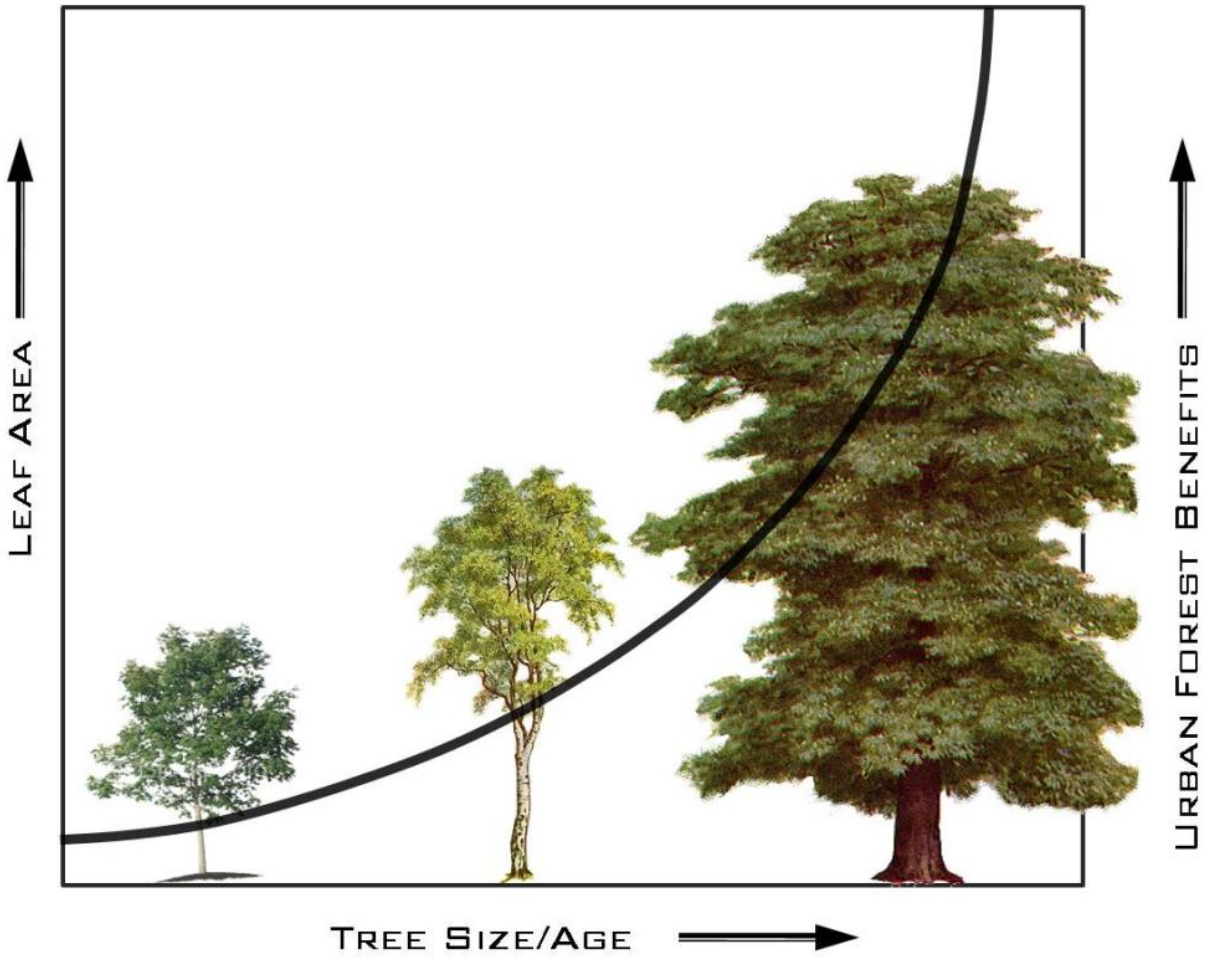


Figure 6: Environmental, economic, and societal and health services provided by the urban forest increase exponentially in amount, value and positive effects as tree size and leaf area increases. This demonstrates the importance of establishing and growing large-statured trees in the urban forest.

Figure 7: The benefits and services provided by urban forests and trees. Source: City of Brampton "Trees" online portal (accessed May 2020).

Urban forest services can broadly be grouped into three categories: environmental, economic, and societal and health. A review of these three categories of urban forest services, including Brampton-specific values and data where available, is provided below.

1.5.1 Environmental services

The environmental services provided by the urban forest make Brampton a more liveable, safe, and healthy community. Among of these services include:

- Reducing air pollution and improving air quality
- Cooling the air and reducing the urban heat island effect
- Storing and sequestering atmospheric carbon
- Reducing flooding and improving water quality
- Providing wildlife habitat and ecosystem connectivity

Reducing air pollution and improving air quality – Poor air quality is linked to premature mortality, adverse health effects such as asthma and heart disease, and increased healthcare costs. Urban forests are among the most efficient and cost-effective air-cleaning mechanisms available in urban areas to reduce harmful concentrations and effects of air pollutants such as carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3) sulphur dioxide (SO_2), and particulate matter of 10 microns or less (PM_{10}).

The 2017 Peel Region urban tree canopy cover assessment (2015 data) estimated that Brampton's urban forest removes 362 metric tonnes of harmful air pollution annually – a service valued over $7.2 million per year. Pollution removal effects were greatest for ozone (O_3), accounting for over 75 percent (277 tonnes) of pollution removed by the urban forest, and were most valuable for $PM_{2.5}$ (over $5.4 million). The 2011 Urban Forest Study found that Brampton's urban forest removes an amount of PM_{10} emissions equivalent to that produced by 170,700 automobiles per year.

Cooling the air and reducing the Urban Heat Island effect – Average temperatures in urban areas can be several degrees higher than in less developed areas, resulting in adverse health and environmental outcomes. This phenomenon is termed the Urban Heat Island (UHI) effect, and occurs when grey infrastructure in urban areas absorbs sunlight and reradiates it as heat. Climate change and urban development are expected to exacerbate the Urban Heat Island effect as average temperatures and the extent of paved surfaces increase.

Trees provide a substantial cooling function in urban centres, particularly when planted in groups and situated with consideration of shading patterns and air flow. For example, one study in Toronto (Slater, 2010) found that well-treed parks can be up to 7°C cooler than surrounding streets. Another study (Coutts and Harris, 2012) found that large-canopied trees are effective at cooling wide urban streets and that trees planted in medians can effectively lower road surface and neighbourhood air temperatures.

Thermal remote sensing of Urban Heat Islands in the Greater Toronto Area (GTA), undertaken by Natural Resources Canada in 2009, found that the suburban areas of Brampton recorded among the highest surface cover temperatures and nighttime UHI intensities in the entire GTA – even higher than those in the dense urban core of downtown Toronto. Projected population growth and related residential and commercial development in Brampton will likely increase the Urban Heat Island effect in both extent and intensity. This effect can be mitigated through maintaining, protecting and growing the urban forest.

Storing and sequestering atmospheric carbon – Carbon is stored in woody plant tissues, and atmospheric carbon is sequestered as trees grow. While this contribution of urban forests towards mitigating climate change is relatively small, especially when carbon emissions related to tree management are accounted for, the many other services provided by trees help communities adapt to climate change impacts.

The 2017 Peel Region urban tree canopy cover assessment (2015 data) estimated that Brampton's urban forest sequesters approximately 43,107 tonnes of carbon per year as trees grow – equivalent to over 9,300 passenger vehicles driven for one year, or the energy used in nearly 5,200 homes. The assessment also estimated that more than 1.38 million tonnes of carbon are stored in the urban forest – a value of nearly $25 million. The 2011 Urban Forest Study found that the largest trees store proportionately more carbon – for example, trees greater than 68.6 cm dbh make up less than 1 percent of the total tree population but store more than 30 percent of the total stored carbon. Average sequestration rates are also positively correlated with tree size, as larger trees sequester more carbon on an average annual basis than smaller trees.

Reducing flooding and improving water quality – Urban areas are characterized by expansive impermeable surfaces, low rates of water infiltration into soils, and grading designed to channel runoff to storm sewers and watercourses rather than retaining water on-site. As rainfall runs over impermeable surfaces towards, it accumulates pollutants such as oils, heavy metals and fertilizers. Water quality in urban streams and other waterbodies is frequently degraded as a result of high pollutant and sediment loading and increased temperatures, adversely affecting habitat for aquatic invertebrates and fish and making waters less suitable for recreation and consumption. During significant rain events, water flow can overwhelm drainage infrastructure and cause erosion, flooding, and combined sewer overflows, which further impact water quality.

Urban forests can protect and improve water quality and help to reduce stormwater runoff, erosion and flooding. Soils with tree root activity are more pervious than compacted soils or hard surfaces, and absorb more water before it reaches storm sewers or causes surface flooding. Trees also intercept rainfall in their canopies and on their trunks, slowing its course towards drains and waterbodies and reducing the likelihood that these systems will be overwhelmed or fail.

Hydrological simulations undertaken as part of the 2011 Urban Forest Study confirmed that removing existing tree cover in the Spring Creek and Fletcher's Creek subwatersheds would increase total stream flows. However, impervious cover has a more significant impact upon stream flows than the amount of tree cover in the subwatershed.

Providing wildlife habitat and ecosystem connectivity – Alteration of forest cover and replacement of natural ecosystems with urban landscape features represents one of the greatest threats to global biological diversity (Lerman et al., 2014). While urban forests are often diverse in plant species, wildlife species richness typically declines in urban areas (Faeth et al., 2011). Urban forests can provide important habitat for diverse flora and fauna, particularly by improving and increasing connectivity between existing ecological features (Fernandez-Juricic, 2000). Improving connectivity can increase the abundance and diversity of fauna such as migratory birds, mammals and invertebrates such as butterflies. Urban wildlife habitat has intrinsic value, and also enables urban residents to more closely and frequently interact with nature, contributing to psychological well-being and a more liveable community.

1.5.2 Economic services

Some of the important economic services provided by urban forests include:

- Increasing residential and commercial property values
- Increasing local economic activity
- Reducing energy use demand and costs
- Reducing healthcare costs
- Reducing infrastructure maintenance costs

Increasing residential and commercial property values – Mature and healthy trees can significantly increase the value of residential and commercial properties. Trees in yards, and even neighbouring street trees, have been found to add between 3% to 15% to residential property values when comparing otherwise similar treed and non-treed properties (Wolf, 2007). In Brampton, this could potentially amount to over $80,000 in increased property value, based on the MPAC average assessed house value of $538,000. Houses with trees on or near the property also sell faster, according to one study (Donovan and Butry, 2010). Similarly, high-quality landscapes with mature trees can increase average office rental rates by up to 7% over similar properties without attractive landscape features.

Increased local economic activity – The presence of well-maintained, mature and healthy trees increases the aesthetic quality of urban landscapes, including commercial areas and business districts. This can directly boost economic activity in such areas, as consumers are willing to travel farther and more often to, and spend more time and money within, well-treed shopping areas. Studies have found that consumers may be willing to pay, on average, up to 12% more for goods and services in well-treed business districts (Wolf, 2007).

Reducing energy use demand and costs – Energy use to cool and heat buildings represents a significant cost for Brampton's residents. Optimally situated trees, such as conifers on the north side or deciduous trees on the south and west side of buildings, can significantly reduce the energy demands associated with heating and cooling by providing windbreak or shading functions. This translates to substantial energy cost savings for residents and businesses, and also reduces energy usage and emissions associated with electricity generation and natural gas combustion. One study found household energy usage for heating and cooling was reduced by

up to 25% in homes surrounded by well-placed trees, compared to similar houses without trees nearby (Heisler, 1986).

Brampton's urban forest contributes to annual energy use savings valued at approximately $970,000 and resulting in avoided emissions of over 1,700 tonnes of carbon (2008 data).

Reducing healthcare costs – Urban forests are associated with reduced stress and improved physical health for urban residents, and the benefits to public health systems of maintaining and expanding the urban forest are potentially significant. For example, one foundational study (Ulrich, 1984) found that exposure to trees significantly reduces recovery time from surgery, demonstrating healthcare cost reductions and wellness benefits related to the urban forest. A more recent study in 15 U.S. states (Donovan et al., 2013) determined that the loss of ash trees due to emerald ash borer was directly responsible for over 21,000 deaths due to cardiovascular and lower respiratory system disease, clearly demonstrating the significant health benefits and cost savings provided by trees. Overall, air quality in Brampton has been improving over time, although exceedances above established limits for specific air pollutants do occasionally occur and may increase as the city continues to develop and its population grows. As described above, Brampton's urban forest can play an important role in reducing the levels of various airborne pollutants, with resultant reductions in healthcare costs.

Reducing infrastructure maintenance costs – It is commonly acknowledged that poorly situated or insufficiently maintained trees can cause damage to infrastructure such as public utilities or sidewalks. However, the positive contribution of trees to prolonging the service life of some types of infrastructure is often overlooked. For example, properly planted and well-maintained trees can significantly reduce the required maintenance frequency of UV and heat-sensitive infrastructure, such as roadway asphalt, thereby reducing lifetime maintenance costs by up to 60% (McPherson and Muchnick, 2005). Trees have a similar positive effect on structures such as playgrounds, slowing the breakdown of plastics and making children's play areas safer and longer lasting. By absorbing rainwater, urban forests can also slow stormwater runoff and reduce pressures on storm sewer systems and watercourses. Currently, the ability to fully quantify tree-related reductions in urban infrastructure maintenance costs is limited, and trees are still often perceived as detrimental. As the body of scientific and technical literature about urban trees grows, these significant benefits will become more readily apparent and will further support the integration of trees into urban environments and infrastructure networks.

1.5.3 Societal and health services

Urban forests improve the physical, mental and social well-being of urban residents. Some of the vital societal and health services provided by urban forests include:

- Improving physical health and well-being
- Improving mental health and cognitive functioning
- Increasing social cohesion and strengthening communities

Improving physical health and well-being – When urban design effectively incorporates green space and trees, cities can be healthy and vibrant places to live. Studies suggest that urban residents in proximity to green areas and trees enjoy better long-term health outcomes and greater longevity than residents without access to such features. The ways in which urban forests promote health are wide-ranging. Urban forest health benefits stem from both direct functions, such as removal of air pollutants, shading (and associated UV protection) or food production, and indirect influences, such as promotion of outdoor activities and walkability, or reducing the perceived severity of stressful life events.

Numerous studies demonstrate the direct correlation between urban forests and improved human health. Various findings suggest people recover from surgery more quickly, are more likely to undertake physical activity such as cycling or walking, have lower blood pressure and rates of sun exposure-related diseases (such as skin cancer and cataracts), and even have higher anti-cancer cell activity, when provided with regular access to or even views of urban natural areas, trees or other vegetation. Trees along urban arterial roadsides also promote traffic and pedestrian safety (Naderi, 2003) by contributing to a reduction in the incidence of mid-block vehicular collisions.

Improving mental health and cognitive functioning – In addition to being potentially challenging for physical health, urban life can lead to adverse mental health outcomes such as stress, depression, and poor cognitive functioning.

Similar to their positive effects on physical health outcomes, urban forests can support the mental health of urban residents. Among urban nature's most important contributions to improved mental health is its apparent restorative function. Ulrich et al. (1991) found significant positive effects upon stress reduction among subjects exposed to a natural setting within just 5 to 7 minutes. Urban nature can also encourage calmness, learning, inquisitiveness and alertness, and improve creativity and cognitive function through attention restoration (Berman et al., 2008). The importance of urban nature to improved mental restoration and function has also been studied among children. For example, one study (Taylor et al., 2001) conducted in Chicago among children with Attention Deficit Disorder (ADD) found that reported symptoms were milder for children with access to green play settings. Nordh et al. (2009) found that the number of trees visible from a given point of view was among the most important components of small urban parks that positively affected mental restoration.

Increasing social cohesion and strengthening communities - Community cohesion and social engagement are important components of vibrant, sustainable communities. Increased social interaction among community members may lead to desirable outcomes such as community stewardship and engagement in civic life, volunteerism, and improved public health (Sullivan et al., 2004). Research suggests that urban green spaces and natural areas can provide areas for people to come together, and that people tend to prefer natural or green settings over hardscaped spaces for outdoor social interactions (Kuo et al., 1998). Other studies have reported significant positive correlations between green spaces and increased social interaction, reduced fear, and lower incidence of crime.

Protecting against UV rays, wind and noise – Trees provide urban residents with shelter from the sun and decrease the health risks associated to sun exposure (Canadian Cancer Society, 2021). Trees planted strategically can buffer the effects of wind, reducing urban wind tunnel effects and winter wind chill factors, making urban areas more comfortable. The United Kingdom Forest Commission found that trees planted in dense wide belts in soft ground have the potential to reduce noise transmission by 50%.

1.6 Challenges to Brampton's urban forest

Like urban forests virtually everywhere, Brampton's urban forest faces considerable challenges to its functional capacity to provide services and to its long-term sustainability. Among the most significant challenges include:

- Difficult urban growing conditions
- Invasive species, pests and pathogens
- Limited community engagement and fragmented urban forest ownership
- Urban forest structure, a lack of information, and management practices
- Climate change

These challenges, and the opportunities available and responses necessary to address them, are described in more detail below.

1.6.1 Challenge 1 – Difficult urban growing conditions

The Greater Golden Horseshoe (GGH) area, which includes Brampton, is among the fastest-growing regions in North America. Brampton will absorb much of the area's projected growth, and the city's population is forecast to increase to nearly 812,000 by 2031 – an increase of over 30% above the 2016 population of approximately 594,000. In Brampton, this population growth will be accommodated in both new greenfield communities and through intensification in existing built-up areas. While it is imperative to protect existing trees during development and to effectively integrate new trees into new communities, both greenfield and intensification approaches to development pose significant challenges to sustaining and expanding the urban forest.

Too often, the urban forest is not afforded adequate consideration in the urban design and planning process, and the needs of trees are often not well understood, planned or budgeted for. As such, built-up environments are typically characterized by degraded and compacted soils, altered moisture regimes, little or no natural vegetation regeneration (except for invasive species), and substantially reduced soil microbiological activity. Urban conditions stress trees by depriving them of moisture, air and nutrients in the soil, and by exposing them to high heat, pollutants or even vandalism. As in other communities, design and construction practices have resulted in insufficient soil volume and quality (among other factors) in many tree growing environments in Brampton and will, unfortunately, consign many existing small trees to premature mortality or reduced growth rates. Unless such sites are retrofitted and more progressive approach to urban and tree habitat design and construction are adopted, the

mature urban forest canopy found in some of Brampton's most desirable and older neighbourhoods may never develop in the city's more recently built communities.

Outside of greenfield communities, intensification brings its own particular challenges to both the existing and future urban forest. For example, the greater lot coverages associated with higher-density dwellings such as townhomes and condominiums may place existing trees in direct conflict with proposed building footprints and landscape elements, resulting in the loss of mature tree cover in intensifying neighbourhoods. Similarly, standard roadway cross-sections in higher density neighbourhoods may provide limited above- and below-ground room for trees, which will have to compete with buried utilities, pedestrian and cycling infrastructure, unsuitable soil conditions, and other constraints. Even when existing trees are protected, they may be injured during site development or suffer from adversely altered drainage patterns. Trees must also contend with maintenance activities such as winter de-icing or periodic infrastructure repair. Landscape maintenance practices such as grass mowing and trimming in City parks and along streetscapes may also be injurious to trees, especially young trees with thin bark. Climate change will only further compound these environmental stressors upon the urban forest.

As population growth and development proceed apace in Brampton, a major challenge facing the city will be to seek and implement solutions that provide and maintain adequate growing environments to sustain healthy, long-lived and mature urban trees in new, existing and intensifying communities. Fortunately, recent years have seen great strides forward in the adoption of planning approaches and construction methods and materials that enable the successful integration of trees as long-term components of urban landscapes. With appropriate policies and a genuine commitment to effective implementation, development can actually present opportunities to better integrate new and existing trees and even woodlands into the urban fabric for the benefit of residents. This requires a multi-disciplinary and cooperative approach to ensure that adequate growing space and other tree habitat needs are secured early in the planning process, that existing significant features are identified and protected, and that stakeholders work together to adopt innovative design and development techniques that maximise opportunities for urban forest protection and establishment. Doing so will strongly complement other key urban design and development objectives, such as the creation of high-quality, human-scaled and pedestrian-oriented public realms, and will ensure that vital urban forest services continue to be provided to Brampton's residents for generations to come.

1.6.2 Challenge 2 – Invasive species, pests and pathogens

Invasive species are organisms whose introduction or spread may adversely affect the environment, economy or society – potentially including human health. Invasive species are considered the second most significant threat to global biodiversity after loss and degradation of habitat (Park, 2004). While invasive species are usually introduced from elsewhere unintentionally, they may also be indigenous to the local area but may, through influences such as habitat degradation or climate change, express invasive tendencies.

In the urban forest, invasive plant species may outcompete indigenous species for habitat or resources – particularly in remnant natural areas such as woodlands. For example, tree species such as Norway maple (*Acer platanoides*) or common buckthorn (*Rhamnus cathartica*), which

are both abundant in Brampton's urban forest, can crowd out indigenous vegetation and permanently degrade ecological structure and function in invaded areas. Invasive insect species, such as the emerald ash borer (EAB), Asian long-horned beetle or LDD moth, can cause widespread devastation by killing large populations of trees. EAB infestation has already had a profoundly adverse effect upon affected streetscapes, parks and natural areas in Brampton. Tree diseases (pathogens) such as oak wilt, Dutch elm disease, or others, can also have devastating effects upon the urban forest.

Managing invasive species, pests and pathogens is an urgent and pressing challenge for urban forest managers, and trees in urban areas are often highly susceptible to such threats due to the challenging growing conditions they experience. The effects of pests and pathogens may be further compounded by factors such as limited tree species diversity, use of poor-quality nursery stock, or inadequate tree monitoring and maintenance practices. Climate change is expected to expand the range of invasive species, pests and pathogens, and to further increase trees' susceptibility to these stressors.

The most effective response to the threat posed by invasive species, pests and pathogens is a strategic and integrated approach to their management. This approach must combine proactive components, such as increasing urban tree species diversity, urban forest monitoring and early detection, adaptation to biological invasions, and promotion of overall urban forest health, with the necessary reactive actions such as tree removal, replanting and, when required, active control measures.

Building resilience through tree species diversity and tree health will reduce the urban forest's potential susceptibility to these threats and buffer the effects of future infestations, while implementing strategies to manage these issues before they arise will ensure that the necessary actions and resources are deployed early on, when the chances of successful control are greatest. Effective invasive species, pest and disease management may require considerable investments of effort and resources. However, failure to make these investments may allow invasive species, pests or pathogens to proliferate, resulting in wide-scale species loss, degradation of functional capacity to provide valuable urban forest services, and considerable environmental, economic and social costs. Therefore, strategies to improve urban forest invasive species, pest and disease management in Brampton will be outlined in the Urban Forest Management Plan.

1.6.3 Challenge 3 – Limited engagement and fragmented ownership

According to the 2011 Brampton Urban Forest Study, nearly one-third of the urban forest can be found in residential land use areas, and the city's many private, commercial or institutional landowners control or influence the majority of the urban forest. Privately-owned lands, which often include permeable and otherwise 'soft' landscaped areas, may provide some of the most suitable growing environments for existing and future urban trees. However, these land holdings are often relatively small in size, resulting in many individual actors each exercising control over a small portion of the urban forest. Private ownership of a large portion of the urban forest is therefore a significant challenge to overall urban forest health, function and sustainability.

Fragmented and private land ownership results in multiple and occasionally contradictory values influencing the urban forest. Some landowners may regard their trees as desirable and important assets worthy of stewardship and care, while others may regard them with indifference, neglect or disdain. For example, trees may be perceived as “messy” nuisances, and misunderstandings about tree damage to foundations and sewers abound. Trees may be recognized for their multiple environmental, economic and social contributions, or may be regarded as constraints and obstacles to site development, landscaping, or other objectives. Some tree owners may be even fearful of trees, despite the statistically very low level of risk they pose. Ultimately, these differing values lead to varying degrees of urban forest stewardship across the city. Overall urban forest health and function may decline if enough individual trees are not provided with adequate care and maintenance, and privately-owned trees and properties may even unwittingly become hosts or dispersal sites for invasive species, pests or pathogens.

Fragmented and private ownership also poses a challenge to engaging and educating property and tree owners about urban forest benefits and the habitat, maintenance and care requirements of trees. The large number of landowners requires that education and outreach by the City be directed towards individuals, and often necessitates coordination with intermediary partners as facilitators. It can therefore be challenging to inform and engage property owners in a consistent and effective manner to support community-wide urban forest objectives, implement proper tree care practices, or adhere to municipal by-laws and standards which regulate or otherwise influence the urban forest. It can also be difficult to engage residents, who may have competing priorities and limited resources and interest, in urban forest stewardship such as tree planting or invasive species control on either private or City lands.

Well designed, adequately resourced, and engaging education and outreach programs will be critical tools to help overcome the challenges associated with fragmented and private ownership of the urban forest and of limited public awareness of its vital importance to community health and sustainability. To succeed, these efforts must leverage existing opportunities such as engaged youth, an active environmental community, and existing partnerships. In doing so, Brampton will experience an increase in participation in urban forest stewardship efforts on both public and private lands, thereby promoting urban forest sustainability and enhancing the provision of valuable environmental, economic, and societal and health services.

1.6.4 Challenge 4 – Urban forest structure, information and management

The structural characteristics of Brampton’s urban forest pose a range of management challenges and potentially compromise the urban forest’s functional ability to provide services and benefits to the city’s residents.

As demonstrated by the devastating combined impacts of EAB and the 2013 ice storm upon Brampton’s ash tree population, the dominance of the urban forest by a limited number of species and genera affects its resilience to a range of external stressors such as pests, diseases, or climate change. Due to a relatively low level of diversity, Brampton’s urban forest faces further threats to sustainability from these and other possible impacts in the future.

The size/age class distribution of trees in Brampton's urban forest also poses a particular management challenge. Small trees dominate across all land use categories – according to the 2011 Urban Forest Study, less than 3 percent of all trees in the city are larger than 38 cm dbh. Smaller trees are less capable of providing important urban forest services and benefits due in large part to their lower leaf area, and newly planted trees require ongoing and long-term care to enable them to reach their full size and functional potential. Tree growing environments and maintenance operations must therefore be designed to provide for the long-term needs of trees; otherwise, many trees will be consigned to premature mortality and fail to provide valuable urban forest services at their full potential.

The challenges to sustainable urban forest management posed by the structural characteristics of Brampton's urban forest are compounded by the lack of up-to-date and accurate information about it. The comprehensive i-tree Eco-based Urban Forest Study (2011) is now over a decade old, and considerable changes in both the city's land use patterns and urban forest structure have occurred in that time, including a significant impact upon the urban forest canopy and species composition due to the 2013 ice storm and EAB infestation. A street tree inventory is only now being completed – to date, management and operational decisions have been made without the valuable information such an inventory can provide. Fortunately, previously developed decision-support tools, such as the Urban Forest Study and the Region of Peel's Tree Planting Prioritization Tool (TPPT) can help to inform management and will complement the tree inventory upon its completion.

Parts of Brampton's urban forest have also experienced a lack of proactive and strategic management over time. For example, some woodlands in the city have been historically undermanaged, leading to the proliferation of invasive species and other environmental degradation. Some City policies, such as planting and landscaping standards and guidelines, have also facilitated existing urban forest structural challenges. Other operational aspects of urban forest management – such as the City's street tree pruning program, are effective and progressive, and should be supported and continued.

The challenges posed by the structure of Brampton's urban forest and historic approaches to its management will require a wide range of strategies and solutions, which will be outlined in Parts 2 and 3 of Brampton's Urban Forest Management Plan.

1.6.5 Challenge 5 – Climate change

Globally, the years since 2014 have consecutively ranked as the hottest on record. Brampton City Council declared a climate emergency in June 2019 and, in September 2020, endorsed the Community Energy and Emission Reduction Plan (CEERP). These actions recognize that climate change will have a profound impact on Brampton and across the world. In fact, climate change effects are already being experienced and, as the Environmental Commissioner of Ontario (2017) reported, "much bigger changes are ahead". It is therefore expected that Brampton's urban forest, like urban forests everywhere, will face increasing environmental stress as a direct result of climate change in the coming years. This will, in turn, strain the urban forest's ability to help the City mitigate and adapt to climate change, and will increase the need for resources to sustainably manage this essential community resource.

In keeping with established climate change science, the Region of Peel (2018) projects that climate change will lead to an increase in annual mean and summer temperatures, as well as increases in the severity, frequency and duration of droughts. These changes will exacerbate the already challenging conditions experienced by urban trees through heat and drought stress and increased water demand, while more variable precipitation regimes will make it increasingly difficult to rely on rainfall to meet tree water demands. Milder winters may encourage the spread of invasive insect pests and pathogens, and longer growing seasons coupled with more frequent mid-winter warming periods may also increasingly stress trees, which will have difficulty acclimating to such rapid changes. Brampton's urban forest has already experienced weather events and other stresses that may be linked to climate change; for example, the 2013 ice storm caused widespread damage to tens of thousands of trees. Other stressors, such as more frequent and severe flooding and an increasing prevalence of urban forest pests and diseases, may also be tied to climate change.

Fortunately, not all climatic conditions are expected to deteriorate as a result of climate change – projections suggest that the frequency of ice storms and freezing rain events is unlikely to change, and the frequency of freeze-thaw cycles, which increase the incidence of frost cracking and other tree damage, is actually projected to slightly decrease (Region of Peel, 2016).

Maintaining and expanding the urban forest can play some role in climate change mitigation efforts. For example, urban forests can significantly lower the demand for seasonal heating and cooling, thereby reducing energy use and greenhouse gas emissions. Healthy and growing urban trees also sequester and store atmospheric carbon. Perhaps more importantly, however, urban forests are a vital climate change adaptation tools for cities. By providing services such as shading, microclimate cooling, and stormwater and pollutant capture, urban forests will make climate change-affected cities safer and more comfortable places to live as global temperatures increase and weather patterns change.

Although climate change is a global challenge and requires a global response, a wide range of actions will need to be implemented by the City and its partners to help Brampton's urban forest adapt to the adverse effects of climate change and, in turn, to help the City itself adapt. Climate change may also give rise to some opportunities for the urban forest, such as enabling the successful long-term establishment of tree species better suited to warmer or drier climates, such as the Carolinian forest zone.

1.7 Urban forest management in Brampton

The municipally owned and managed portion of Brampton's urban forest is influenced by the decisions and actions several City departments. However, the Parks Maintenance and Forestry division of the Community Services Department is generally considered the 'home' of urban forest management in Brampton, as it is responsible for the City's core urban forest-related operations. Several sections within this division, including Forestry, Horticulture, Cemetery Operations and the Parks Maintenance districts (East and West), may undertake various aspects of urban forest maintenance under the coordination of the Forestry section or on an as-needed basis. Core urban forestry operations undertaken by the Parks Maintenance and Forestry division include:

- Development and maintenance of parks and open spaces
- In-house provision and contract management of urban forest maintenance operations, including:
    - Tree pruning (cyclical and reactive/emergency)
    - Tree and stump removal
    - Tree planting
    - Tree watering and fertilization
    - Tree inspection
    - Tree risk assessment and mitigation
    - Tree inventory and mapping
    - Pest and disease management, including pesticide application
    - Invasive species management
- Providing technical and operational support for planning and policy initiatives

In addition to the Parks Maintenance and Forestry division, many other City services and divisions may also interact with or influence the urban forest. These divisions and their urban-forest related activities include:

In the Corporate Support Services Department:

- Digital Innovation and Information Technology (IT): which helps other City division manage information technology to support business processes and maintains the City's technology platforms,
- Finance: which oversees the development and implementation of the City's Corporate Asset Management Plan (CAMP) and asset management framework, and
- Strategic Communications, Culture, and Events: which, among other functions, communicates City programs and services; engages with key audiences, stakeholders, employees and media; and creates advertising, marketing, and branding.

In the Legislative Services Department:

- Enforcement and By-law Services: which promotes awareness of and enforces City by-laws,
- Insurance and Risk Management: which ensures that proper risk mitigation strategies are implemented by the City, and
- Legal Services: which advises City departments regarding legal implications and risk.

In the Planning, Building and Economic Development Department:

- Building: which, among other functions, administers and enforces the Ontario Building Code to regulate the construction of buildings and administers the zoning by-law,
- City Planning and Design: which delivers planning and design services that guide development, including short and long range policy planning, urban design review, and growth management,
- Development Services: which manages the planning process and processes and makes recommendations on major development applications, and
- Transportation Planning: which manages the development of the Brampton Complete Streets Guidelines.

In the Public Works and Engineering Department:

- Building Design and Construction: which oversees planning, design and construction services for all City owned facilities,
- Capital Works: which delivers capital road infrastructure projects and maintains the asset management inventory for the City's road system infrastructure,
- Environment and Development Engineering: which facilitates the planning, development and delivery of new infrastructure through the subdivision design process; plans for and manages the City's natural heritage features; manages the City's stormwater assets; and manages various design and construction guidelines and standards,
- Facilities Operations and Maintenance: which maintains City-owned facilities, and
- Road Maintenance, Operations and Fleet: which maintains roads and sidewalks.

1.8 Legislative and policy framework

In Canada, urban forests tend to come under the responsibility of local municipalities. The federal and provincial governments occasionally make contributions related to individual emergencies (ice storms, fires, insect infestations etc.) and perform some research, but lack a sustained, long-term commitment for the support of urban forest stewardship.

- ***Canadian Urban Forest Strategy 2019 – 2024***

Urban forest management in Canada is largely the domain and responsibility of municipal and, to a lesser extent, regional governments. Provided that they do not conflict with Federal and Provincial statutes, regulations and policies, municipalities directly and indirectly influence the urban forest through their policies and practices, which may include (but are not limited to):

- Land use zoning
- By-laws: tree and woodlot preservation, site alteration, grading, etc.
- Site plan guidelines and standards
- Engineering guidelines and standards, including for municipal capital projects (e.g. tree planting guidelines, soil standards, etc.) and development
- Urban forest maintenance (e.g., tree pruning, removal, risk mitigation, etc.)
- Urban forest establishment (e.g., tree planting)
- Stakeholder engagement, education, and outreach

Although municipalities are the primary level of government responsible for urban forest management, both the Federal and Provincial governments do maintain a limited level of involvement or influence. Moreover, in Ontario the Provincial government establishes the legislative and regulatory framework influencing many aspects of urban forest management. These roles and responsibilities are described in more detail, below.

1.8.1 Government of Canada

Federal government involvement in urban forestry is limited in Canada. In addition to research support (e.g., climate change impacts, plant health) lead by Natural Resources Canada – Canadian Forest Service (NRCan-CFS), the Canadian Food Inspection Agency (CFIA) regulates, monitors and controls a limited number of priority urban forest insect pests and pathogens under the auspices of the *Plant Protection Act, 1990.* Pesticides, including those used in urban forest pest management, are regulated by the Pest Management Regulatory Agency (PMRA), an agency of Health Canada. The *Migratory Birds Convention Act, 1994* regulates the disturbance of active bird nest sites, which may affect urban forestry operations such as tree pruning or removal. The *Species at Risk Act, 2002* protects threatened species, including several tree species, and their habitats.

1.8.2 Province of Ontario

As with the Federal government, the direct involvement of the Province in urban forestry issues is relatively limited, leaving the majority of responsibilities to municipalities. While the Provincial government has, to a limited degree, engaged in issue-driven and reactive management efforts to some urban forest challenges (e.g., limited EAB research, ice storm response), there is a conspicuous lack of proactive and consistent Provincial leadership in urban forestry (Green Infrastructure Ontario, 2015).

Although there is no comprehensive policy-based guidance related to urban forest planning at the Provincial government level in Ontario, a number of Provincial statutes, regulations and plans influence urban forest management.

Federal and Provincial statutes, regulations, plans and policies relevant to urban forest planning and management in Brampton are summarized in Table 1, below.

Table 1: Summary of Federal and Provincial legislation and regulations related to urban forest management.

Item	Overview	Relevance to Urban Forest Management in Brampton
Federal statutes		
Species at Risk Act (SARA), 2002	SARA regulates species listed as federally Endangered or Threatened including trees known to occur in Peel such as American Chestnut, Eastern Flowering Dogwood, Kentucky Coffee-tree, and Butternut.	Limited relevance as trees listed under SARA are only regulated on federal lands. SARA prohibitions also apply to migratory bird nesting habitat for species also listed in the MBCA (see below).
Migratory Birds Convention Act (MBCA), 1994	The MBCA protects the nests, eggs and young of most bird species from harassment, harm, or destruction. Nesting periods are defined by Environment and Climate Change Canada, also responsible for enforcing this legislation.	To comply with the MBCA approved vegetation removal during the active nesting season should either be avoided so as not to disturb nesting birds, or requires a qualified inspector (e.g., an avian biologist) to screen the area and confirm that no active nests are present immediately prior to works being undertaken.
Fisheries Act, 1985	In Ontario, the federal Department of Fisheries and Oceans Canada (DFO) manages fish habitat and the Ontario Ministry of Natural Resources and Forestry (MNRF) manages fisheries. Fish and fish habitat are protected under the federal Fisheries Act which was last amended on August 28, 2019.	This Act applies to urban forestry in Brampton in cases where serious harm to fish or fish habitat has been approved by the agencies and involves the removal of individual trees and/or treed natural areas. Habitat mitigation and offsetting or compensation are generally identified as part of this process.
Plant Protection Act, 1990	The Canadian Food Inspection Agency (CFIA) is responsible for enforcing this Act and for the	Brampton can leverage CFIA: • As a source of technical and educational resources;

Item	Overview	Relevance to Urban Forest Management in Brampton
	management of regulated invasive non-native species wherever they occur in Canada, defining the pests of regulation concern, implementing plant pest surveillance programs and communicating issues of concern that apply to pest management objectives (e.g., the movement of firewood). Currently regulated pests relevant to the urban forest include Asian Gypsy Moth, Asian Long-horned Beetle (ALB) and Emerald Ash Borer (EAB).	• To help regulate activities in formally identified management zones and undertake follow-up monitoring on pest presence/absence; and • To help inform municipal urban forest planning and management (e.g., area-specific and jurisdiction-wide species selection guidelines).
Provincial statutes, plans and policies		
Conservation Authorities Act, 1990	Credit Valley Conservation (CVC) and Toronto Region Conservation Authority (TRCA) have jurisdiction in Brampton to the west and east respectively. They regulate wooded areas associated with wetlands, watercourses, shorelines, and hazard lands. They also advise the municipalities on aspects of natural area protection and management, including wooded areas.	Brampton staff work with CVC and TRCA in both their regulatory and advisory capacities to minimize disturbance to trees and other natural areas (including woodlands and forests) and pursue mitigation (including wooded habitat replacement and enhancement) where appropriate.
Electricity Act, 1998	Wherein S. 40(4) states, “A transmitter or distributor may enter any land for the purpose of cutting down or removing trees, branches or other obstructions if, in the opinion of the transmitter or distributor, it is necessary to do so to maintain the safe and reliable operation of its transmission or distribution system.”	Brampton and the local electric utility (Alectra) have a good working relationship around tree maintenance, although there are opportunities to enhance coordination.
Endangered Species Act (ESA), 2007	The Ontario ESA regulates the habitat of provincially Endangered or Threatened species and is enforced by the Ministry of Environment, Conservation and Parks (MECP).	In Brampton there are more than 20 such species known to occur including four trees (American Chestnut, Eastern Flowering Dogwood, Kentucky Coffee Tree and Butternut) and four species of bats for which trees may provide critical habitat.
Environmental Assessment Act, 1990	Ontario’s Environmental Assessment (EA) Act provides a process to ensure that governments and public bodies consider potential environmental effects before an infrastructure project begins. In southern Ontario, the act is typically triggered as part of proposals to build or improve electricity facilities	Treed resources both within and outside of significant natural features and areas are and should continue to be considered through the EA process. Opportunities for enhancing protection and/or enhancement of wooded natural areas and treed areas through the EA

Item	Overview	Relevance to Urban Forest Management in Brampton
	and lines, transportation facilities and routes, waste facilities, water and wastewater facilities, and other infrastructure under provincial or municipal jurisdiction. The EA process requires engagement with Indigenous groups and consultation with government experts, stakeholders, and the public.	process may also include consideration of: • The value of existing treed assets including the social and economic services they provide; • Local municipal urban forest policies, guidelines and standards; and • Opportunities to compensate for trees or wooded areas approved for removal, and opportunities to introduce new or additional trees and/or wooded areas to address climate change considerations.
Forestry Act, 1990	This Act regulates aspects of forestry in Ontario and makes provisions pertaining to boundary trees.	Boundary tree provisions of this Act may affect how Brampton issues tree removal permits for trees situated on boundary lines.
Greenbelt Act, 2005, and Greenbelt Plan, 2017	This Act and the Greenbelt plan outline the Greenbelt area, which is intended to permanently protect green space, agricultural lands, forests, wetlands, and watersheds from urban development. Varying levels of protection are extended to natural areas as defined in the plan and identified with guidance from various supporting technical papers (e.g., MNRF 2012). The Greenbelt Plan is an umbrella plan that provides protection to ecological features and functions outside of identified settlement areas and to municipally owned portions of identified Urban River Valleys that connect the Greenbelt to Lake Ontario. Policies encourage the conservation and management of the valleys where these lands are in public ownership.	• The Greenbelt Natural Heritage System extends into a small portion of northwestern Brampton. Wooded natural areas in this system are protected under Greenbelt policies. • Several Urban River Valleys also run through Brampton (and Mississauga) to Lake Ontario. • In addition, the Greenbelt includes some policies related to climate change and green infrastructure that could be considered as part of future municipal plan reviews and updates.
Health Protection and Promotion Act, 1990	The Ministry of Health's *Healthy Environments and Climate Change Guideline* (2018) developed to help implement this Act reinforces the need for municipalities to work with Public Health to ensure natural environment (including urban forest) planning supports: (a) data collection that assists with identification of human health risk factors in the environment related to climate change, (b)	These policy linkages and connections support and reinforce the relationship between having a healthy urban forest and a healthy community. They can be used to support jurisdiction-wide and area-specific investments in urban forest management.

Item	Overview	Relevance to Urban Forest Management in Brampton
	approaches that enable mitigation of these risk factors, (c) strategies that advance a healthy built and natural environment, and (d) alignment of natural environment and public health initiatives where possible.	
Infrastructure for Jobs and Prosperity Act, 2015	Under this Act, the Asset Management Planning for Municipal Infrastructure Regulation (O. Reg. 588/17) includes (a) green infrastructure in the definition of an infrastructure asset and as a consideration in municipal lifecycle management strategies, and (b) a definition for green infrastructure that includes "natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs". This regulation also requires that municipalities consider options to reduce full lifecycle costs of assets, including the potential use of green infrastructure solutions.	This Act and the related regulation provide a basis for municipalities to consider municipally owned and managed natural assets (including the urban forest) as part of overall asset management planning.
Invasive Species Act, 2015	Ontario's Invasive Species Act (2015) provides the Province with the authority to: (a) make regulations prescribing invasive species, (b) classify invasive species as either prohibited or restricted, (c) designate an invasive species control area, and (d) prescribe and enforce actions to control or eradicate the classified species, including development of a prevention or response plan.	Currently, no tree pests are prescribed under this Act. However, Brampton could explore options for leveraging the *Invasive Species Act* as an educational tool and potentially even a regulatory tool if selected "high priority" invasive plants and/or pests were to be listed.
Municipal Act, 2001 and *Modernising Ontario's Municipal Legislation Act, 2017 (MMA)*	The *Municipal Act*, 2001 broadly establishes municipal powers. The *MMA* updated this Act and gave municipalities more responsibility and power to protect 'green infrastructure'. The *MMA* now requires municipalities to enact policy pertaining to "The manner in which the municipality will protect and enhance the tree canopy and natural vegetation in the municipality." The *Municipal Act*, 2001 enables local municipalities of any size to prohibit or regulate the destruction	Under the *Municipal Act* (2001) (Section 135) local municipalities are given the authority to develop tree by-laws and regional municipalities are given the authority to develop woodland by-laws. However, regional and local municipalities can delegate these powers to each other as long as the by-laws are harmonized. In Peel, the Region has delegated its tree by-law authority to Brampton. Brampton has enacted a series of tree by-laws to regulate activities that may impact trees

Item	Overview	Relevance to Urban Forest Management in Brampton
	or injuring of trees, enables upper-tier jurisdictions to regulate the same in woodlands, and enables municipalities to regulate other aspects of the natural environment.	in woodlands (316-2012), on private properties (317-2012), along municipal boulevards (163-2013) and in municipal parks (163-183).
Ontario Heritage Act, 1990	This Act is primarily intended to be used for the designation of heritage buildings and landscapes but can capture wooded areas and can also be used to designate specific trees of historical and/or cultural value.	Most municipalities in Ontario do not use the Heritage Act as a legislative tool to regulate tree protection because it is a lengthy process that provides protection for only a small subset of trees. This is the case in Brampton which exclusively relies on the authority granted under the Municipal Act.
Ontario Public Health Standards, 2009	Provide direction to Boards of Health to promote healthy built environments and policies supportive of healthy communities.	These standards can lend support to planning initiatives and decisions that support integrating the urban forest into the built environment.
Places to Grow Act, *2005* and Growth Plan for the Greater Golden Horse-shoe (2019)	This Act and the associated plan establish a range of controls, targets and requirements for the development and expansion of existing settlement areas. The plan's definition of green infrastructure includes urban forests.	Growth and development in Brampton must conform to the provisions of the Growth Plan.
Planning Act , *1990* and Provincial Policy Statement, 2020	This Act empowers Ontario municipalities to develop official plans and regulate development, including requiring landscaping with trees and shrubs. The Provincial Policy Statement (PPS) is the most important and effective planning tool at the Provincial level for ensuring the long-term protection of treed natural areas in Ontario. The most recent iteration (2020) recognizes the value of green infrastructure (including the urban forest), and the need for communities to mitigate and adapt to climate change. Section 1.8.1 states, "*Planning authorities shall support energy conservation and efficiency, improved air quality, reduced greenhouse gas emissions, and preparing for the impacts of a changing climate through land use and development patterns which: g)*	Brampton builds on the PPS policies to help protect trees associated with natural heritage features and areas identified as significant in its Official Plan (see Section 5.1). The PPS also contains high-level policies around green infrastructure and climate change which allows municipalities to undertake activities related to both mitigation and adaptation (including activities related to urban forestry).

Item	Overview	Relevance to Urban Forest Management in Brampton
	maximize vegetation within settlement areas, where feasible."	
Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan, 2018	This plan establishes four goals, including: • Protecting air, lakes, and rivers • Addressing climate change • Reducing litter and waste and keeping land and soil clean • Conserving land and greenspace	Plan implementation may encourage increased Provincial support for urban forest management (TBD)

1.8.3 Region of Peel and City of Brampton

A number of Region of Peel and City of Brampton policies, strategies and plans provide direction and guidance related to urban forest planning, management and enhancement in Brampton. These guiding documents include:

Region of Peel

- Climate Change Master Plan 2020-2030 (2019)
- Healthy Development Index
- Official Plan (office consolidation 2018)

City of Brampton

- Brampton 2040 Vision (2018)
- Complete Streets Guide (2021, pending approval)
- Eco Park Strategy (2019)
- Grow Green Environmental Master Plan (2014)
- Natural Heritage Environmental Management Strategy (2015)
- Natural Heritage Restoration Program (2019)
- Official Plan (2006, office consolidation 2020)
- One Million Trees Program (2019)
- Sustainable Community Development Guidelines (2013)

These are discussed in detail in Sections 3.2.1 and 4.2.3. Other Region of Peel and City of Brampton plans and guiding documents (e.g., Parks and Recreation Master Plan, 2017) may also influence Brampton's urban forest through the implementation of their strategies and actions, but are not considered as providing strategic or policy guidance for urban forest management.

1.9 Strategic direction for Brampton's urban forest

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) assessment matrix for Brampton's urban forest as a biological system and for the management and usage of data and information about it.

The section also assesses Brampton's performance in seven criteria related to the urban forest and its assessment, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool – the most recent iteration of the established Criteria and Indicators of Urban Forest Sustainability assessment framework (C&I) (Clark et al., 1997; Kenney, van Wassenaer and Satel, 2011; Leff, 2016). It should be noted that the Assessment Tool's scoring system was modified for the purposes of this UFMP by eliminating the negative score (-1) for "Low"-level performance assessments. To avoid unduly penalizing performance and to recognize the valuable contribution of even low-level programs, policies and practices, the score for this performance indicator was increased to zero (0).

The SWOT matrix and C&I assessments informed the development of strategic directions for Brampton's Urban Forest Management Plan, presented at the end of the section. The strategic directions will be addressed through UFMP strategic goals, objectives, and action items.

1.9.1 SWOT matrix analysis

Table 2: SWOT matrix for Brampton's urban forest.

Strengths	Weaknesses
Urban forest (biological system): • Relatively high tree species diversity in residential land uses may contribute to resilience. ***Urban forest (information):*** • Several different urban forest-related monitoring programs are already in place. • Tree planting monitoring element is included in City's publicly available GeoHub dashboard. • Some existing knowledge of urban forest structure and function (e.g., 2010 UTC analysis, 2011 Urban Forest Study, 2017 canopy cover study, partial tree inventory). • Tree inventory (under development) will inform UFMP, operational planning, and urban forest maintenance/establishment operations. • Decision support tools already in place and can be utilized and built upon (e.g., Peel TPPT, UTC/PPI analysis). • Staff have good working/anecdotal knowledge of many urban forest conditions. • Some knowledge of the private components of the urban forest on sample/aerial basis (2011 Urban Forest Study, 2008 data).	***Urban forest (biological system):*** • Low overall tree species/genus diversity increases vulnerability to wide range of external stressors (e.g., pests, diseases, climate change). • Size/age class composition skewed largely towards small/young trees, which reduces provision of services/benefits and threatens service decline/loss if trees do not mature. • Invasive species are established across the city. • Low trees per capita and per hectare relative to comparator municipalities. • Less than one-half of trees in good or excellent condition. ***Urban forest (information):*** • Coordination of monitoring is limited and has not been used to effectively guide management. • Urban forest-specific monitoring is limited, incomplete or sporadic. • Tree inventory incomplete and currently limited to residential street trees. • Urban forest study data outdated (2008/09 data, 2010/11 analysis). • No program of citizen science/public engagement through access to tree inventory or other means.
Opportunities	**Threats**
Urban forest (biological system): • Existing small/young trees are the foundation of future mature trees is maintained. • Underutilized and novel species may be suitable and should be used. • Ongoing development presents an opportunity to enhance various metrics of urban forest structure (e.g., diversity) and tree growing/maintenance conditions. ***Urban forest (information):*** • Tree inventory (in development) will increase understanding of the urban forest and facilitate management, planning and monitoring. • Urban forest-related monitoring elements of existing plans and strategies can be coordinated through the UFMP. • Tree inventory is planned to increase scope beyond residential street trees. • Tree inventory can be integrated with asset management systems. • Existing information and tools can be used to a limited degree to inform planning and management.	***Urban forest (biological system):*** • Urban forest challenges (see Section 1.6) pose threats to health, functioning and sustainability of the urban forest. • Risk of environmental degradation due to invasive species. ***Urban forest (information):*** • Tree inventory can become rapidly obsolete without active management and integration with asset management systems. • Future changes to information technology frameworks could render urban forest inventory unusable; system compatibility must be maintained.

1.9.2 Criteria and Indicators assessment

Table 3: Criteria and Indicators assessment of seven criteria related to Brampton's urban forest and its assessment, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (0)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Measure Your Current Tree Canopy and Set Goals	CANOPY COVER: NO DATA, NO ACTION	Achieve desired degree of tree cover, based on potential or according to goals set for entire municipality and for each neighborhood or land use.	The existing canopy cover for entire municipality is <50% of the desired canopy.	The existing canopy is 50%-75% of desired.	The existing canopy is > 75%-100% of desired.	The existing canopy is >75%-100% of desired- at individual neighborhood level as well as overall municipality.	Assumes UTC target of 20%, no actual UTC target has been established in Brampton.
Urban Forest Inventory and Assessment	INVENTORY	Current and comprehensive inventory of tree resource to guide its management, including data such as age distribution, species mix, tree condition, and risk assessment.	No Inventory	Complete or sample-based inventory of publicly owned trees.	Inventory guides planning, management decisions.	Systematic comprehensive inventory system of entire urban forest -with information tailored to users and supported by mapping in municipality-wide GIS system. Provides for change analysis.	Tree inventory is in progress; actual ranking is between Low (-1) and Fair (1). Zero (0) points awarded.
Urban Forest Inventory and Assessment	ASSESSMENT METHODOLOGY	Urban forest policy and practice driven by accurate, high-resolution, and recent assessments of existing and potential canopy cover, with comprehensive goals municipality-wide and at neighborhood or smaller management level.	No Assessment	Low-resolution and/or point-based sampling of canopy cover using aerial photographs or satellite imagery, for example i-Tree Canopy.	Complete, detailed, and spatially explicit, high-resolution Urban Tree Canopy (UTC) assessment based on enhanced data (such as LIDAR) accompanied by comprehensive set of goals by land use and other parameters.	As described for "Better" rating- and all utilized effectively to drive urban forest and green infrastructure policy and practice municipality-wide and at neighborhood or smaller management level.	2010 UTC analysis and 2011 Urban Forest Study findings are outdated. Assessment methodology exceeds minimum for Fair (1) category but does not satisfy requirements for Good (2).
Know What's Happening to Trees in Your Community	ASSESSMENT OF PUBLICLY-OWNED TREES	Current and detailed understanding of the condition and risk potential of all publicly owned trees that are managed intensively (or individually).	No Information	Sample-based tree inventory indicating tree condition and risk level.	Complete tree inventory that includes detailed tree condition ratings.	Complete GIS tree inventory that includes detailed tree condition and risk ratings.	
Know What's Happening to Trees in Your Community	ASSESSMENT OF TREES ON PRIVATE PROPERTY	Understanding of extent, location, and general condition of privately owned trees across the urban forest.	No Information	Aerial, point-based assessment- capturing extent and location.	Bottom-up sample based assessment, as well as basic aerial view.	Bottom-up sample based assessment, as well as detailed UTC analysis of entire urban forest, including private property, integrated into municipality-wide [multi-agency] GIS system. LIDAR and hyper-spectral imaging most helpful.	2010 UTC analysis and 2018 "vegetation" layer include trees on private lands. 2011 Urban Forest Study includes sample-based assessment of urban forest on private lands. UTC and UFS findings are outdated.
Urban Forest Characteristics	RELATIVE PERFORMANCE INDEX BY SPECIES	Understanding the age, health and condition of publicly-owned trees, by species. Note: Establishing an RPI for common public tree species requires at least a sample-based field inventory and assessment.	No Information	Six most common species have lower RPI scores than the average of all species in community. (<1.)	Half of the six most common species have higher RPI scores than the average of all species in community. (>1.)	All six most common species have higher RPI scores than the average of all species in community. (>1.)	No RPI assessment due to incomplete tree inventory.
Urban Forest Characteristics	USE OF NATIVE VEGETATION	Preservation and enhancement of local natural biodiversity.	No coordinated focus on native vegetation.	Voluntary use of native species on publicly and privately owned lands: invasive species are recognized.	Use of native species is encouraged on a project-appropriate basis in all areas; invasive species are recognized and discouraged on public and private lands.	Native species are widely used on a project-appropriate basis in all areas; invasive species are proactively managed for eradication to the full extent possible.	Multiple non-native and some potentially invasive species are listed as approved in City's Landscape Guidelines (see Section 3 – Growing Brampton's Urban Forest).

1.9.2.1 Criteria and Indicators assessment summary

Using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, Brampton's performance in seven criteria related to the urban forest and its assessment scores 7 out of 28 (25%). The lack of a completed tree inventory or other up-to-date and comprehensive urban forest assessments precludes several of the analyses for which points are awarded, therefore partly explaining the low performance score. Furthermore, in the absence of a vision, goals, and objectives for the urban forest (to be established in Part 2 of the UFMP), this assessment assigns the Optimal performance level as the performance target for each criterion. However, Brampton's actual performance target levels will be established in Part 2 of the Urban Forest Management Plan, and may be lower than the Optimal level for some or all criteria. In this case, although the number of points awarded for the City's current status will not change, Brampton's relative performance in this series of criteria may increase.

1.9.3 UFMP directions

Currently, aspects of both the structural elements of Brampton's urban forest as a biological system and the City's approaches to building knowledge of the urban forest exhibit considerable shortcomings. However, there are strategic opportunities to improve the understanding of the structure and function of Brampton's, to incorporate that knowledge into urban forest management planning and operations, and to enhance the urban forest resource itself over time. These are outlined below.

1.9.3.1 Increase urban forest diversity by various metrics and at different scales

Urban forest diversity by various metrics (e.g., genetics, species, genus, family, size/age class, condition, etc.) is essential for promoting resilience against a broad range of external stressors ranging from pests and diseases, to difficult urban growing conditions, to climate change and others. Increasing diversity by definition increases the heterogeneity of the urban tree population, buffering the entire system against stressors which target selected characteristics (e.g., species, age) and promoting adaptative capacity among the remaining population.

Although species richness is relatively high in residential areas due to ornamental plantings, overall urban forest diversity in Brampton is low by various metrics. At various scales for which data are available, it is apparent that the urban forest is dominated by a relatively small number of tree species and genera, including several non-native species (Norway maple and European buckthorn), with invasive tendencies and other undesirable traits. The perils of low urban forest species diversity were clearly evidenced by the combined ravages of the 2013 ice storm and emerald ash borer infestation upon the city's ash trees, which led in some cases to entire neighbourhoods losing virtually all of their street trees nearly overnight. Urban forest size/age class distribution is also highly skewed towards small and young trees, which provide fewer valuable urban forest services than larger and older trees.

Due to local differences of geography, land use and other factors among various municipalities, there is no single definitive set of targets for optimum urban forest structure, and the various guidelines for tree population species, genus and family-level diversity that do exist in the scientific and technical literature have limited basis in scientific research. For example, the optimum age class distribution proposed by Richards (1983), though often cited and generally considered appropriate, is not rigorously science based. As such, Brampton's UFMP should outline a range of approaches to enhance urban forest diversity by different metrics and at varying spatial scales. These approaches may include, among others, reducing reliance on overabundant species, undertaking trials of novel and underutilized species, ensuring that trees are able to reach mature size/age classes through enhancing growing environments and maintenance practices, using and refining existing decision-support tools and processes, and promoting private-land urban forest stewardship in combination with educational outreach. Efforts to increase urban forest diversity should also account for local conditions, which may value the aesthetics associated with species and age class uniformity or similar considerations. However, such deference should not come at the expense of strategic needs for pest and disease prevention or other important urban forest management objectives.

It must be recognized that significant improvements in urban forest diversity cannot be achieved in a short timeframe. Instead, sustainable urban forest management requires long-term and strategic approaches that consider existing urban forest structure at various scales, opportunities and challenges for enhancing diversity through existing programs and practices, and the development and undertaking of new urban forest establishment and maintenance initiatives.

1.9.3.2 Establish and pursue urban forest targets/performance indicators

Like elsewhere, urban forest management in Brampton has increasingly been supported and, to some degree, directed by targets for various metrics and at different scales. Existing targets are described in detail throughout in this report, and include among others: site-level canopy cover, soil volume and other performance-related targets for development applications; tree species, genus and family-level targets recommended in the 2011 Urban Forest Study; and the One Million Trees Program tree planting target.

Brampton's UFMP should, where feasible, incorporate these targets and consider, if appropriate, the establishment of additional targets and performance metrics for the urban forest. These may include:

- **Canopy cover:** the UFMP should outline action items and implementation guidance to undertake the assessments necessary to develop canopy cover targets at both a city-wide scale and at different spatial scales (e.g., land use, ward, etc.). A canopy cover target (or targets) would need to account for the City's existing commitments under the One Million Trees Program.
- **Urban forest structure:** the UFMP should consider establishing long-term targets for tree species, genus, size/age class and condition. These targets may mirror or differ from those outlined in the 2011 Urban Forest Study.

- **Performance indicators:** using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, the UFMP should establish performance indicator targets, ranging from Low to Optimal, for each of the 28 urban forest management criteria. The City's current performance relative to these criteria is described in this part (Part 1) of the UFMP.

- **Others:** other targets may be established or considered.

Targets must be supported by actions and resources that will enable the planning and operations necessary to achieve them, and by a comprehensive program of urban forest monitoring to track implementation progress and facilitate adaptive management. It must also be recognized that due to the usually slow pace of change among a population of trees, the achievement of many urban forest targets will be a long-term pursuit exceeding the 10-year planning horizon of Brampton's Urban Forest Management Plan.

1.9.3.3 Leverage and enhance existing decision-support tools

Several decision-support tools are already available for use by the City of Brampton to facilitate urban forest planning and operations. These include the 2010 Urban Tree Canopy (UTC) and Potential Plantable Area (PPA) assessment, the 2011 City of Brampton Urban Forest Study (technical report, including Priority Plantable Index (PPI) mapping), and the Peel Region Tree Planting Prioritization Tool (TPPT). The City's tree inventory, which is currently under development, will represent an additional valuable decision-support tool.

To date, these use of these tools in guiding urban forest management in Brampton has been limited. The UFMP should provide detailed guidance about how these tools can be better integrated into urban forest planning and operations, such as target-setting or prioritizing tree establishment efforts in conjunction with the City's One Million Trees Program. The UFMP should also outline actions to enhance the data and analyses underlying these decision-support tools to ensure they reflect the current condition of Brampton's urban forest.

1.9.3.4 Complete, maintain and enhance the tree inventory

Brampton is currently undertaking its first inventory of City-owned and intensively managed trees, commencing with trees in the municipal right-of-way along residential streets. Brampton ultimately plans to inventory all City-managed street trees, trees in actively managed park areas, and selected trees in valley lands and woodlands. However, the inventory plan is not fully formed or supported by committed resources for data collection and long-term management.

The Brampton UFMP should outline strategies and actions to support a comprehensive inventory of all intensively managed City-owned trees and, if possible, selected private trees. To enhance its utility as a management decision-support tool, the tree inventory must be supported by a detailed and appropriately resourced plan to ensure it is integrated with urban forest maintenance and broader asset management systems. The plan should also ensure that tree inventory data currency is maintained on a near real-time basis to reflect the current condition of Brampton's urban forest. Opportunities to use the inventory as an urban forest education and stewardship engagement tool should also be explored and integrated into UFMP action items.

2 Maintaining Brampton's urban forest

2.1 Overview

Brampton's urban forest requires active and ongoing maintenance to sustain and enhance its health, condition, functional capacity to provide services, and safety. The various urban forestry operations undertaken by the City and its contractors are intended to ensure that:

- Tree health and longevity are promoted, thereby reducing removal and replacement costs, increasing urban forest cover, and enhancing the provision of valuable urban forest services,
- Trees are able to attain their maximum genetic potential for size and leaf area, thereby providing a wide range and greater value of urban forest services,
- Tree-related risk to persons and property is managed at a reasonable level, and
- Potentially harmful urban forest pests and diseases are identified and managed within acceptable thresholds.

This section of the UFMP reviews urban forestry maintenance practices and operations in Brampton and identifies potential strategies to enhance the undertaking of this critical aspect of urban forest management. Elements of urban forest maintenance operations reviewed in this section include:

- Program administration
- Tree maintenance
- Tree risk management
- Pest, disease and invasive species management
- Wooded natural areas management,
- Urban forest monitoring, and
- Other program elements

Tree maintenance activities related to post-planting and establishment care, such as watering or mulching, are addressed in Section 3 – 'Growing the urban forest'.

2.2 Current status and best practices

2.2.1 Program administration

2.2.1.1 Scope of urban forest maintenance

Urban forest maintenance operations in Brampton are primarily the responsibility of the Parks Maintenance and Forestry division of the Community Services Department. Division staff and contractors undertake a combination of proactive and reactive maintenance operations for City-owned street trees, trees in actively managed park areas, and trees associated with municipal facilities and other City of Brampton properties. Core urban forestry maintenance operations include:

- Tree pruning (cyclical and reactive/emergency)
- Tree and stump removal
- Tree planting
- Tree watering and fertilization
- Tree inspection
- Tree risk assessment and mitigation
- Tree inventory and mapping
- Pest and disease management, including pesticide application
- Invasive species management
- Providing technical and operational support for City planning and policy initiatives

Tree establishment is also a major component of urban forestry operations, and is addressed in Section 3.

The 2011 Urban Forest Study estimated that Brampton's entire urban forest comprises some 3.6 million trees. While much of the urban forest is found on privately-owned lands, it is estimated that the City may be responsible for approximately 250,000 to 300,000 street trees alone. Due to the absence of a comprehensive tree inventory, however, the actual number of trees along streets and in parks and natural areas that are the City's direct management responsibility is currently unknown. The City assumes maintenance responsibility for the publicly owned portion of boundary trees, and may prune or remove private trees to mitigate an unacceptable level of risk posed to public property (e.g., streets, sidewalks) or assets.

2.2.1.1.1 Interdepartmental coordination

Guided by Action 2.1 of the Eco Park Strategy, the City has mobilized a Green City Working Group to bring together staff from the Parks Planning and Development; Parks Maintenance; and Forestry, Horticulture and Cemetery Services units of the Parks Maintenance and Forestry Division (Community Services Department), and the Environmental Planning and Stormwater Management units from the Environment and Development Engineering Division (Public Works and Engineering Department.) The group will work together to strengthen the already effective interdepartmental coordination and cooperation on urban forestry issues. The Working Group

should work to resolve the occasional lack of clarity identified by staff concerning roles, responsibilities and procedures related to urban forest maintenance and, more commonly, protection. The group should continue to meet on a periodic and as-needed basis to enhance communication; promote awareness of each division's roles, responsibilities and expertise; and promote a consistent approach to various aspects of urban forest management. The function of Green City Working Group may also be enhanced by broadening its membership to regularly or occasionally include staff from other City divisions whose policies, programs, and practices may affect the urban forest. These divisions may include, but are not limited to, Building, Capital Works, City Planning and Design, Development Services, and Enforcement and By-law Services, among others.

Best practices – Interdepartmental urban forestry working group

Mississauga established an urban forest working team of staff from the City's planning, parks, engineering, and transportation departments meet bi-monthly to discuss and resolve urban forest-related issues. The UFMPs for the Town of Oakville and Saanich, B.C., among others, recommend proactive and formalized collaboration.

2.2.1.1.2 Interagency coordination

Brampton is a member of the Peel Urban Forest Working Group, which meets regularly to coordinate on broader urban forest strategic initiatives or special projects. In the past, the City used to maintain street trees along Regional roads, but this relationship has changed in recent years as the Region of Peel has begun to contract out maintenance of its own trees. There is limited coordination between the City and the Region on the maintenance of Regional road trees, trees that may be jointly owned by Brampton and Peel, or trees whose ownership is otherwise unclear. The current arrangement also leads to occasional confusion for residents or others about the nature or undertaking of tree maintenance and establishment works along Regional roads.

The City has also coordinated directly with other municipalities on urban forest-related projects, such as the joint development of the Sustainability Metrics Tool with Richmond Hill and Vaughan (see Sections 3 and 4). The Canadian Food Inspection Agency (CFIA) and Brampton continue cooperation on urban forest pest monitoring efforts on an as-needed basis.

Best practices – Regional/municipal coordination

The Peel Region Urban Forest Working Group, established as an outcome of the Peel Region Urban Forest Strategy (2009), convenes representatives of the Region and the area municipalities of Brampton, Caledon, and Mississauga to build focus and consistency across departments and agencies. The group is a leading example of interagency coordination on both high-level and project-specific urban forestry issues.

2.2.1.2 Program resources

2.2.1.2.1 Funding and budget

Urban forest management in Brampton is supported by both Operating and Capital budgets, approved by Council on an annual basis. The tree main sources of urban forestry capital funding include project-based capital funding (e.g., EAB management), valleyland restoration, and road and infrastructure capital projects which may include tree protection or planting.

The City's recently adopted Tableland Tree Compensation requirements will also provide a source of funding to plant trees as compensation for tree removals.

A $2.7 million annual capital funding request for the Urban Forest Canopy Program was approved in December 2021 to support enhanced tree maintenance, woodlot/valleyland strategies, invasive species management, and citywide tree planting and tree establishment care initiatives.

Best practices – Operating budget

Based on 2018 data (the latest data available for all compared municipalities at the time of publication), including an operating budget of $2.65 million for urban forest maintenance operations and an estimated population of 656,900, Brampton's 2018 urban forestry operations expenditure of $4,034 per 1,000 residents ($4.03 per capita) ranked considerably below the national median ($7,672) and average ($9,246) levels based on a survey of 22 Canadian municipalities.

2.2.1.2.2 Staffing

The Parks Maintenance and Forestry division is largely focused on undertaking urban forest maintenance operations. Staff from other divisions (most notably Environmental Planning), are routinely requested to lead or support various non-operational urban forest management initiatives or processes, such as strategic planning, policy review and development, project management, or development application and permit review. Current organizational structures and staffing levels compromise some aspects of operational efficiency and effectiveness and limit the City's ability to deliver the full range of services necessary to maintain and enhance the urban forest.

Brampton's staffing resources for urban forest maintenance operations include 16 full-time arborists, which exceeds selected comparator municipalities by several metrics, including street trees per arborist, residents per arborist/arborist per capita, and municipal land area per arborist. However, the proportion of arborists who maintain current International Society of Arboriculture (ISA) Certified Arborist certification is less than half, which underperforms selected comparator municipalities.

Despite this relatively large complement of arborists on staff, the Parks Maintenance and Forestry division is limited in its capacity to undertake the broader range of urban forestry-related activities beyond tree maintenance. Currently, the division is limited in its ability to

undertake or support tree preservation by-law and development/building application review and compliance enforcement; contract administration for tree planting and maintenance operations; wooded natural areas management; pest, disease, and invasive species management; and strategic planning; in an effective or timely manner.

The organizational structure of the Parks Maintenance and Forestry division is largely 'flat', and is predominantly composed of urban forest maintenance operations staff, including arborists and associated forepersons and supervisors. Notably absent from the division's organizational structure are specialized units or staff (e.g., strategic planning, Integrated Pest Management, inspection and enforcement, natural areas and woodlot management, risk assessment, asset management, education and outreach, etc.). Instead, many divisional staff are often required to multi-task and fulfill a wide range of roles and responsibilities on an as-needed or *ad hoc* basis. This current structure compromises operational efficiency and effectiveness, as staff without specialized training may be required to undertake technical operations that require specialized expertise. Moreover, because existing urban forest-related strategic initiatives and policies have historically been developed by staff or in other departments or divisions, there are considerable gaps between operational capacity (i.e., staffing, expertise, budget) and the resources needed to achieve higher-level objectives and implement established actions and initiatives.

Given the expected increase in Environmental Planning staff responsibilities that is likely to occur as a result of ongoing development, Brampton's climate change commitments, and other ongoing environmental initiatives (e.g., One Million Trees Program, Grow Green Strategy, Brampton Eco Park, etc.) it is likely that this division's ability to support urban forest planning and management will be diminished in the near future. As such, Parks Maintenance and Forestry's internal capacity to deliver urban forestry programs more effectively, efficiently, and strategically, will need to be enhanced through an expanded and diversified organizational structure and associated resources.

Best practices – Urban forestry program structure and administration

Due to significant differences in organizational structures, service levels and other characteristics between municipalities, there are no definitive best practices for urban forest management and maintenance program administration. However, the Society of Municipal Arborists (SMA) provides some guidance for urban forestry department structure (in Miller et al., 2015):

- Maximum 10,000 street trees per climbing arborist
- Maximum 10-year pruning cycle
- Minimum 20 hours training per staff member per year
- One in five staff should be ISA Certified or equivalent
- Minimum of 30% of urban forestry budget should be spent on tree maintenance
- Maximum 30% of budget spent on tree removal and administration (each)
- No more than 30% of labour time spent on request-based maintenance
- Minimum 5% of budget for tree establishment
- At least $2.00 USD ($2.60 CAD) per capita on urban forest budget

The City of Mississauga's Forestry Section, under the Parks, Forestry & Environment Division of the Community Services Department, includes 51 staff in seven units, including Forestry Operations, Woodlands and Natural Areas, Tree Preservation and Protection, Forestry Inspections, Contract Administration, Forestry Analyst, and Infrastructure Management Asset Coordinator. Staff in these units report to supervisors who work collaboratively minimize the 'silo' effect and pursue shared departmental goals under the direction of the Forestry Manager. Staff from different units may work together on various assignments, but the Section's division into discrete units enables staff roles and responsibilities to be clearly defined.

In the City of Ottawa, responsibility for the urban forestry program is shared between the public works and planning departments. In a unique arrangement, two "Planning Forester" staff positions are housed in the planning department, greatly facilitating review of tree-related aspects of planning and other permit applications, including the City's tree by-law.

2.2.1.3 Guiding policies

Urban forest maintenance operations in Brampton do not appear to be guided by specific departmental/divisional policy statements or a formalized 'Levels of Service' (LoS) document. However, the City has established service levels for urban forest maintenance operations, including service request response time (inspection and action) and street and park tree cyclical pruning (see Section 2.2.2). Contracted tree pruning is guided by tree maintenance contract stipulations, including written pruning standards.

Best practices – Levels of Service (LoS)

In an effort to enhance asset management planning and implementation, municipalities are increasingly articulating departmental Levels of Service in operating manuals or departmental policies. Level of Service (LoS) can be defined as "service quality for an activity against which service performance may be measured", and may include a commitment to undertaking a given operation within a specified timeframe, duration or frequency. Defining a LoS for different urban forestry operations can support program resourcing requirements, demonstrate fulfillment of legal Duty of Care, ensure effective operations, and manage customer service expectations.

Examples of municipalities with defined Levels of Service for urban forestry maintenance operations include: Aurora, Lethbridge, Markham, Red Deer, Richmond Hill, and Saskatoon. Richmond Hill's POLOSS (Parks Operations Level of Service Study) document identifies a target condition for street and park trees and trees in natural areas, with a focus on tree health, safety, sight lines and ecological functioning, and recommends consideration of a 5-year pruning cycle to optimize condition. Markham has developed a comprehensive Urban Forestry Operations Manual that outlines Level of Service standards for 16 urban forest maintenance operations, such as tree inspection, pruning, removal, stumping and planting, among others.

Best practices – Urban forestry policies

Aurora maintains among the most comprehensive set of urban forest policies of Canadian municipalities. The Town's Urban Forest Management Policy (2015) includes a comprehensive review of all municipal urban forest management operations and activities, outlines departmental goals and objectives, and includes eight comprehensive policy appendices related to landscape design guidelines, planting, removal and pruning, compensation, protection, emergency response, safety, heritage trees and memorial trees.

Red Deer, AB also maintains a series of urban forest policies related to risk management, tree pruning, setback trees (trees on lawn areas of the right-of-way), downtown tree maintenance, and community tree planting programs.

2.2.2 Tree maintenance

2.2.2.1 Overview

Tree pruning is the most common municipal urban forest maintenance operation, and accounts for the largest single share of the City's urban forestry operating expenditures. Pruning involves the selective removal of tree branches and foliage for a variety of reasons, such as providing clearance, mitigating risk, promoting tree health, or shaping crown form, among others. Pruning of Brampton-owned and managed trees is undertaken by both City staff and contractors, with an approximately 60:40 split between City staff and contracted effort. City residents are not permitted to undertake any maintenance of City-owned trees, including pruning.

As in all municipalities, tree pruning and other urban forest maintenance operations in Brampton are undertaken both reactively and proactively. Proactive maintenance aims to pre-empt and prevent problems of tree health and condition through scheduled service delivery. Conversely, reactive maintenance is typically undertaken in response to resident or staff-initiated service requests in response to identified issues with tree health, structure, or other conditions.

Best practices – Service delivery models

A joint service delivery model, whereby urban forestry operations are undertaken by both in-house staff and contractors, is the norm among most larger and mid-sized Canadian municipalities, and few if any are known to provide services solely on an in-house or contracted basis. There are a few exceptions – in Red Deer, AB, almost all urban forest maintenance operations except technical tree removals are undertaken by staff. Conversely, in Brantford, ON all work is undertaken by contractors under staff coordination.

Typically, cost is known to be lower with contracted services, but work quality tends to be higher with in-house services. In 2019, Toronto's Auditor General estimated an annual productivity loss of $2.6 million due to certain practices such as inaccurate logging and failure to perform scheduled work by contractors. Such practices could have adverse long-term effects upon the urban forest as trees may not receive maintenance until the next scheduled maintenance 7 years later. Contractor and City crew operations should be GPS-logged and verified with consistent inspections.

In Toronto, residents can engage City-approved contractors to undertake certain maintenance activities on City-owned trees at the residents' expense. This may enable a higher level of maintenance for trees which would otherwise only be maintained through the pruning cycle.

Best practices – Arborist licensing

In a novel approach among Canadian municipalities, the Town of Oakville in 2018 enacted a by-law requiring the licensing of arborists operating in the Town. The intent of the by-law is to protect arboricultural service consumers and the urban forest by ensuring that licensees demonstrate prescribed educational and certification requirements. The by-law establishes four classes of licensing for arborists, arboricultural companies, tree companies, and landscaping/ tree companies. Annual license fees range from $347 to $552. Prior to enacting the by-law, the Town held two open house meetings to consult with industry stakeholders and the public.

2.2.2.2 Standards and specifications

Pruning of City-managed trees is guided by two sets of pruning standards: the tree maintenance contract standards administered by the Parks Maintenance and Forestry division and applicable to contracted urban forestry operations such as the tree pruning cycle, and Landscape Specification No. 02232 – Tree Pruning, applicable to development and City capital projects. There is a moderate level of technical inconsistency between these standards, and parts of both standards do not align with current standards for tree pruning and urban forest management. If integrated into tree maintenance contracts, the technical structure and format of the pruning specification No. 02232 may facilitate consistent implementation and contract performance auditing.

Best practices – Pruning standards and specifications

Tree pruning should be undertaken in general accordance with the *ANSI A300 (Part 1) – 2017 Pruning* standard and associated International Society of Arboriculture Best Management Practices (BMPs). This guidance recognizes that pruning must have an objective, and must be implemented using recognized and acceptable techniques and procedures. The Standard and BMPs are not pruning specifications – every pruning assignment should be guided by written specifications that conform to ANSI/ISA guidance but reflect local conditions and requirements. For example, York Region developed its own comprehensive tree pruning specifications based on the ANSI A300 standard.

2.2.2.3 Reactive maintenance

The Parks Maintenance and Forestry division undertakes tree maintenance on a reactive basis in response to customer (resident or staff)-initiated tree service requests. Customers can initiate tree service requests through the City's 311 call centre, the 311brampton.ca online portal, via email, or through the Pingstreet mobile device application.

The online portal enables customers to initiate requests for five discrete service categories, including:

- Report damaged trees
- Report dead or unhealthy trees
- Request new/replacement tree
- Tree debris cleanup required
- Tree pruning or removal required

Through a “Learn More” link, each of the five service categories is supported by a detailed description of the category, enabling requesters to ensure that the correct category is selected and to understand the City’s service levels and process. The online service request form enables requesters to submit supporting information such as location, photographs, descriptions, and contact details.

Upon receipt of the request, a Service Request (SR) is generated and forwarded to a City Forestry Inspector for follow-up. SRs are addressed on a priority basis depending upon the request category and supporting details, and Forestry Inspectors leave a doorhanger notice advising of the inspection and providing a follow-up service request number. Brampton has established an initial inspection response target of 90 days in peak periods (Nov. 15 to Mar. 15) and 35 days in off-peak periods (Mar. 16 to Nov. 14). If maintenance work is required, a Work Order (WO) is generated and is to be completed within a maximum 12 months. Higher-priority Wos are, by necessity, addressed within a shorter timeframe. According to the 2020 Budget, the Parks Maintenance and Forestry division responded to 13,314 service requests in 2019, including internally generated service requests.

City staff report that the request-based maintenance process is generally effective and that there is no significant backlog of higher-priority requests.

Best practices – Request-based maintenance

A consolidated service request management system, such as Brampton’s 311 portal is considered the best practice for managing urban forest maintenance requests. Ideally, call centre operations, online portals, mobile apps and other methods of initiating requests should be integrated with the urban forestry work order management system and, if possible, the tree inventory. Few municipalities maintain such effective integration at this time, although some are making efforts towards this level of integration.

Service Request (SR) response times vary between municipalities. Lethbridge, AB – where most SRs are consistently investigated within just 2 days, appears to be a municipal leader, but this is likely facilitated by the city’s large urban forestry staff relative to the city’s area. Markham’s targeted response time of 5 days is also considerably faster than in most large municipalities, where response times typically range from between two to four weeks, except for the highest-priority requests and emergencies. Work Order action times vary widely depending upon the priority and nature of the work required.

2.2.2.4 Proactive maintenance

Proactive urban forest maintenance typically entails undertaking tree inspection and maintenance in a scheduled, systematic and repeated manner within defined geographic units (e.g., streets, parks, neighbourhoods, etc.) In Brampton, both street and park trees are pruned on an approximately 5 to 7-year cycle in a program known as block pruning (or the pruning cycle). Block pruning is undertaken by both City staff and contractors; contractors are retained on a 3-year contract with the opportunity for two 1-year contract extensions. The pruning cycle is location-based rather than based on a tree inventory, as the City does not currently have a complete inventory of actively managed trees. Consequently, pruning cycle frequency in Brampton does not vary by location, species, size or other tree characteristics.

Trees in City-managed wooded natural areas are predominantly managed on a reactive Service Request-initiated basis.

Best practices – Proactive maintenance

Cyclical inspection and, if necessary, pruning, of both young and established trees is a standard urban forestry practice. Miller and Sylvester (1981) identified 4 to 5 years as the optimal pruning cycle for temperate climates to balance costs and benefits. Sisinni et al. (1995) recommend a 5 to 10-year cycle for mature trees and a 3-year cycle for immature trees. Pruning cycle intervals between 5 to 8 years are common targets for municipal urban forest maintenance programs in Ontario and elsewhere. Utility clearance pruning requirements may necessitate more frequent pruning operations.

A more frequent pruning cycle does not necessarily demonstrate better urban forest management; for example, a longer cycle combined with young tree structural pruning, higher-quality nursery stock in good habitat, regular tree inspection, etc., can allow for longer pruning cycles while maintaining good tree condition.

Some trees may require more frequent pruning depending upon species or individual characteristics and pruning cycles should account for this. Species-dependent cycles are undertaken in some areas, especially where species diversity is low (e.g., Calgary and Edmonton, which have shorter elm tree pruning cycles and longer cycles for other species). Pruning cycles must account for species-dependent ‘pruning windows’, such as not pruning any oak trees in Ontario between, at minimum, April 15 and July 15 or only during the dormant season if possible. Additional considerations for pruning cycle variations may include site use frequency, proximity to overhead power or other utilities and infrastructure, storm/emergency response, or other factors.

2.2.2.5 Young tree structural pruning

Newly established and younger trees, particularly those that are intended to develop large stature at maturity, require specialized and more frequent pruning to develop appropriate long-term structure. This practice is commonly referred to as young tree structural pruning, or tree training, and focuses on preventing co-dominant or otherwise compromised branch unions, promoting appropriate radial and vertical branch spacing and, for most species, developing a single central leader.

In Brampton, young trees are pruned by Horticultural staff approximately three to four years after planting, as guided by planting lists of previous years. While young trees may be structurally pruned through the block pruning program, there is no program dedicated to regular young tree structural pruning, which typically requires more frequent pruning than provided by the block pruning program. The only recognition of specific young tree pruning requirements in the City's tree pruning contract specifications is the stipulation of different limb clearance requirements for trees of 15 cm dbh or less (2.5 m clearance, versus 5 m for larger trees).

Best practices – Young tree structural pruning

Young trees should be inspected and, if necessary, pruned at a higher frequency than mature trees. Although management needs will vary depending upon local factors such as species, climate, growth rates, and others, a minimum of 3 inspection and pruning rounds within the first 10 years following planting is commonly cited as a best management practice (e.g., Gilman and Bisson, 2007.) Young tree structural pruning can be undertaken using hand tools by staff with basic arboricultural training. If provided proper training, non-arborist staff, contractors or even volunteers may be able to undertake basic young tree structural pruning.

Saskatoon, SK enhanced service delivery efficiency by including young tree structural pruning in its tree maintenance contracts, eliminating the need for staff to 'follow' contractors to prune young trees after mature trees are pruned. In Red Deer, staff undertake the Structural Tree Pruning Program for young trees, which involved pruning every 2 to 5 years until good structure is developed. The STPP is informed by previous years' planting lists and prioritizes trees in high-traffic and occupancy areas due to program resource constraints. York Region implements a Juvenile Tree Maintenance Program for young street tree pruning, which includes a 3-year cycle for trees up to 10 years old.

2.2.2.6 Park tree maintenance

In Brampton, trees in actively managed park areas are included in the 5 to 7-year tree maintenance cycle. Actively managed park areas are typically defined as areas of turfgrass maintenance or regular occupancy by park users.

Best practices – Park tree maintenance

Park trees are frequently not included in municipal tree pruning cycles due to resource constraints and perception of lower target/risk, or are managed on considerably longer cycles than street trees. Examples of municipalities with park tree pruning cycles include Ajax (6-8 years), Saskatoon (13 years) and Surrey, where park trees are pruned at 4,8,12 and19 years after planting, and every 10 years thereafter. A park tree inventory confers the same management utility as a street tree inventory, and should be a priority undertaking for any municipality's urban forest management program.

2.2.2.7 Tree inventory/asset management system

Urban forest maintenance Service Requests (SR) and Work Orders (WO) are managed using the Cityworks enterprise asset management system. As stipulated in Brampton's tree maintenance contracts, contractors are required to submit end-of-day updates on the status of Work Orders to the City's asset management system using internet-enabled mobile devices. This process is intended to facilitate work order management and accounting, but data updates are inconsistent and are not currently integrated with the municipal tree inventory, undermining the currency and management utility of the inventory database.

Best practices – Tree inventory and asset management integration

The Green Infrastructure Ontario Coalition (GIO) has developed a publication entitled *Urban Forests and Asset Management Planning – A Primer* (2015). It reviews the key concepts of asset management as applied to trees and urban forest, and reviews key challenges and opportunities for integrating trees into asset management planning.

A 'one stop' Geographic Information System (GIS)-integrated urban forest asset management platform to manage (i.e., receive, dispatch, map, and track) tree service requests and work is a best management practice increasingly being adopted by municipalities. Asset management is further enhanced through integration with the tree inventory, which can enable maintenance tracking and reporting for individual trees and real-time updating of tree inventory data as trees are inspected or maintained. With such integration, tree maintenance staff and contractors can also update the tree inventory if basic data that do not require specialized assessment expertise are updated as trees are maintained.

The City of Toronto is seeking to integrate its trees and other green infrastructure assets in the "OneCall" utility information system to provide advance notice of below-ground presence of elements such as tree roots, soil cells, and other urban forest assets. This will facilitate capital project planning and daily operations and maintenance activities, and protect trees from injury.

Mississauga's Parks and Forestry department is working in conjunction with the City's Information Technology service area to expand the capabilities of its Infor Public Sector 8 (IPS) system to hold and manage all inventory, condition and replacement data of Community Services assets. TreePlotter™, a GIS and cloud-based urban forest management software suite, effectively integrates tree inventory data and asset management functions. Other urban forest management software such as ArborPro, ArborScope, and TreeKeeper fulfill similar functions. Several broader enterprise asset management (EAM) platforms may also have urban forestry components or plugins, or otherwise enable tree inventory integration into the corporate asset management framework.

York Region has included street trees and other urban forest assets in its Green Infrastructure Asset Management Plan. The plan reports on the state of the infrastructure assets, outlines levels of service, asset management and financing strategies, and measures for continuous improvement. It establishes targets of 95% street tree stocking, 90% of street trees in satisfactory or better health, and to increase ecosystem benefits provided by the urban forest on an annual basis. It also identified the need to establish a funding reserve for long-term urban forest maintenance.

Ontario Asset Management Regulations

The Ontario *Infrastructure for Jobs and Prosperity Act, 2015; Building together – Guide for municipal asset management plans, 2016* and *O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure* will require municipalities to develop and adopt asset management plans. The regulation includes green infrastructure in its definition of Municipal Infrastructure Assets, and the definition of green infrastructure includes natural heritage features and systems, parklands, street trees and urban forests as elements. Every Ontario municipality will be required to "prepare an asset management plan… in respect of all of its other municipal infrastructure assets by July 1, 2023." Green infrastructure assets are considered "other" infrastructure assets and not "core" assets.

2.2.2.8 Utilities coordination

Electrical utility distribution companies play an important role in urban forest management due to the regular tree pruning they undertake. However, utility pruning is largely directed by the need to maintain minimum required clearances between trees and power lines (typically 3 m), and promoting tree health and structure are secondary considerations. Alectra Utilities is Brampton's the local electrical utility distribution company, and is responsible for tree utility clearance pruning. City staff report a good working relationship with Alectra, which includes the utility providing clearance pruning of primary utilities for Brampton staff and contractors in advance of tree maintenance pruning, if necessary. Parks Maintenance and Forestry and Alectra are currently in the process of establishing clearer working guidelines and procedures. The City and Alectra also coordinate efforts through a Public Utility Coordination Committee (PUCC), which may include addressing potential above- and below-ground utility and urban forest conflicts for capital projects such as road improvements.

Best practices – Utilities and urban forest maintenance

In Ontario, the Electrical Safety Authority (ESA) requires minimum three-metre clearance between trees and overhead utilities. Insufficiently pruning frequency can reduce those clearances, leading to excessive and potentially damaging pruning by utility arborists to provide the necessary clearances and potentially resulting in decay, crown imbalances, vigorous re-sprouting, and other undesirable conditions. Urban forestry departmental coordination with local utility providers is an effective means to reduce tree pruning frequency and expense, reduce impact upon trees, and improve pruning practices.

As in Brampton, Oakville's urban forestry staff and local utility are members of Public Utility Coordinating Committee (PUCC) which enables information exchange regarding current and best practices and coordination of work planning and implementation. Oakville Hydro contracts the Town's Urban Forestry Services and its contractors to conduct tree maintenance, including in proximity to overhead utilities, on a three-year pruning cycle. This enables the Town to conduct utility and other tree maintenance pruning simultaneously, greatly enhancing operating efficiency.

Municipal and utility tree-related standards, including pruning and planting, should be reviewed and coordinated on a regular basis. In the absence of or in addition to an effective PUCC process, utility representatives should be invited to participate in periodic urban forestry working group sessions to be made aware of initiatives, to provide input, and to coordinate policies, practices and operations.

2.2.3 Tree risk management

Virtually all trees in the actively managed portions of the urban forest pose some level of risk, although the level of risk posed by the vast majority of trees is statistically very low. Managing and, where necessary, mitigating to a reasonable degree the risk posed by City-owned trees is part of any municipality's Duty of Care. Tree risk management comprises two major components: tree risk assessment and tree risk mitigation. Tree risk assessment entails the inspection of trees to identify potential sources of risk, assess consequences, and develop appropriate responses, whereas tree risk mitigation involves the implementation of arboricultural practices to reduce the likelihood of tree or component part failure and/or the severity of associated consequences.

In Brampton, tree risk is managed both proactively (as part of routine tree inspections through the tree maintenance cycle) and reactively (in response to resident or staff-initiated Service Requests). Trees are not proactively inspected or assessed for risk outside of the tree maintenance cycle, meaning that most City trees are inspected every five to seven years. The City's three Urban Forest Inspectors, who undertake the majority of tree risk assessment in response to Service Requests, hold the ISA Tree Risk Assessment Qualification (TRAQ), ensuring that they are knowledgeable about the practice of tree risk assessment. External third parties may be engaged to undertake tree risk assessments in certain circumstances, such as those requiring advanced tree risk assessment methods.

Best practice – Tree risk assessment standard

The North American industry standard for tree risk assessment is *ANSI A300 (Part 9)-2017: Tree, Shrub and Other Woody Plant Management – Standard Practices (Tree Risk Assessment a. Tree Failure).* Its implementation is guided by the *International Society of Arboriculture (ISA) Best Management Practices, Tree Risk Assessment, Second Edition (2017)*, which includes a two-part matrix that considers the likelihood of failure and target impact and associated consequences to assign a qualitative tree risk rating to the subject tree. Other tree risk assessment methodologies, such as Quantified Tree Risk Assessment (QTRA) and VALID Tree Risk-Benefit Assessment & Management, have also been employed by some practitioners.

Best practice – Tree risk management zones

Tree risk assessment or management zones should be developed based upon factors such as frequency of target area occupation, tree size/age, or species profiles. Limited visual (e.g., drive-by) risk assessment of trees in these zones should be undertaken on a periodic basis, with frequency depending upon zone characteristics. For example, a zone with larger, older trees should be assessed more frequently than areas with younger or smaller trees. Trees which are identified as requiring a more advanced level of risk assessment would be noted and assessed accordingly. Trees in natural areas should also be assessed on a periodic basis, with particular focus on trees within 1.5x tip-out distance in proximity to trails and perimeters/edges.

Appropriate frequencies for Level 1 – Limited Visual Assessment or Level 2 – Basic tree risk assessments in a municipal context may include:

- 1 year for frequent use or high target value areas, or areas with older and larger trees,
- 2-4 years for trails, woodlot perimeters or other moderate use or target value areas
- On a request basis for low-use, unsanctioned or other areas

Approaches to tree risk mitigation in Brampton primarily entail tree pruning or tree removal. Other tree risk mitigation measures, such as cabling or bracing, are not commonly implemented.

Best practice – Conservation-oriented tree risk mitigation

Branch pruning or tree removal are the most commonly implemented tree risk mitigation measures in most municipalities. However, other approaches – such as cabling and bracing, are highly effective and may enable the conservation of valuable trees which would otherwise be removed or heavily pruned. The City of Red Deer, AB is a municipal leader in mitigating tree risk through such conservation-based approaches, and multiple City trees are cabled.

The Parks Maintenance and Forestry division or other City divisions have not adopted a formal tree risk management policy. However, the City's Strategic Asset Management Policy outlines as a foundational principle of the City's Corporate Asset Management Plan to, "Achieve a strategic balance between established levels of service and the amount of acceptable risk in order to manage resources, expenditures, and priorities." This policy statement implicitly supports the implementation of tree risk management practices and, perhaps more importantly, recognizes the need for a balanced approach to risk management that accepts that some level of risk may be acceptable.

Best practices – Comprehensive tree risk management program and policy

A comprehensive tree risk management program should include the following elements:

- Tree inventory with ANSI/ISA-aligned tree risk assessments and other detailed attributes
- Tree risk management policy
- Tree risk management zones
- A combination of proactive and reactive tree management approaches
- Level 1 – Limited Visual to Level 3 – Advanced tree risk assessments, as required
- Tree Risk Assessment Qualification (TRAQ) for tree risk inspectors
- Educational and training opportunities for tree risk assessors and other arborists
- Use of third-party expert tree risk assessors, as required

A tree risk management policy supports tree risk assessment and management by outlining municipal roles, standard of care, and responsibilities, approved Levels of Service (LoS), risk thresholds, assessment and reporting methods, assessor training and qualification requirements, and other components of the overall tree risk management approach. Such a policy is intended to ensure that all municipally-owned trees are appropriately managed to reduce risk and liability, and that adequate resources are allocated to tree risk management efforts. Examples of municipalities with tree risk management plans or policies include Saskatoon, SK; Red Deer, AB; Oakville, ON; and Surrey, BC. Many jurisdictions in the United Kingdom also maintain such policies.

2.2.4 Pest, disease, and invasive species management

Tree pests and diseases can adversely affect the health, condition, aesthetics and functional capacity of individual trees or tree populations. Similarly, invasive plants can threaten the ecological integrity and functioning of natural areas. While these stressors can rarely be entirely eliminated once present, monitoring and controlling their populations and effects is an important component of a municipality's urban forest management program.

2.2.4.1 Current practices

In Brampton, urban forest pest and disease management is undertaken by the Parks Maintenance and Forestry division. With the exception of the EAB management program, which is outlined in detail in a 2015 Report to the Planning and Infrastructure Services Committee of Council, Brampton's approach to pest management is not currently coordinated by any plans, policies, or Levels of Service. Instead, urban forest pest, disease and invasive species

management is largely implemented on a relatively small-scale and reactive basis, and is largely subject to resource availability. The City recently began undertaking proactive giant hogweed (*Heracleum mantegazzianum*) management, including manual plant removal and warning sign installation. The City will also be undertaking proactive LDD (Lymantria dispar dispar) moth egg mass surveying in response to ongoing infestation, first observed in 2019.

Parks Construction Standard Detail drawing "L724 – Woodlot Edge Management", which applies to Woodlot Management Plans (see Section 2.2.5), stipulates that weed control, including "pulling up of invasive weeds such as garlic mustard, and buckthorn" "is required until the edge planting is established (yrs. 1-2)."

Best practices – Integrated Pest Management (IPM)

IPM is a commonly used term to describe the implementation of a variety of methods and materials to prevent and mitigate the effects of pests and diseases. IPM for the urban forest includes the following practices:

- Selection and establishment of diverse species to promote urban forest resilience
- Maintaining tree vitality to enhance tree resistance to infestation and disease:
- Cyclical, systematic maintenance and sanitation
- Replacement planting to replace lost trees
- Inspection of nursery stock to identify and reject infested or diseases trees
- Encouragement of beneficial species and alternative pest control methods
- Chemical control
- Monitoring and adaptive management
- Reporting and planning
- Community and partner engagement and education

Red Deer, AB has developed a comprehensive Integrated Pest Management (IPM) manual for use by City staff and the public to guide urban forest pest management. The manual and accompanying informational webpage outline the key elements of IPM and specifically target the most significant pest and disease issues found in Red Deer. The manual outlines key IPM procedures including monitoring, control, reporting and education, and provides detailed guidance on management approaches for specific pests and pathogens.

2.2.4.1.1 Pests and diseases

With the exception of EAB management, urban forest pest and disease management in Brampton has to date largely undertaken on a reactive basis in response to observed infestations or infections of individual trees. By necessity, the emerald ash borer infestation – which has killed most of Brampton's ash trees since its beginnings in 2008, will continue to be managed in a more strategic and long-term manner. The EAB management program included the protection of some 2,500 ash trees with stem-injectable insecticide, but most of these trees were damaged by the 2013 ice storm and were removed. For 2020 and 2021, Council approved $1.7 million in annual capital funding for EAB management. Capital funding of $2.7 million was approved in December 2021 for the Urban Forest Canopy Program which, among other initiatives, will support remaining EAB and ash tree management and replacement needs.

2.2.4.1.2 Invasive plant species

Due to their potential adverse human health effects, giant hogweed (*Heracleum mantegazzianum*) and poison ivy (*Toxicodendron radicans*) are currently the priority invasive plant species for management by the City, and are managed by the City's IPM technician. Other invasive plant species, such as buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolate*), dog-strangling vine (*Vincetoxicum rossicum*), and phragmites (*Phragmites* sp.), are also tracked on a largely informal basis, and management of these species is sporadic and integrated with any broader City asset management practices or programs.

Data and mapping of invasive species populations in City managed natural areas is not collated in a systematic manner, and is instead interspersed throughout woodlot management plans, the Natural Areas Inventory, and other sources of information.

Several City documents provide some guidance for invasive species management, as described in Section 2.2.4.3, below.

2.2.4.2 Vulnerability assessment

In the absence of a tree inventory or an up-to-date urban forest structure assessment, it is difficult to assess the vulnerability of Brampton's urban forest to priority pests and diseases. However, based upon the 2011 Urban Forest Study and the partially complete street tree inventory, the urban forest may be vulnerable to the following priority pests and diseases (in addition to EAB):

- Asian longhorned beetle (*Anoplophora glabripennis*): between approximately 33 to 56 percent of the tree population (by stem count), or 1.2 to 2 million trees
- LDD moth (*Lymantria dispar*): approximately 23 percent of the urban forest, or 830,000 trees
- Dutch elm disease (*Ophiostoma ulmi*): approximately 3.2 percent, or 115,000 trees
- Oak wilt (*Ceratocystis fagacearum*): approximately 5 percent of inventoried street tree population, or 3,783 trees (note: inventory is incomplete, and the number of susceptible street, park, woodland, and private oak trees is likely much higher)

Other potentially significant pest and disease species, for which a vulnerability assessment cannot currently be completed due to an absence of reliable or complete inventory data, include:

- Hemlock woolly adelgid (*Adelges tsugae*)
- Thousand cankers disease (*Geosmithia morbida)*
- Asian LDD moth (*Lymantria dispar asiatica*)
- Canker worm/tent caterpillar (*Geometridae/Lasiocampidae*)
- Beech bark disease (*Nectria coccinea var. faginata)*
- Butternut canker (*Ophiognomonia clavigignenti-juglandacearum)*
- Sudden oak death (*Phytophthora ramorum*)

2.2.4.3 Strategic guidance

Although invasive species management in Brampton is largely undertaken on a reactive or otherwise informal basis, several City documents provide some management guidance, as described below.

- **Brampton Grow Green Environmental Master Plan (EMP) Implementation Action Plan, 2014:** the EMP Implementation Action Plan lists invasive species as a challenge for Brampton's remaining natural vegetation communities, and identifies "removing invasive species" as a core part of the City's naturalization efforts. EMP actions that directly support urban forest pest, disease, and invasive species management include:
    - L 8.2. – Update the Naturalization Program to focus on improving natural vegetation communities including wetlands and wildlife habitat, and support invasive species management efforts.
    - L10. - Develop an Invasive Species Management Strategy for all City properties.
    - L 10.1. – Develop Official Plan and Secondary Plan policies to require new development applications to undertake invasive species management efforts.
    - L 13. – Implement the Emerald Ash Borer Management Program through annual funding and staff resources, and undertaking community plantings in parks and open spaces, etc.

  The City undertook a refresh of the Environmental Master Plan in 2020. The refreshed EMP catalogues the numerous plans, policies, projects and practices catalysed by the 2014 EMP and reports on the City's performance in relation to various environmental targets, such as natural heritage restoration, public ownership of NHS lands, and others.

- **Natural Heritage and Environmental Management Strategy (NHEMS) Implementation Action Plan, 2015:** the NHEMS Implementation Action Plan includes three recommendations related to invasive species management, including:
    - A1.1.4 - Develop Official Plan policies to require development applications to undertake invasive species management prior to dedication of NHS and/or open space lands, as appropriate.
    - A2.2.5 - Develop and implement an Invasive Species Management Strategy for all City of Brampton properties, including NHS, recreational open space, the urban forest and green infrastructure.
    - A2.2.6 - Prioritize areas within the NHS for active restoration to remove invasive species and enhance ecological functions.

- **Woodland Management Guidelines, 2018:** these guidelines for the development of Woodland Management Plans (WMP) in conjunction with Plan of Subdivision applications direct applicants to consider invasive species management. For example, areas of invasive species populations can be identified as opportunity areas for development. WMPs should also outline mitigation strategies for invasive species, highlight areas of high invasive species infestation on a Woodland Feature Map, provide detailed construction drawings for invasive species removal, and outline specific "Invasive Species Measures", including control by pulling, trimming/treatment, and/or canopy and soil management.

- **Natural Heritage Restoration Program (NHRP), 2019:** this framework document and action plan identifies invasive species as a major threat to Brampton's remaining natural vegetation communities and states that removing invasive species from natural features "is vitally important to the City's efforts to improving the diversity and health of Brampton's natural heritage system." Invasive species management is identified as one of five key methods for restoration and naturalization. The NHRP is supported by a publicly accessible map of completed, ongoing and future planned restoration sites.

Best practices – Urban forest pest, disease, and invasive species plan or strategy

At minimum, a municipality's approach to IPM should be outlined in an operating policy. Optimally, a comprehensive IPM plan, strategy or manual should be adopted to:

- identify and priority-rank the full range of known and potential urban forest pests, pathogens, and invasive species, including mapping of known locations of priority and vulnerable species
- establish thresholds for acceptable infestation and action
- establish inspection and monitoring protocols
- define appropriate management techniques
- explore education and collaboration opportunities and partnerships
- consider priority sites and pilot projects for assessment of management techniques
- establish long-term funding and other resource (i.e., staffing, contractor, etc.) requirements and allocation strategies

Mississauga recently developed a comprehensive Invasive Species Management Plan (ISMP), which focuses on invasive plant species but also addresses several urban forest pests. The plan prioritizes areas for restoration and control action based upon ELC and other factors, such as area size, native flora abundance, priority invasive flora, soil disturbance, access, visibility, etc. Credit Valley Conservation (CVC) is currently updating its Invasive Species Strategy.

2.2.4.4 Education and partnerships

2.2.4.4.1 Education

Outreach and education by the City about urban forest pests, diseases and invasive species is limited. The newly updated “Trees” portal on the City of Brampton website includes a “Tree Pests & Diseases” page, which provides a brief description of the City’s overall approach to tree pest and disease management and includes a brief list of priority or common pests and diseases. The list is relatively limited, and does not differentiate between the nuisance pests and more serious urban forest pests and diseases listed. The page also provides links to related external resources.

2.2.4.4.2 Partnerships

In the past, the City has joined with local partners on a few invasive species management projects, such as the 2010 Hickory Wood Invasive Species Management Project. The City has also occasionally partnered with TRCA and CVC on site-based invasive species management projects. To date, invasive species management partnerships have been undertaken at a small scale, and have not been coordinated by any City program or strategy. The City has also coordinated with the Canadian Food Inspection Agency (CFIA) to establish and monitor urban forest pest survey traps.

Best practices – Community involvement in invasive species management

Edmonton offers a free pest identification service for its residents, who can deliver specimens in person or by mail, or can submit photographs of suspected urban forest pests, diseases, and invasive species.

Oakville allows interested residents to pay for the protection of ash street trees which do not meet criteria for protection under the Town’s own stem injection program. Near the outset of EAB infestation, Oakville also formed the Canopy Club to raise awareness of the threat posed by EAB to the urban forest and encourage ash tree protection on private property.

Community members can also be engaged in basic invasive species management through community ‘weed pulls’. Residents can be effectively engaged if first educated about the threats posed by invasive species and the importance of their management, and if management activities are undertaken in valued natural areas or in close proximity to other valued community assets. Richmond Hill engages residents in invasive species pulls through its Community Stewardship Program (CSP). Waterloo’s volunteer Pollinator Working Group, established under the City’s support of the Bee City Canada initiative, undertakes invasive species removal projects such as buckthorn pulls. Engagement opportunities are posted on the City’s online events calendar, where interested volunteers can register to participate.

Ontario municipalities can encourage residents to use EDDMapS Ontario – an online or mobile-based reporting and mapping platform for invasive species. User-submitted data can be used to inform management.

2.2.5 Wooded natural areas management

City of Brampton's Official Plan (2006) contains various policies that protect woodlands, and the City requires that development proponents prepare and implement management plans in accordance with the City's Woodland Management Plan Guidelines (2018) before woodlands are assumed by the City. A Woodland Management Plan must include the following information:

1. Woodland Evaluation
2. Development Opportunities and Constraints
3. Definition of Tree Retention Zone
4. Location of Perimeter Fencing
5. Planting Between Fence and Woodland Edge
6. Management Objectives for the Woodland
7. Management Strategy for Woodland
8. Pedestrian and Open Space Linkages
9. Woodland Development and Mitigation Strategy
10. Staging and Implementation
11. Mapping
12. A Woodland Development Plan that includes consideration of trails, re-use of soils/seedbank/plants/other biotic materials, and enhancement plantings.

At a City-wide scale, the Natural Heritage & Environmental Management Strategy (2015) touches on several woodland management best practices:

- Reducing edge habitat and increasing interior habitat by reducing woodland "fingers" and filling in woodlands gaps
- Creating linkages between isolated woodland areas in the City
- Replacing ash trees that have been impacted by Emerald Ash Borer and ice storms
- Leading public stewardship activities to restore woodlands

Brampton's Eco Park Strategy (2020) also addresses woodland management as it aims to increase natural cover in the City and suggests avoiding mowing directly adjacent to woodlands, increasing the size of woodlands within park and valleyland systems, and restoring mown areas to woodlands where opportunities permit.

Best practices – Wooded natural areas management

Ottawa manages over 2,100 ha of urban woodlands and is shifting from reactive and request-based invasive species, encroachment, trail, and tree risk management to a more proactive system under its Forested Areas Maintenance Strategy (FAMS). Key elements of this program include:

- allocating adequate resources to long-term activities including stand monitoring, tending, supplemental planting, etc. necessary to ensure successful woodland restoration
- establishing protocols for visual inspections of trees along City-sanctioned formal trails in wooded natural areas in conformance with the ANSI/ISA BMP Level I: Limited Visual Assessment
- identifying appropriate tree risk management responses (such as tree pruning and removal, temporary or permanent trail or woodland closures, directional signage, and others).
- including fire risk assessment
- including strategies for developing partnerships to assist in forest management where possible and appropriate

Additional best practices for wooded natural areas management include, among others:

- design of ecologically sensitive trail systems (e.g., boardwalks over wet areas, limiting number of trails, limiting trail width)
- planting indigenous species as a buffer between natural areas and other public uses
- formalizing trails to discourage informal trail creation
- closing informal trails with large logs and/or prickly shrubs (such as raspberry)
- installing signs indicating permitted activities (such as hiking and dogs on-leash) and prohibited activities (such as motorized vehicle access)
- communicating with regular users and user groups to educate them about limiting impacts associated with use and, where possible, engaging them in stewardship associated with limiting impacts

As part of its woodland ash tree management efforts, the City of Mississauga undertook an inventory of all individual ash trees within tip-out distance of formal trails and woodlot edges.

2.2.6 Outreach and engagement

The City has recently enhanced its public education and outreach materials and approaches, particularly in relation to tree care by residents. The City's "Trees" online portal has been expanded to provide detailed tree care information under the banner "Residential Tree Planting and Care", and includes resources such as a tree planting guide brochure, tree planting and maintenance instructional videos, and external links. Notification contacts between Urban Forestry Inspectors, tree maintenance contractors and residents related to tree maintenance Service Requests or scheduled maintenance are also used as engagement and educational opportunities when feasible.

Residents are not currently permitted to undertake any maintenance of City-owned trees except watering. The City's Adopt-a-Park program encourages residents to volunteer time or resources to support park maintenance and beautification. According to the program activity report form, tree mulching is currently the only tree-related activity under the Adopt-a-Park program.

Best practices – Engaging residents in tree stewardship

Municipalities are increasingly recognizing the benefits of encouraging residents to share in the responsibility for urban forest stewardship, which include reduced costs, improved post-planting survival rates, and increased community support for urban forestry programs. Some municipalities operate programs whereby trained volunteers are engaged to monitor the urban forest, mulch and water trees, and even structurally prune young trees. Depending upon the level of engagement, resident-involved tree stewardship programs may require staff time to assign and track work and monitor quality.

Several municipalities have supported LEAF, a Toronto-based urban forest advocacy NGO, in the delivery of tree stewardship training. LEAF's "Tree Tenders" program instructs participants in the basics of urban forest management (including regulations), tree biology, species identification and selection, planting and establishment, and maintenance. Attendees of such courses are often keen to transfer these skills to street and park tree watering and other non-technical, volunteer-based activities, and the stewardship skills learned can be applied on their own or other private properties. Participation is usually on a cost-recovery/fee basis.

"Adopt-a-Tree' programs encourage residents to take on responsibility for watering and mulching individual trees or groups of trees. Participants often include schools, Business Improvement Associations (BIAs), neighbourhood associations and individuals. Tree adopters can also be engaged to monitor the urban forest more widely for pests and diseases. Cambridge, Massachusetts provides an online map of available and adopted trees, and provides residents the opportunity to be recognized as tree stewards.

Urban forest ambassador programs encourage volunteers to spread information about the value of the urban forest, proper arboricultural practices, invasive species and pests, and other urban forestry subjects to their neighbours and communities.

Best practices – Citizen pruners

Citizen pruner programs are becoming increasingly popular among municipalities, and instruct volunteers in more advanced young tree structural pruning techniques. Volunteers may be provided with tools (which should be inventoried and tracked), and are assigned a number of recently planted trees to provide young tree structural pruning. Volunteers must be trained and demonstrate proficiency in proper pruning techniques, committed to the program for a minimum duration, and instructed to only apply the minimum necessary pruning (i.e., one pruning visit per three years). Work must be carefully tracked and inspected by staff to ensure proper implementation, and municipal ownership of the trees in the program must be clearly delineated.

Thunder Bay, ON established Canada's first citizen pruner program in 2011. Twenty-five participants are trained annually and are required to complete a minimum of three 2-hour supervised work sessions, after which Citizen Pruners are permitted to prune young boulevard trees in assigned areas. The program received a TD Green Streets grant to help cover the cost of training, which is provided by an independent ISA Certified Arborist.

2.2.7 Other program elements

Urban trees are predominantly valued for the economic, health and community, and environmental services that they provide as they live and grow, and less so for tangible products such as wood or edible fruit. However, municipalities and their residents are increasingly recognizing the value of urban tree products from both living and removed trees.

2.2.7.1 Wood utilization

City of Brampton staff have recently begun to use logs salvaged from removed urban trees as benches and decorative carvings in parks and stormwater ponds. While this is an example of urban wood utilization, there is currently no wider-scale program to divert waste wood from urban forest maintenance operations to alternative and higher-level uses. Instead, wood waste is typically disposed of in accordance with common urban forestry practices (i.e., chipping), and is used as wood chip mulch throughout public lands across the city. Although it is unlikely to generate significant revenue, divert a significant amount of wood waste, or reduce operating costs, a wood waste utilization program may effectively engage community members in urban forest stewardship and support the local economy.

Best practice – Wood utilization directory and program

In 2015, the City of Toronto partnered with local businesses and NGOs to develop the award-winning Urban Wood Directory. The Directory is intended to connect residents with local businesses that utilize urban forest products, such as lumber salvaged from municipal urban forestry operations. Toronto's Office of Economic Development & Culture supports the small-scale, local urban wood industry by providing event and exposition support, supplying wood to community and industry development projects, developing a strategic growth plan and supply chain strategy, and other initiatives.

Other municipalities have also implemented urban wood utilization programs of various scales. The City of Ottawa has partnered with several local businesses to divert some wood waste for firewood and artisan uses. Mississauga has partnered with a local sawyer to market high-quality urban wood to residents and local businesses.

2.2.7.2 Urban forest foods

While some edible fruit-bearing trees and shrubs (e.g., cherry, serviceberry, walnut, etc.) may be planted through City operations and capital projects or community development, there is no formal City program to encourage resident harvesting of urban forest foods.

Best practice – Community food forests

Communities are increasingly recognizing the role of community or urban food forests in promoting community resilience and economic activity. In Toronto, 14 fruit trees of various species were planted by volunteers in Ben Nobleman Park, an easily accessible but underused green space, with City permission. The food forest was designed to minimize interference with other park uses, and is actively used by community members.

Several municipalities have shared tree inventory data with local groups to harvest, use, distribute or promote urban forest foods; examples of such groups include Hidden Harvest in Ottawa, Not Far From the Tree in Toronto, and Environment Lethbridge in Lethbridge. Other communities have established 'passive orchards' that include small fruit trees and shrubs for passive use by residents. Examples of such orchards include 'Community Food Forests' in Red Deer; Sudbury's 'Shared Harvest' orchards, London, Ontario's 'Carolinian Food Forest', and 'Permaculture Park' in Auburn, New York. A new community master plan in Richmond Hill includes the establishment of a 'Community Orchard' to promote education and outreach related to urban agriculture and urban forest foods.

2.3 Strategic direction for maintaining Brampton's urban forest

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) assessment matrix for Brampton's approaches to maintaining the urban forest.

The section also assesses Brampton's performance in twelve criteria related to maintaining the urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool - the most recent iteration of the established Criteria and Indicators of Urban Forest Sustainability assessment framework (C&I) (Clark et al., 1997; Kenney, van Wassenaer and Satel, 2011; Leff, 2016).

The SWOT matrix and C&I assessments informed the development of strategic directions for Brampton's Urban Forest Management Plan, presented at the end of the section. The strategic directions will be addressed through UFMP strategic goals, objectives, and action items.

2.3.1 SWOT matrix analysis

Table 4: SWOT matrix for maintaining Brampton's urban forest.

Strengths	Weaknesses
Program administration: • Interdepartmental coordination on some urban forestry issues assessed as moderate to good by staff. ***Tree maintenance:*** • Effective 311 Service Request system meets best practices and is supported by detailed information on website. • Tree maintenance cycle (5-7) years meets best practices, including in parks. • Some young tree structural pruning is undertaken. • Good working relationship with Alectra (local utility) on urban forest maintenance. ***Tree risk management:*** • Tree risk is managed both proactively and reactively. • Urban Forestry Inspectors hold ISA Tree Risk Assessment Qualification (TRAQ). ***Pest, disease, and invasive species management:*** • Capital funding for EAB management to 2022 projected, subject to Council approval. • Some knowledge of invasive species populations and locations. • Strategic guidance for invasive species management in several existing plans and guidelines. • Some previous small-scale partnership/outreach-based invasive species management activities. ***Wooded natural areas management:*** • Comprehensive guidelines for preparation of wooded natural areas management plans in conjunction with Plans of Subdivision (2018 Woodland Management Plan Guidelines). ***Outreach and engagement:*** • Tree Care webpage provides clear, succinct, and correct information about tree maintenance.	***Program administration:*** • Lack of clarity about some roles and responsibilities related to urban forest management. • Parks Maintenance and Forestry division focused on tree maintenance operations, requires support from other divisions for strategic and policy initiatives and processes. • 'Flat' and operations-focused organizational structure compromises ability to deliver some important urban forest management services and align with strategic initiatives and higher-level organizational goals and strategic actions. ***Tree maintenance:*** • Efficiency of current joint service delivery model is not known or audited. • No formal Levels of Service for many tree maintenance operations. • Tree pruning standards do not reference ANSI and include some specifications that do not meet best practices. • Some existing service levels (e.g., SR response) underperform comparators and/or best practices. • Proactive maintenance cycle is location based on not informed by inventory. • Trees in natural areas are managed on a reactive basis. • Young tree structural pruning is not program-based and may be insufficient; pruning contract does not address young tree pruning sufficiently. • No integration between tree inventory, SR/WO processes, and corporate asset management systems. • Occasional confusion about relationship between Peel Region and City about tree maintenance and ownership. ***Tree risk management:*** • Proactive tree risk management is based on 5-7-year inspection cycle which may be too long for some trees. • No tree risk ratings or effective substitute attributes (e.g. structure rating) in tree inventory. • Limited if any application of advance tree risk assessment methods or conservation-based mitigation approaches. ***Pest, disease, and invasive species management:*** • Management not coordinated by any policy, plan, or Levels of Service. • Pest/disease management is reactive or tied to 5-7-year maintenance cycle. • Limited knowledge of invasive species populations. • Most management is small-scale and *ad hoc.* • Limited educational outreach or partnerships for pest, disease, and invasive species management. ***Wooded natural areas management:*** • Lack of policies and resources for implementation of ongoing woodland management (in accordance with Woodland Management Plans) following assumption by City. ***Outreach and engagement:*** • No opportunities exist for engagement of residents in tree maintenance beyond watering and mulching.

Table 4, cont'd: SWOT matrix for maintaining Brampton's urban forest.

Opportunities	Threats
Program administration: • Improving coordination and cooperation would, increase efficiency and effectiveness, and enhance outcomes. ***Tree maintenance:*** • Planned transition to CityWorks by end of 2020 should enable integration of tree inventory with Service Requests/Work Orders and other asset management processes. • Tree-related scope of existing Adopt-a-Park program could be enhanced beyond tree mulching. ***Tree risk management:*** • Tree inventory can be used to inform tree risk assessment/management zones and other program elements. • City's Strategic Asset Management Policy is likely supportive of developing a tree risk management policy and/or plan. • User-submitted data (e.g., 311, Pingstreet or other PPGIS tools) can inform tree risk management. • Increasing adoption of advanced tree risk assessment methods by local arborists can be leveraged to apply conservation-based approaches to tree risk management. ***Pest, disease, and invasive species management:*** • Data and mapping of invasive species populations exists in several sources, including BNAI, woodlot management plans, and potentially other sources. • Community members and other partners can likely be engaged to undertake site-based, low-risk/low-difficulty invasive species management. ***Wooded natural areas management:*** • Develop and implement standards for woodland management following assumption. ***Outreach and engagement:*** • Active and involved community members can be engaged to undertake basic tree maintenance outside of existing Adopt-a-Park program.	***Program administration:*** • Failure to enhance interdepartmental cooperation/coordination may compromise efficacy of aspects of urban forest management. ***Tree maintenance:*** • Sub-optimal urban forest maintenance practices may compromise health, function, safety, and other tree characteristics. • Climate change, invasive species and urban stressors threaten the tree population and require more resources to be expended on urban forest maintenance. ***Tree risk management:*** • N/A ***Pest, disease, and invasive species management:*** • Existing and emerging pests and diseases may threaten urban forest (e.g., oak wilt, ALHB, hemlock woolly adelgid, etc.) • ALHB is likely the highest current management priority urban forest pest. • Oak wilt is likely the highest current management priority pathogen. ***Wooded natural areas management:*** • Lack of management in City-owned woodlands may increase risk to users and also result in decline of the functions and services provided by these features. ***Outreach and engagement:*** • Increase in nuisance or unnecessary service requests due to lack of understanding or appreciation of trees and associated urban forest services, causing strain on urban forest management resources. • Poor maintenance or unauthorized injury or removal of trees by residents lacking awareness of the value of the urban forest, thereby adversely affecting urban forest health, condition, and services. • Lack of support for municipal investment in sustaining and enhancing urban forest management due to lack of resident awareness of needs and urban forest services.

2.3.2 Criteria and Indicators assessment

Table 5: Criteria and Indicators assessment of twelve criteria related to maintaining Brampton's urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (0)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Know What's Happening to Trees in Your Community	ASSESSMENT OF PUBLICLY-OWNED NATURAL AREAS	Detailed understanding of the ecological structure and function of all publicly owned natural areas (such as woodlands, ravines, stream corridors, etc.), as well as usage patterns.	No Information	Identified only in natural area survey.	Level and type of public use documented.	Management plan focused on sustaining and, where possible, improving overall ecological structure and function while facilitating appropriate public use. Plan should consider impacts on contiguous natural areas [open space corridors] outside the community's borders.	Publicly-owned natural areas assessments outlined in Brampton Natural Areas Inventory (BNAI)
Engaging Peers and Residents in Process	ALIGN MUNICIPAL DEPARTMENTS	Align affected municipal departments, county and regional authorities and state agencies behind common agenda.	Municipal departments/agencies take actions impacting urban forest with no cross-departmental coordination or consideration of the urban forest resource.	Municipal departments/agencies recognize potential conflicts and reach out to urban forest managers on an ad hoc basis- and vice versa.	Informal teams among departments and agencies communicate regularly and collaborate on a project-specific basis.	Municipal policy implemented by formal interdepartmental/ interagency working teams on all municipal projects.	
Creating Essential/ Effective Public/Private Partnerships	ALL UTILITIES WORK WITH MUNICIPALITY, EMPLOY BMPS	All utilities - above and below ground - employ best management practices and cooperate with municipality to advance goals and objectives related to urban forest issues and opportunities.	No utility consideration of the health of the urban forest resource.	Utilities take actions impacting urban forest with no municipal coordination.	Utilities employ best management practices, recognize potential municipal conflicts, and reach out to urban forest managers on an ad hoc basis- and vice versa.	Utilities are included in informal municipal teams that communicate regularly and collaborate on a project-specific basis.	
Resource Management: Planning	DEVELOP URBAN FOREST MANAGEMENT PLAN	Develop and implement a comprehensive urban forest management plan for public and private property.	No urban forest management plan.	Modest planting on public lands primarily for replacement on case-by-case basis, reactive risk management.	-	-	Assessment tool does not define Good and Optimal indicators. UFMP in development.
Resource Management: Planning	COOPERATIVE PLANNING WITH OTHER MUNICIPALITIES	Cooperation and interaction on urban forest plans among neighboring municipalities within a region, and/or with regional agencies.	Municipalities have no interaction with each other or the broader region. No regional planning or coordination on urban forestry.	Some neighboring municipalities and regional agencies share similar urban forest policies and plans.	Some urban forest planning and cooperation across municipalities and regional agencies.	Widespread regional cooperation resulting in development of regional urban forestry strategy.	
Resource Management: Planning	FORESTRY PLAN INTEGRATED INTO OTHER MUNICIPAL PLANS	Forestry plan is designed to reinforce, and be reinforced through comprehensive plans, sustainability plans, park development, storm water and watershed plans, neighborhood revitalization, climate mitigation and sustainability plans, etc.	Urban forestry plan mentions how it could meet other municipal objectives, or inform other planning efforts.	Urban forestry planning team presents plan to other agencies, encouraging them to consider how forestry might help achieve their objectives.	Once completed, urban forestry planning team works with other agencies to align current and future objectives.	All agencies whose goals are served by urban forestry practices, participate in creation of forestry plan, and commit to designated roles and responsibilities.	Not assessed/scored due to inapplicability of indicators to current status in Brampton (no UFMP).
Resource Management: Implementation	URBAN FORESTRY PROGRAM CAPACITY (APPLIES TO IN-HOUSE AND CONTRACTED STAFF]	Maintain sufficient well-trained personnel and equipment-whether in-house or through contracted or volunteer services - to implement municipality-wide urban forest management plan.	Lack of personnel and/or adequate equipment severely limits needed maintenance. Few resources, if any available to achieve new goals.	Lack of staff training and/or access to adequate equipment limits effectiveness.	-	-	Assessment tool does not define Good and Optimal indicators. Two points awarded due to relatively good tree maintenance program capacity.

Table 5, cont'd: Criteria and Indicators assessment of twelve criteria related to maintaining Brampton's urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (-1)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Resource Management: Implementation	MUNICIPALITY-WIDE URBAN FORESTRY FUNDING	Develop and maintain adequate funding to implement municipality-wide urban forest management plan.	Little or no dedicated funding.	Ad hoc funding for emergency, reactive management.	Funding sufficient for some proactive management based on urban forest management plan.	Sustained, long-term funding from multiple municipal, regional and/or provincial agencies, along with private sources to implement a comprehensive urban forest management plan, and provide for maintenance and adaptive management as circumstances change.	No UFMP, but funding is generally sufficient for some proactive management.
Resource Management: Implementation	MANAGEMENT OF PUBLICLY-OWNED NATURAL AREAS	The ecological integrity of all publicly owned natural areas is protected and enhanced – while accommodating public use where appropriate.	No natural areas management plans or implementation in effect.	Only reactive management to facilitate public use. e.g. hazard abatement. trail maintenance.	Management plan in place for each publicly owned natural area to facilitate appropriate public use.	Management plan for each publicly owned natural area focused on sustaining and, where possible, improving overall ecological integrity (i.e., structure and function -while facilitating appropriate public use.	Some woodlot management plans submitted in conjunction with Plans of Subdivision exist but have not been implemented.
Resource Management: Monitoring and Maintenance	MONITORING	Periodic, cyclical inspection of urban trees to identify health, pests and disease, growth, canopy, site conditions, and potential risks. Regular inspections guide urban forest management activities, including regular maintenance, species selection, planting sites, preventative and reactive disease and pest control.	No monitoring.	Monitoring is infrequent and reactive to reported changes in tree health, site condition.	Monitoring on a regular basis with rotating schedule for each area. Monitors are professionals or volunteers trained to collect specific data required by municipality. Multi-year data available for trend analyses.	Monitoring adheres to the standards and protocols established by the Urban Tree Growth and Longevity network.	Current status exceeds Fair level but does not meet data-collection requirements of Good level.
Resource Management: Monitoring and Maintenance	TREE RISK MANAGEMENT	Comprehensive tree risk management program fully implemented, according to ANSI A300 (Part 10) "Tree Risk Assessment" standards, and supporting industry best management practices.	No tree risk assessment or risk management program. Response is on a reactive basis only.	Citizens and city staff report tree safety issues to the forestry department or manager (e.g. 3-1-1 system, online form, etc.). System tracks the time between damage report and mitigation action.	The community has written tree risk management policy (aka, 'standard of care') and an operational plan for inspecting and mitigating reported tree problems, including a timetable for mitigating potential hazards.	Includes "better" but with TRAQ-qualified contractors on city projects. Educate tree care companies and public about importance of TRAQ qualifications.	
Resource Management: Monitoring and Maintenance	URBAN WOOD AND WASTE UTILIZATION	Create a closed system diverting all urban wood and green waste through reuse and recycling.	No utilization plan; wood and other green waste goes to landfill with little or no recycling and reuse.	While most green waste does not go to landfill, uses are limited to chips or mulch.	The majority of green waste is reused or recycled - for energy, products, and other purposes beyond chips or mulch.	Comprehensive plan and processes in place to utilize all green waste one way or another, to the fullest extent possible.	Current status exceeds Fair level, but does not meet Good level requirements for reuse or recycling of "majority" of green waste.

2.3.2.1 Criteria and Indicators assessment summary

Using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, Brampton's performance in eleven criteria (note: one of twelve criteria not assessed due to inapplicability) related to maintaining the urban forest scores 15 out of 44 (34%). Key shortcomings include the limited assessment and reactive management of natural areas, the generally *ad hoc* nature of interdepartmental coordination on urban forestry issues, the limited extent of urban forest monitoring, the absence of a tree risk management policy, and the limited extent of urban wood waste reutilization. Brampton's strengths include coordination between the City and local utility, cooperation with the Region and other municipalities, and generally adequate urban forest maintenance program capacity.

It should be noted that in the absence of a vision, goals and objectives for the urban forest (to be established in Part 2 of the UFMP), this assessment assigns the Optimal performance level as the performance target for each criterion. However, Brampton's actual performance target levels will be established in Part 2 of the Urban Forest Management Plan, and may be lower than the Optimal level for some or all criteria. In this case, although the number of points awarded for the City's current status will not change, Brampton's relative performance in this series of criteria may increase.

2.3.3 UFMP directions

Currently, Brampton's programs and practices for maintaining the urban forest exhibit both significant shortcomings and notable strengths. The Urban Forest Management Plan Framework and Implementation Plan should reflect the need to support and enhance existing programs and practices, and to enhance other elements of urban forest maintenance. Strategic directions for the UFMP based upon an assessment of the City's current status are outlined below.

2.3.3.1 Enhance capacity to deliver urban forestry services and programs

The Parks Maintenance and Forestry section is the "home" of urban forest management in the City of Brampton, but is currently limited in its capacity to deliver the broad range of urban forestry services beyond tree maintenance operations. This lack of capacity is, in part, a result of the section's relatively flat organizational structure and an absence of specialized staff and differentiated units. Currently, Forestry staff are frequently required to fulfill a wide range of responsibilities on an *ad hoc* basis, and considerable support is required from other departments and divisions to fulfill core urban forestry responsibilities. Operational and strategic capacity should be enhanced by clearly defining specialized sub-sections within the Forestry section for delivering services such as tree preservation by-law and development/building application review and compliance enforcement; contract administration for tree planting and maintenance operations; wooded natural areas management; pest, disease, and invasive species management; and strategic planning; among others.

2.3.3.2 Strengthen interdepartmental coordination

Although interdepartmental coordination and cooperation on urban forestry issues is reported to be generally adequate in Brampton, issues related to departmental roles, responsibilities and procedures occur and occasionally result in adverse outcomes for the urban forest. These could be readily resolved through enhanced communication and coordination, facilitated by the recently established Green City Working Group.

2.3.3.3 Support and enhance current programs and practices

Several aspects of Brampton's current urban forest maintenance programs and practices align with recognized best management practices and are comparable to or exceed those in comparator jurisdictions. Perhaps the most notable example is the City's five to seven-year tree maintenance cycle, wherein both street and park trees are inspected and, if necessary, pruned or scheduled for removal. This level of service should be maintained (at the more frequent five-year interval if possible) and enhanced through integration with the forthcoming tree inventory which, upon completion can be used to enhance the planning and delivery of the tree maintenance cycle.

Existing urban forest maintenance programs and practices in Brampton which should be supported and enhanced by the UFMP may include:

- The program administration structure and service delivery model, through strengthened interdepartmental coordination, a clarification of roles, and an audit of service delivery efficiency and efficacy
- Other elements of tree maintenance operations, through improvement of service response times and young tree structural pruning practices, adoption of asset management principles and practices, and enhanced coordination with local utilities and the Region of Peel
- Tree risk management, through the adoption of a tree risk management policy, development of tree risk management zones, and implementation of advanced tree risk assessment methods and conservation-based risk mitigation approaches
- Pest, disease, and invasive species management, through the development of a strategy or policy (including a robust vulnerability assessment), integration with other City strategic initiatives and site-specific projects, and strengthening of education and partnerships
- Wooded natural areas management, through developing and implementing standards for woodland management following assumption and allocating the resources necessary for targeted and sustained woodland management
- Other program elements, through enhancing urban forest waste reutilization, facilitating the provision of urban forest foods, and others

2.3.3.4 Formalize urban forest maintenance Levels of Service

Urban forest maintenance operations in Brampton are not currently guided by departmental or divisional policies or a formalized 'Levels of Service' (LoS) document, as can be found in Richmond Hill, Markham, Lethbridge, and other municipalities. Some existing service levels, although not described in policy or otherwise formalized, currently align with best practices, while others considerably underperform or are inconsistently delivered. The absence of approved and formalized Levels of Service may enable the reduction of service levels in the future, potentially compromising urban forest health, condition, function, and safety. Conversely, formalizing service levels will establish clear expectations for service delivery, clarify divisional responsibilities, facilitate asset management planning, and enhance overall service delivery performance. Doing so will also help to ensure sustainable resourcing for necessary urban forest maintenance operations. As such, Brampton's UFMP should outline actions and provide clear guidance to formalize a range of maintenance Levels of Service for Brampton's urban forest.

2.3.3.5 Develop necessary plans, policies and guidelines

As described, virtually all aspects of urban forest maintenance in Brampton currently lack the guidance afforded by issue-specific plans or operating policies. These include elements of the tree maintenance program; tree risk management; pest, disease and invasive species management; and wooded natural areas management. The development of operating plans, policies or guidelines for these urban forest maintenance program elements would provide the strategic and procedural guidance, coordination, and clarity necessary to enhance program delivery to meet existing targets, targets to be established by the UFMP, and applicable best practices for urban forest management. Examples of such plans, policies or guidelines may include, among others, an oak wilt response and management plan, a series of tree maintenance and tree risk management operating policies, or additional woodland management plans. As such, the Brampton UFMP should direct the City to develop the plans, policies, and guidelines necessary to enhance the urban forest maintenance service delivery.

2.3.3.6 Integrate the urban forest with broader asset management frameworks

Urban forest maintenance programs in Brampton are not currently integrated with the City's broader asset management framework. Achieving this level of integration is hindered by the lack of a complete street tree inventory and, even upon inventory completion, is likely to be constrained by the inventory's limited scope and attributes. However, Brampton's asset management policy framework, Provincial asset management regulations, and the City's forthcoming transition to the CityWorks enterprise asset management system will enable the application of asset management principles to urban forest maintenance operations. Outcomes may include enhancing information sharing about the City's urban forest resources across all relevant City departments and other stakeholders; integrating Service Request and Work Order processes and histories with the tree inventory; enabling full lifecycle cost accounting and enhancing financial planning for urban forest assets; and enhancing overall service delivery efficacy and efficiency.

2.3.3.7 Engage the community and other partners in urban forest maintenance

Community members can play an important and valuable role in urban forest stewardship. Residents can be engaged through relatively simple measures such as tree watering, weeding and mulching, or through more involved initiatives such as ‘Adopt-a-Tree’ or ‘citizen pruner’ programs. Through the UFMP, Brampton should pursue opportunities to engage residents more effectively in urban forest stewardship.

3 Growing Brampton's urban forest

3.1 Overview

Tree establishment is a major component of urban forest management in Brampton. Tree establishment entails more than tree planting – it also includes prior planning to ensure that appropriate planting sites are selected or developed and the post-planting maintenance necessary to ensure that trees thrive in the long-term. Tree establishment may be undertaken to replace removed trees, increase urban forest canopy cover, restore or naturalize sites, complete new streetscapes, and fulfill multiple other functions and objectives.

Trees in Brampton's urban forest are established by City staff and contractors, developers, Conservation Authorities, private landowners, and other partners, through several different programs and approaches. These include:

- Urban forestry operations
- City and Regional capital projects
- City- and partner-led community stewardship and engagement initiatives
- Residential, commercial and institutional development
- Private land stewardship

This section of the UFMP addresses the City of Brampton's and its partners' current approaches to growing the urban forest and presents strategies to enhance the undertaking of this important aspect of urban forest management. The section primarily focuses on City-led and developer-initiated tree planting programs and practices, as these are the two major drivers of tree establishment on City-managed lands in Brampton.

3.2 Current status and best practices

3.2.1 Policies, strategies, plans and studies

City of Brampton policies, strategies, plans and studies that provide strategic guidance for tree establishment include:

- Living the Mosaic Brampton 2040 Vision (2018)
- Official Plan (2006, office consolidation 2020)
- Grow Green Environmental Master Plan (2014) and EMP refresh (2020)
- Natural Heritage Environmental Management Strategy (2015)
- Natural Heritage Restoration Program (2019)
- Eco Park Strategy (2019)
- One Million Trees Program Strategy (2019)
- Urban Forest Study (2011)

The Grow Green Environmental Master Plan, One Million Trees Program Strategy, and Urban Forest Study are described below. Other guiding policies and plans, which also include high-level land use planning guidance or provide some, albeit relatively limited, guidance for tree establishment, are reviewed in Section 4.2.3. The Region of Peel Priority Tree Planting Areas to Grow Peel's Urban Forest report (2015) is also discussed below.

3.2.1.1 Urban Forest Study, 2011

The 2011 Urban Forest Study makes multiple recommendations related to tree establishment in Brampton. Tree establishment-related recommendations include:

- prioritizing planting in neighbourhoods as identified through the Priority Planting Index (PPI)
- planting in high impervious/low canopy parcels
- planting trees and shrubs under existing tree cover to increase leaf areas
- establishing a diverse and pest-resilient tree population
- using native, seed-grown, non-clonal nursery stock
- planting in "hot spots" identified by thermal imagery
- using the UTC analysis together with natural cover mapping to identify priority planting and restoration areas
- developing guidelines to ensure the provision of adequate soil quality and quantity and eliminating tree/infrastructure conflicts, and
- using and monitoring enhanced rooting environment techniques

To date, implementation of these recommendations has been limited, and the decision-support tools provided by the Urban Forest Study (e.g., PPI, "hot spot" mapping) have not been effectively integrated into tree establishment programs and practices.

3.2.1.2 Grow Green Environmental Master Plan, 2014 and EMP refresh, 2020

The 2014 Grow Green Environmental Master Plan includes multiple actions related to tree establishment and growing Brampton's urban forest. These include (note: actions related to naturalization and restoration are excluded from this list):

- L 11 – Develop Official Plan policies for new development to require mitigation and compensation for the loss of tableland vegetation to facilitate development.
    - L 11.1 – Update Landscape Standards and guidelines to increase tree planting requirements for new residential, commercial, industrial and institutional sites.
    - L 11.2 – Update Landscape Standards to increase tree planting requirements for City and Regional road projects.
    - L 11.3 – Update Landscape Standards to increase soil quantity and quality for park and boulevard tree planting.

- L 12 – Implement the recommendations of the Brampton Urban Forest Study.
    - L 12.2 – Develop a range of tree canopy targets for the city.
    - L 12.3 – Develop a Priority Planting Tool to assist municipal staff and community partners to identify planting sites to maximize urban forest benefits across the city.
    - L 12.5 – Establish a baseline and monitoring protocol for the total number of trees planted on City-owned land per year.
    - L 12.6 – Establish a baseline and monitoring protocol for the total number of trees planted city-wide per year.

- L 15 – Support the Conservation Authorities' 'Greening Corporate Grounds' and 'Partners in Project Green' programs.
    - L 15.1 – Work with Conservation Authorities to partner with community associations, ICI sectors and School Boards to plant trees on their properties, including greening parking lots.

- L 16 – Work with Conservation Authorities to establish a residential Tree Planting Program in Brampton.
    - L 16.1 – Develop an annual private tree planting program that includes discounted trees and planting advice for homeowners (*initiated in 2021*).
    - L 16.2 – Develop a communication strategy to educate residents on the benefits of Brampton's urban forest and how they can assist in maintaining its health (*initiated in 2021*).

The "refreshed" EMP action plan carries forward and adapts key actions from the original EMP in a simplified framework, and adds several new actions. Many of the actions outlined in the EMP refresh, especially those under the "Land" goal area, directly relate to maintenance, enhancement, protection and engagement with Brampton's urban forest, and it is expected that there will be some overlap between EMP actions and those presented in the UFMP. Selected urban forest-related actions outlined in the EMP refresh (2020) include:

- #31 - Develop and commence implementation of an Urban Forest Management Plan.

- #32 - Update the Tree Preservation By-law to enhance preservation of healthy tableland trees.

- #33 - Launch a marketing campaign to increase awareness of and compliance with the Tree Preservation By-law.

- #34 - Develop and commence implementation of a Woodland Management Strategy for City-owned woodlands.

- #35 - Transition the Valleyland Naturalization Program to the Naturalization Program to widen its scope from solely valleyland restoration to both valleyland restoration and tableland naturalization.

- #37 - Review and update the City by-laws to ensure they do not restrict designed naturalization efforts on public and private lands.

- #39 - Develop and commence implementation of an Invasive Species Management Strategy for City-owned land.

- #40 - Develop planning policies that require invasive species management to be undertaken as part of new development.

- #44 - Expand the City's Alternative Design Standards for public right-of-ways (e.g. roads, streets, sidewalks) to improve active transportation, naturalization, street tree health, and stormwater management.

- #48 - Develop a communication strategy to promote the Adopt-a-Park program and increase participation.

- #49 - Update and commence implementation of an updated Sustainability Communities Program: New Development (i.e. Sustainability Metrics and Thresholds).

- #50 - Establish upgraded Sustainability Thresholds for urban centres as part of the Sustainability Communities Program: New Development.

3.2.1.3 One Million Trees Program Strategy, 2019

The Living the Mosaic Brampton 2040 Vision established a key action of planting one million trees in the public and semi-public realm by 2040. In February 2020, Brampton City Council endorsed the planting of 50,000 trees per year across the city, representing an annual increase of 7,000 trees planted above the historical average of 43,000 trees planted per year. Achieving this level of planting on an annual basis will continue to require the considerable support of various City partners, including Conservation Authorities, the Region of Peel, school boards, the development industry, and residents, among others, as the City itself has only planted an annual average of approximately 7,000 trees between 2014 and 2018. In contrast, these other partners plant a combined total of approximately 36,000 trees per year. It should also be noted that a component of the Brampton 2040 Vision is that "citizens have doubled this [one million trees] by planting more trees on private property," suggesting that the City and its partners will need to significantly increase education, outreach and support efforts for private land tree establishment and stewardship.

Implementation of the One Million Trees program will be supported by the One Million Trees Program Strategy (Draft 2019), which outlines the current status of tree planting programs and approaches in Brampton and establishes four program goals, including:

- Analyse and identify
- Implement
- Educate, engage and empower
- Monitor and update

The Strategy also highlights gaps in current programs and opportunities to expand planting partnerships and efforts. Key gaps identified in the Strategy include:

- The absence of a coordinated planting program and planting requirements for existing neighbourhoods
- A lack of consistent standards for integrating tree planting with capital projects
- Minimal tree canopy cover on streets and school grounds
- No residential tree subsidy programs
- Few community tree planting events, and
- The absence of tree monitoring strategies

Key opportunities identified in the Strategy include:

- Integrating tree planting into all capital projects, including park and playground renewals, road repaving, and others
- Planting in existing neighbourhoods through capital projects and other means
- Using Peel Region's Tree Planting Prioritization Tool (TPPT) in conjunction with the City's Nurturing Neighbourhoods Program to identify priority areas for tree planting
- Incorporating community planting events into park planting projects
- Enhancing public education and awareness about the urban forest
- Increasing collaboration with corporate, non-governmental organizations and Conservation Authority partners, and
- Pursuing new partnerships and funding opportunities

The One Million Trees Program's five-year action plan outlines four strategies to support the realization of the program's goals. These include:

1. Develop a holistic, neighbourhood-based approach to identify tree planting opportunities that incorporates climate change mitigation and adaptation.
2. Increase tree planting and canopy cover and support tree planting initiatives on public parks, roads and other City-owned properties, in existing residential neighbourhoods, and on commercial, industrial, and institutional lands.
3. Educate, activate, and engage the public and City staff through expanded education and outreach.
4. Set baselines and targets for the next 20 years to inform and drive the success of the Brampton One Million Trees Program.

These strategies are supported by multiple action items (see Appendix 2). Brampton's UFMP should support the One Million Trees Program by outlining actions to fill gaps and to capitalize on identified opportunities. It is anticipated that there may be considerable overlap between the action items recommended in the One Million Trees Program Strategy and the UFMP strategies and actions.

Best practices – Tree planting strategy

In 2017 London, ON published the "Plant More" Tree Planting Strategy (2017-2021) to support the City's target of achieving 34% canopy cover by 2065. The strategy identifies partnerships with the community as perhaps the most important factor for success, and includes an "urgent call to action" to support the planting of 2,430 ha of urban forest canopy, or 2.44 million trees. The strategy effectively illustrates the amount of effort required by equating it to planting 400 times the area of Victoria Park, a well-known local park, at full canopy coverage. The strategy also outlines the considerable resources required to achieve the planting target.

3.2.1.4 Priority Tree Planting Areas to Grow Peel's Urban Forest, 2015

In 2013, the Region of Peel, local municipalities of Brampton, Caledon and Mississauga, CVC and TRCA partnered under the Region's leadership to develop a GIS-based mapping tool to support tree establishment. The resultant Tree Planting Prioritization Tool (TPPT) facilitates the identification and prioritization of opportunity areas for tree establishment based on the environmental, economic and social benefits (or services) that trees in those areas could provide. The TPPT was developed to help the project partners achieve five objectives, as summarized below:

- To provide more equitable urban forest benefit distribution in Peel
- To develop a decision making tool to prioritize tree planting to meet multiple objectives
- To optimize growing Peel's urban forest in a cost-effective manner
- To support a coordinated approach to long-term tree planting programs between project partners and others, and
- To provide an interactive tool to prioritize areas for planting based on one or more benefit objectives

The TPPT was also developed to help guide and prioritize tree establishment in the context of climate change.

The TPPT project included the development of the GIS mapping tool and an opportunity zones/priority areas mapbook based on pre-selected urban forest benefits (Figure 8). Use of the tool is supported by the Priority Tree Planting Areas to Grow Peel's Urban Forest report (2015), which outlines the rationale and methodology underlying the TPPT project.

To date, the TPPT has not been used in a consistent or effective manner by the City of Brampton in tree establishment planning or implementation.

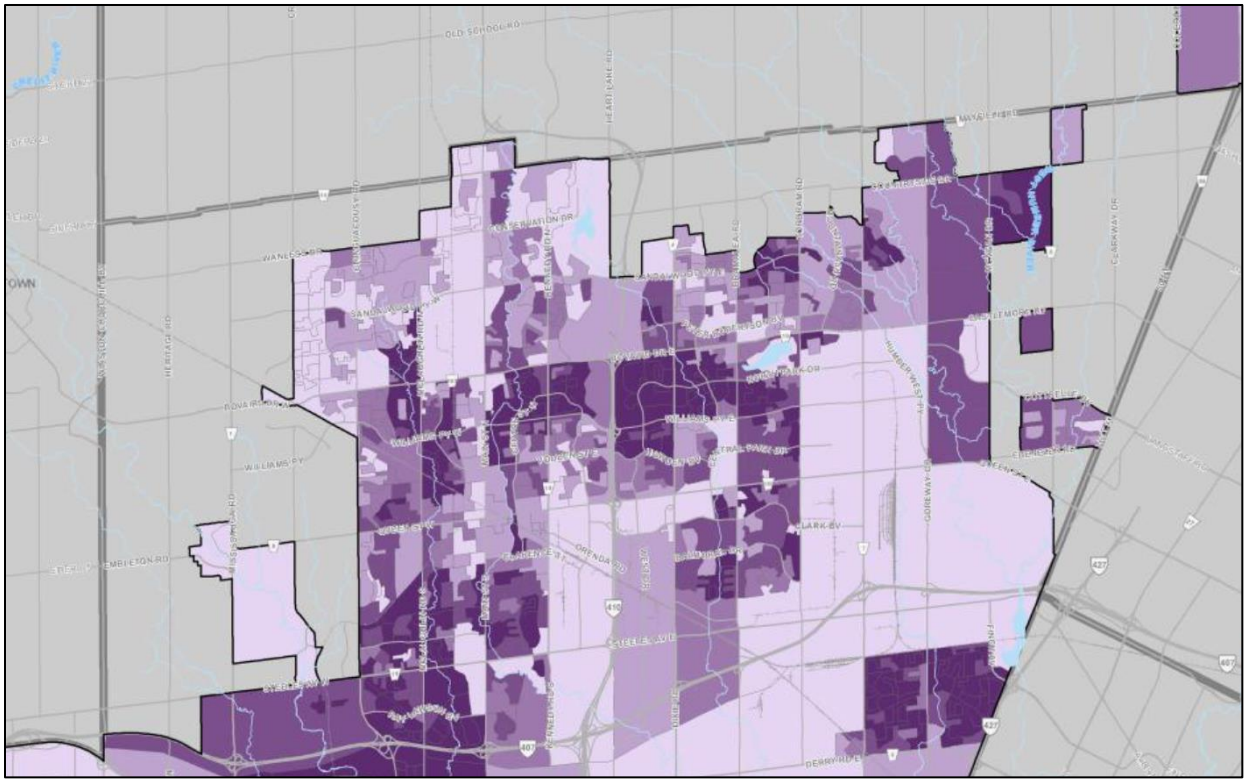


Figure 8: Detail of Brampton urban area ranking planting areas based on “overall theme” score (combining environmental, economic and social benefits), Priority Tree Planting Areas to Grow Peel’s Urban Forest report, 2015. Darker purple areas have a higher overall priority planting score.

3.2.2 Guidelines and reference manuals

Land development in Brampton, including the tree establishment component of landscape development, is guided by multiple design guidelines and reference manuals. The relationship between these guiding documents and tree establishment is reviewed in detail, below.

3.2.2.1 Landscape Development Guidelines, 2019

As stated in Brampton’s recently approved Landscape Development Guidelines (LDGs) “most of the City’s open space development will be associated with and implemented through the Subdivision Application and Site Plan processes.” As such, the LDGs are intended to guide the development of public open space in Brampton, which includes but is not limited to parks, streetscapes, buffers, recreational trail systems, cemeteries, woodlands, valley lands, hazard lands, natural heritage systems and NHS blocks, engineered channels, and stormwater management facilities. These guidelines outline the process and minimum design requirements for a range of landscape design elements – perhaps most notably trees.

Key technical guidance elements for the establishment of boulevard trees in new subdivisions (a major component of Brampton’s urban forest) are outlined in Sec. 1.1.1 of the LDGs, and are summarized and critically assessed in Table 6, below.

Table 6: Summary and critical assessment of key technical guidance elements for boulevard tree establishment in subdivision developments outlined in Sec 1.1.1 of the Brampton Landscape Development Guidelines, 2019.

Element	Guidelines	Assessment
Spacing/density	8.0 m to 10 m, on centre	May be too narrow/close for growth of large-canopy trees if adequate soil volumes for large tree growth are provided. In good growing sites with large-statured trees, 10 m or wider spacing should be used to allow for canopy growth and expansion without interference. Tighter spacing may be appropriate for smaller-statured trees.
Dominant species	Dominant species at least 50% of overall mix; planted in groups of 4-6 trees	Does not align with urban forestry best practices for tree species diversity. Significantly increases potential for wide-scale tree loss impacts (ref. EAB/ice storm ash mortality). Table 1 (common boulevard trees) includes highly over-abundant, potentially invasive and generally poor species (e.g., *A. platanoides*, *Pyrus calleryana*)
Sub-dominant species	Two sub-dominant species to “make up the balance”; planted in groups of 3-5 trees	See above.
Arrangement	Sub-dominant species interwoven among larger groupings of dominant species	See above.
Texture	Similar texture for any given street; fine or coarse	Does not align with urban forestry best practices for tree species diversity. Excessive focus on aesthetics over other functions and diversity.
Minimum tree size	70 mm caliper at dbh (ball and burlap only)	Caliper at dbh is not a standard measurement and cannot be integrated into contract specifications/standards or enforced. Caliper is measured at 15 cm above the soil line for trees up to and including 100 mm. A tree of 70 mm dbh may have a significantly larger caliper. Smaller (40-60 mm caliper) trees transplant more successfully than larger stock.
Soil	30 m^3 of soil per tree (20 m^3 per tree if shared)	Conforms to best practices.
Soil depth	Minimum 0.7 m soil depth	Generally conforms to best practices. Conflicts with Minimum Target for Sustainability Criterion 2.1.11 (60 cm topsoil, 90 cm total uncompacted subsoil depth) in the *Sustainable Community Development Guidelines.*

For subdivision development applications, the Landscape Development Guidelines also:

- outline provisions for tree plantings along boulevard buffers (Sec. 1.1.2)
- prescribe large canopy, salt-tolerant and winter-hardy trees along arterial roads, to be planted in designated planting buffers, tree rows and groupings (Sec. 1.1.3)
- prescribe medium to large trees along collector roads, to be planted in boulevards with a minimum 1.0 m roadway setback (Sec. 1.1.5)
- prescribe deciduous trees (size varies by tree planting area) at narrower spacing in boulevards or front yards (Sec. 1.1.6)
- prescribe conifers in planting buffers for “immediate visual screening” along “window roads” (Sec. 1.1.7)
- allow the selection of trees with “more compact form” in areas where Alternative Design Standards (ADS’s) have minimized clearances and setbacks (Sec. 1.1.8)
- include tree establishment guidelines for gateways and other streetscape enhancements (Sec. 1.1.9)
- include tree establishment guidelines for the Neighbourhood Park park typology, including setbacks, conifer spacing, arrangement to enable visual surveillance and provide shade and wind screening, and density of 120 trees per hectare (Sec. 1.2.6)
- include guidelines for the management of valleylands, invasive species, woodlands and wetlands; habitat enhancement; restoration planting; and environmental buffers (Sec. 1.3)
- include tree establishment guidelines for stormwater management facilities; notable among these is the listing of EAB-susceptible white and green ash as acceptable (Sec. 1.4.2)
- refer to the Tableland Tree Assessment Guidelines for direction regarding evaluation and compensation requirements for existing tableland trees (Sec. 1.5)
- outline supplementary design requirements for trees, including minimum planting stock sizes of 70 mm caliper for deciduous trees and 1.8 m to 3.0 m for conifers (Sec. 1.8.3)
- detail the landscape submission, construction, inspection and release processes for subdivision development (Sec. 1.9 to 1.20), and
- include a comprehensive list of approved tree species (Appendix B: Plant Chart, described in more detail in Section 3.2.5.3.2)

Some of the tree establishment-related provisions in the LDGs align with urban forestry best practices and are appropriate for Brampton’s land use and development context. Among these include the soil volume and depth requirements, preference for tree planting in front yard areas where soil volumes are greater, and guidelines for natural areas and invasive species

management. However, the LDGs also exhibit several shortcomings which, if implemented, may compromise the long-term resilience, functional capacity and sustainability of the urban forest. Among these include:

- provisions that appear to favour aesthetics over urban forest diversity, function and resilience, such as requiring dominance (min. 50%) by one species per street
- a provision that enables the selection of small-statured and narrow trees in constrained streetscapes, which compromises the urban forest services provided by large-statured trees with greater leaf area
- prescription of large (min. 70 mm) tree stock, which may transplant less successfully or more slowly than smaller-sized stock (e.g., 50-60 mm)
- listing as acceptable overabundant, potentially invasive, or otherwise undesirable tree species including Norway maple, Callery pear, ivory-silk lilac, and (for stormwater ponds) EAB-susceptible white and green ash

Part 2 of the Landscape Development Guidelines outlines supplementary design requirements for trees planted through Site Plan development applications, including minimum planting buffer widths, minimum planting stock sizes of 70 mm caliper for deciduous trees and 1.8 m for conifers (Sec. 1.7.4), and preservation (Sec. 1.7.6) and mapping guidelines for existing (Sec. 1.9.1.6) and proposed (Sec. 1.9.1.7) vegetation.

The Landscape Development Guidelines do not explicitly supersede other City standards and specifications, and are instead intended to be complementary to other relevant guidance. Applicants may be required to “produce project-specific, non-standard details where necessary,” and are cautioned that, “All plans that are submitted for review and approval are to incorporate the *Parks Construction Standard Details, Standard Subdivision Notes for Landscape Development and Landscape Specifications* as applicable.” As described in the Terms of Use section of the LDGs, the Guidelines are intended to be a “living document that will be updated from time to time”. As such, it is anticipated that opportunities to address shortcomings will be made available through periodic review of the LDGs.

Best practices – Enhanced landscaping requirements

Municipalities commonly require the establishment of one tree per dwelling lot in new communities, and collect cash-in-lieu for trees that cannot be planted due to site design and layout constraints. This practice may result in the under-provision of street trees in new communities, especially where lots are small and rights-of-way are narrow. In recognition of this challenge, Edmonton significantly enhanced its zoning by-law in 2016 to include minimum requirements for landscaping of new residential developments. All new residential developments in certain zones are now required to plant trees and shrubs in accordance with these enhanced landscaping provisions, which consider site width and building type to specify the minimum required numbers of trees and shrubs. Trees and shrub species and quantities are to be listed in text on the site plan, and plant locations do not need to be shown on the site plans to allow future homeowners to decide the ultimate location of the trees and shrubs. Minimum landscaping requirements are shown in Figure 9, below. A reduction in required plant quantities may be provided as an incentive to retain existing mature trees on the site.

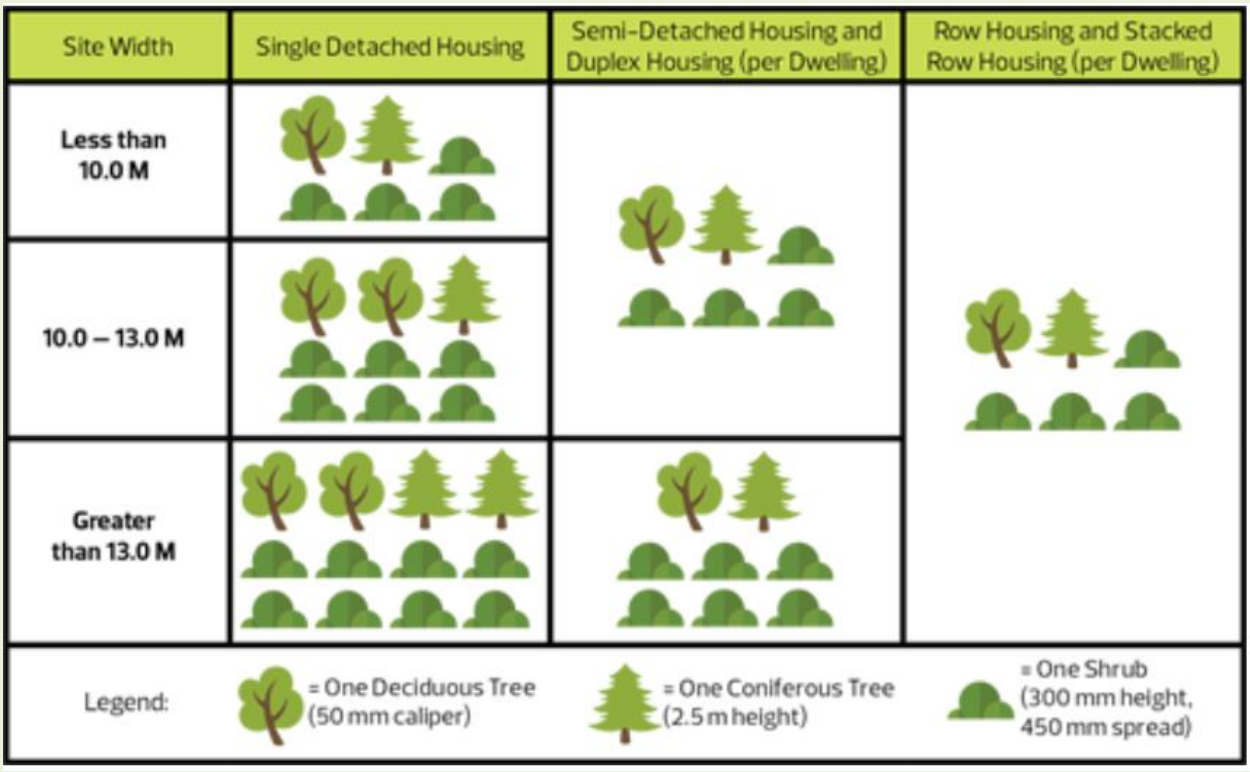


Figure 9: Minimum tree and shrub landscaping requirements for new residential developments in Edmonton. These requirements significantly exceed the 'one tree per lot' or spacing-based requirements common in most municipalities.

3.2.2.2 Site Plan Review User Guide, 2018

In Brampton, municipal Site Plan Approval (SPA) is required prior to the issuance of a Building Permit for all development types subject to Site Plan Control. The Site Plan Review User Guide (SPRUG) describes the Site Plan Review and Approval process, including required submissions and design considerations.

The SPRUG requires that applications adhere to all applicable Brampton guidelines or requirements documents, including the various documents described in this section that provide tree establishment guidance. As such, tree establishment related guidance in the Site Plan Review User Guide is limited to:

- C.14.6 Landscape Criteria:
    - Provide high quality streetscapes that offer appropriate planting materials to address summer/winter conditions, and provide canopy closure on local roads.
    - Street trees shall be provided to contribute to the urban tree canopy and to create a canopy and shade over sidewalks.
    - Street trees must be of a species that would provide a large canopy and shade over sidewalks. Street trees should provide shade over at least 40% of the length of the sidewalk or road to reduce heat island effect and enhance pedestrian comfort and safety.
    - On landscape trails abutting natural features use native, non-invasive species that can contribute to the urban tree canopy and shade the trail.

As described in the User Guide, Site Plan applicants may be required to complete a Sustainability Assessment Tool (SAT) assessment and submit a Sustainability Summary. Achieving Minimum or Aspiration target levels related to tree establishment may raise an application's Sustainability Score. The above guidance may be interpreted as equivalent to the Minimum target: "Satisfy the City's tree planting requirements" for Sustainability Metric 2.1.12 – Percent (%) Tree Canopy within Proximity to Building/Pedestrian Infrastructure (see Section 3.2.2.7), as higher-level targets require a greater extent of projected shading over walkways or sidewalk lengths (50% to 75%).

The user guide also encourages tree planting as a passive traffic calming measure.

3.2.2.3 Development Design Guidelines, 2003 (ongoing)

Brampton's Development Design Guidelines (DDGs) establish minimum design standards for planning, design and construction of new communities and other development projects. The DDGs outline high-level guidance for tree establishment in the open space system, street network, streetscapes, edges and gateways, commercial areas, automotive service centres, drive-through facilities, and transit-supportive townhouses. The DDGs are considered a 'living document', and revisions and additions to the guidelines continue to be made periodically.

Tree establishment supports the vision and design principles outlined in the DDGs. Tree establishment guidelines articulated in the DDGs include:

For the open space system:

- Parkettes (Village Squares): The landscape along the street frontage, including canopy street trees, should be complementary on both sides of the street.

For the street network:

- Primary streets (Sec. 3.1): Large canopy tree species are encouraged in the curbside boulevard to define the street edge and reinforce the public avenue of movement along these important streets.
- Arterial roads (Sec. 3.1.1): Large canopy trees should be planted along Arterial Streets.
- Community connector roads (Sec. 3.1.2): Street tree planting is encouraged in the curbside boulevard to define the street edge and reinforce the public avenue of movement. Encourage landscape medians at gateways to include the planting of a minimum of 4 trees (@ 6.0metres on centre).
- Neighbourhood connector roads (Sec. 3.1.3): Street tree planting is encouraged in the curbside boulevard to define the street edge and reinforce the public avenue of movement.
- Local streets (Sec. 3.2): Street trees species may vary in ultimate canopy and height along Local Streets.

For streetscapes:

- Streetscapes (Sec. 4.0): Typical street sections shall be developed at the Block Plan stage to illustrate how the components of the Streetscape combine to achieve a high quality environment. These shall illustrate … boulevard landscaping/tree locations. Streetscape design shall consist of Street Trees… . Street tree planting shall form a continuous canopy along the street; tree species shall be selected to reinforce the role of the various streets within the community and to visually and thematically distinguish the various streets from one another.
- Arterial roads (Sec. 4.1.1): Multiple rows of trees, tree groupings, plantings and sometimes berming shall be used to improve the spatial enclosure of Arterial Roads.
- Community connector streets (Sec. 4.1.2): Along these streets provide a row of large canopy street trees. Street tree species should be selected to visually or thematically distinguish these streets as Community Connector Streets. Accent trees may be planted at the intersections of the Neighbourhood Connector Streets with other Primary Streets.
- Neighbourhood connector streets (Sec. 4.1.3): An additional row of trees should be provided along private property adjacent to Open Space, Community Uses, Commercial Sites, and Schools. Street tree species should be selected and placed to visually or thematically distinguish these streets from others within the community.
- Scenic drives (Sec. 4.1.3.1): Street trees consistent with the opposite side of the street shall be planted in along the R.O.W.
- Local streets (Sec. 4.2): Street trees should be planted in locations within the street R.O.W. which is consistent with the City of Brampton's standards.
- Streetscape components (Sec. 4.3): Streetscape Components include: … street trees.

- Street Trees (Sec. 4.3.1): Street Trees are an important component of the streetscape zone. The type and spacing of street trees should reflect the role of the street and reinforce the street zone. Street tree species should be selected for horticultural diversity, variety in colour, form and textures and visual interest.

For edges and gateways:

- Window streets: Generally the landscaped buffer zone should include … deciduous and coniferous trees and shrubs.

For commercial areas:

- Parking (Sec. 2.1.3): Where portions of street frontage are characterised by adjacent commercial parking areas, landscaping and tree planting shall be designed to improve the pedestrian comfort and visual streetscape

For automotive service centres:

- Public domain landscaping (Sec. 4.1): Streetscapes at automotive service centres shall be designed to provide an enriched visual experience that reinforces their contiguous character and minimizes the impact of the vehicular functions of these service centres through the use of tree rows … . Tree selection shall be in accordance with City standards and shall take into consideration the impact of high vehicular traffic. High branching deciduous trees shall be planted in the boulevard spaced at 15 meter centres along the street front-ages.
- Private domain landscaping (Sec. 4.2): Landscape plantings with high branching deciduous trees and small groups of conifer trees shall be provided to screen service centre operations from non-compatible uses such as residential properties and public open space.

For drive-through facilities:

- Lighting (Sec. 3.3.2): Locate lighting, trees, soft landscaping, and exterior furniture along pedestrian walkways through out the site in order to create a more pedestrian friendly environment.
- General requirements (Sec. 4.1.1): High branching deciduous trees shall be planted in the boulevard in accordance with the City of Brampton, Peel Region, and Hydro One requirements and any other agencies/utilities concerned with the public realm.
- Edges (Sec. 4.2.2): Screen cars from view while allowing eye-level visibility into the site by using trees, shrubs and low walls
- Noise and visual screening (Sec. 4.2.3): Landscape planting with high branching deciduous trees and small groups of conifer trees shall be provided to screen drive-through operations from non-compatible uses such as residential properties and public open space.

For transit-supportive townhouse design:

- Streetscape interface (Sec. 4.1.1): Coordinate tree location/tree planting with driveways, utilities and other municipal infrastructure. Base any landscaping strategy in part on achieving species diversity and resilience (to address urban conditions).
- Access and parking (Sec. 4.2.3): Pair single driveways wherever possible in order to create larger areas within the boulevard for tree planting and landscaping, and longer sections of uninterrupted streets for on-street parking. Incorporate tree planting to increase the overall urban canopy and help to reduce the heat island effect.
- Front yards and landscaping (Sec. 4.2.7): Where there is not appropriate condition for tree planting in the right-of-way, increase front yard setback to allow for tree planting. Where space permits, plant a deciduous canopy tree behind the lot line, in the front yard, to enhance the urban tree canopy. Preserve and protect existing healthy and mature trees both in the right-of way and in site, and incorporate them into the building and landscape designs to ensure their survival. Enhance biodiversity and create interesting streetscapes through a varied planting of native, non-invasive, trees and shrubs. Maximize soil volumes and conditions for optimum tree growth.
- Transition (Sec. 4.3.3): The interface between townhouses and different adjacent land uses should consider… including a minimum 6.0 metres of landscape strip for tree planting and other landscape elements.
- Front yard and landscaping (Sec. 5.1.7): Infill townhouse developments and live/work units may be exempt from street tree planting requirements if street trees already exist, or where no space is available to plant trees.

Architectural control guidelines:

- Coordination (Sec. 2.6): Coordination of house sitings and driveway locations with streetscape elements such as … street trees … is required to ensure there is no conflict.
- Driveways (Sec. 4.6): A mix of paired and unpaired driveway combinations is desirable to contribute to visual interest along the street and provide sufficient space for boulevard trees.

Overall, Brampton's Development Design Guidelines are highly supportive of integrating trees into new communities and projects. The Transit-Supportive Townhouse Design Guidelines include the most rigorous and innovative tree establishment guidelines, likely because these guidelines are the most recently developed of the series, and elements of these guidelines should be carried forward into any new guidelines or guideline revisions. Notable shortcomings of the DDGs in relation to tree establishment include a significant emphasis on visual uniformity, consistency (Figure 10) and the aesthetic benefits afforded by tree establishment. While this function is important, undue focus on visual consistency and other aesthetic elements may compromise urban forest resiliency and functional capacity through a lack of genetic and structural diversity. Furthermore, the townhouse guidelines enable projects to be exempted from street tree planting, potentially compromising the achievement of key strategic, policy and urban design objectives for livability and environmental sustainability.

Figure 10: Figure captioned “Visually Consistent Street Trees” in the Development Design Guidelines, Streetscapes chapter. While visually appealing, such monocultures are not resilient and could result in the loss of a street’s entire tree population, as occurred in many parts of Brampton following the December 2013 ice storm and due to EAB infestation.

The Development Design Guidelines (DDGs) also include Part 8 - Sustainable Community Design Guidelines, which are discussed in Section 3.2.2.7.

Best practices – Integrating trees in narrower rights-of-way.

The City of Ottawa’s Street Tree Manual for Greenfield Neighbourhoods recognizes that trees may be eliminated from narrow rights-of-way due to competition for space with more immediately essential infrastructure, and offers several solutions. Potential solutions include:

- Optimizing driveway and lot layouts to ensure adequate soil volume and tree quantity, which may involve pairing or unpairing driveways, depending upon configuration
- Placing underground utility services beneath driveways
- Installing root break-out zones or pathways to join small growing spaces (such as boulevards) with larger soil volumes (such as front yards)
- Eliminating front driveways through the use of rear lane access
- Recognizing that (somewhat) fewer large trees are preferable to more small trees
- Including trees at pre-application stage Site/Grading Plans and Composite Utility Plans
- Consulting with utility companies on tree placement in new neighbourhoods
- Providing compensation when trees cannot be accommodated in the R.O.W.

The Manual also includes an innovative “Tree Planning Matrix” tool which allows users to determine available planting opportunities given different site dimensions and configurations.

3.2.2.4 Subdivision Design Manual, 2008

Brampton’s Subdivision Design Manual outlines engineering and design standards for subdivision development. The manual provides little direct guidance for tree establishment, but its standards influence many aspects of subdivision design which in turn directly influence the design and construction of tree growing environments.

Direct guidance for tree establishment in the manual is limited to:

- Streetscape Design (Sec. VIII), Trees: Trees when approved for planting on the boulevard, shall be located in accordance with the applicable standard cross-section but subject to adjustments required to avoid underground utilities which are in non-standard locations, or to address site line issues.

This guidance simultaneously provides the flexibility necessary to adjust tree planting locations to accommodate trees in non-standard locations, but can also be interpreted as giving precedence to underground utilities over trees and contradicting the principle that green infrastructure is as important as traditional, or "grey", infrastructure. This may result in trees not being planted due to potential infrastructure conflicts, rather than encouraging creative or non-standard solutions to mitigating such conflicts.

3.2.2.5 Street Corridor Master Plan, 2003

The Street Corridor Master Plan (SCMP) is intended to apply a consistent and high-quality design vocabulary to road reconstruction projects for main street corridors. Despite its relatively advanced age, the SCMP includes progressive tree establishment guidance, including planting double rows of trees in the right-of-way where feasible or on adjacent private lands (Figure 11), and coordinating below-grade service locations to minimize disruptions to tree locations during servicing. The recommended 15 m on-centre tree spacing may be excessively wide but, if combined with adequate soil volumes to promote large tree development, may enable the growth of wide-spreading tree canopies while maintaining ample pedestrian clear space, commercial signage clearance, and space for other streetscape elements.

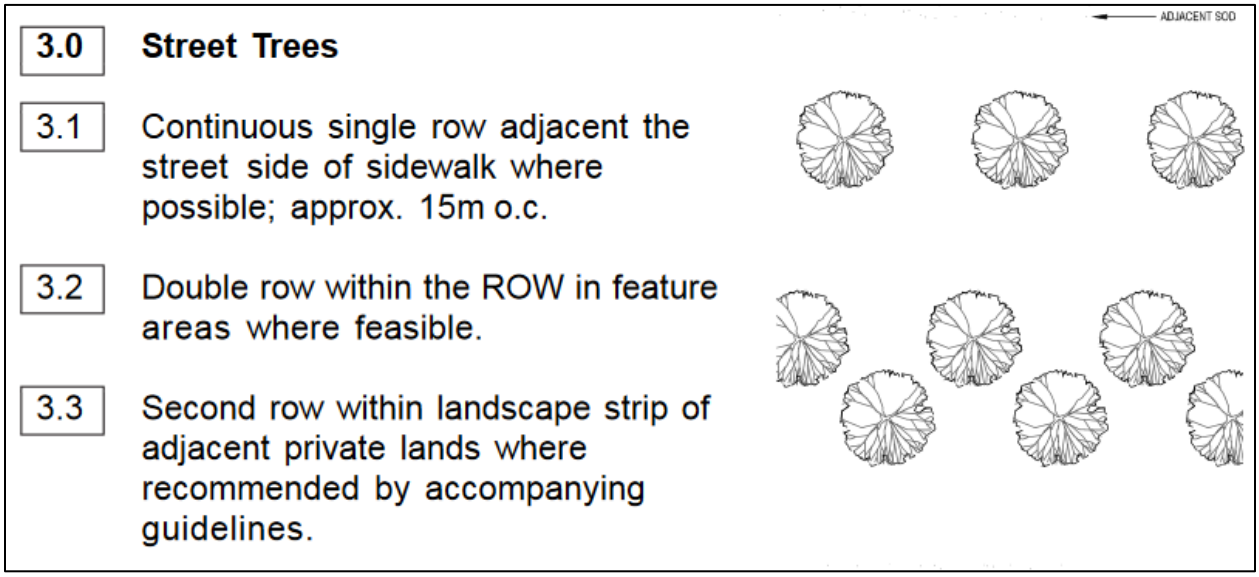


Figure 11: Street tree design vocabulary, City of Brampton Street Corridor Master Plan. Note the 15 m o.c. spacing recommended for street trees which, while considerably wider than in most comparable guidelines, may enable the development of wide-spreading canopies if combined with high-quality tree growing environments with adequate soil volumes.

3.2.2.6 Downtown Civic Design Guide

The Downtown Civic Design Guide (DCDG) provides design recommendations for Downtown Brampton, and outlines streetscape treatments and specific street furnishing components. The Guide identifies trees as an important streetscape element (or "furnishing") of the Downtown area, and establishes a 7.0 m "module" to coordinate tree and other street furnishing placement within a 1.0 metre "amenity zone" adjacent to back-of-curb (and a second amenity zone along property lines, where feasible). Typical drawings suggest the planting of "light foliage" trees adjacent to commercial frontages. The DCDG also recommends removing existing tree-guards to improve "unity of elements".

The level of guidance provided in the DCDG for tree establishment is relatively limited, and the recommended planting configurations are somewhat inconsistent with contemporary best practices. For example, the one-metre amenity zone is likely too narrow to provide adequate soil volumes for trees, unless the below-ground portion of the tree growing environment can extend well beyond the amenity zone. Additionally, increasing tree spacing beyond 7 metres may be desirable in locations with optimal tree growing environments (i.e., sufficient soil volumes, good irrigation/drainage, etc.) to promote wider-spreading canopies of mature trees.

Best practices – Increased tree spacing for larger trees

According to the City of Toronto's 'Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual', typical dense tree spacing guidelines of 6 m to 8 m on-centre do not allow the recommended minimum soil volumes (20 m^3 to 40 m^3) necessary to support the growth of relatively large-statured trees. The Manual states that "trees must be planted at a distance wide enough to allow each tree the recommended soil volume", and specifies a typical minimum tree spacing of 10 m on-centre. It also notes that "sizeable canopies, not precise layout, provide streetscape impact" and encourages flexible and, if necessary, irregular tree spacing to avoid growth-limiting conflicts with utilities, street furniture, and other trees.

3.2.2.7 Sustainable Community Program: New Development

The Sustainable Community Program: New Development consists of the Sustainable Community Development Guidelines (SCDGs) and the Sustainability Assessment Tool (SAT). The program is encapsulated in the Sustainable Community Program: New Development Manual (2018), which refers to the SCDGs, details over 50 Sustainability Metrics for development applications, and outlines Terms of Reference for a typically compulsory Sustainability Summary. These program elements are designed to measure and report on the planned environmental sustainability performance of new development applications.

3.2.2.7.1 Sustainable Community Development Guidelines, 2013

The Sustainable Community Development Guidelines (SCDGs) are Part 8 of the broader Development Design Guidelines (DDGs, see Section 3.2.2.3), and are intended to provide direction to development proponents and serve as a basis for the City's review of development applications with regard to environmental sustainability.

The SCDGs define the urban forest "which includes trees and shrubs on public and private lands, provides ecological services that support natural area functions and assists in mitigating the urban heat island effect." Three urban forest design guidelines are outlined in the SCDGs, including:

- SG60. Implement street tree and naturalization programs to increase urban canopy cover.
- SG61. Preserve and expand existing tree cover to connect and buffer protected woodlands and other natural areas and to mitigate heat island impacts.
- SG62. Protect the water table and drainage patterns to ensure the long term sustainability of existing woodlots within development areas.

3.2.2.7.2 Sustainability Metrics and Sustainability Assessment Tool (SAT)

A key element of the Sustainable Community Program: New Development is a series of over 50 Sustainability Metrics, which was developed jointly by Brampton, Vaughan, and Richmond Hill to aid in the evaluation and scoring of the environmental sustainability performance of Block Plans, Plans of Subdivision, and Site Plans. The environmental sustainability of development applications is assessed relative to the Sustainability Metrics target levels and associated point allocations, thereby generating a sustainability score and ranking the application in one of three Sustainability Thresholds (bronze, silver or gold) (Figure 12).

Bronze Threshold	Site Plans	35+ points
	Plans of Subdivision	29+ points
	Block Plans	30+ points
Silver Threshold	Site Plans	53+ points
	Plans of Subdivision	40+ points
	Block Plans	39+ points
Gold Threshold	Site Plans	70+ points
	Plans of Subdivision	51+ points
	Block Plans	49+ points

Minimum score required

Figure 12. Sustainability Thresholds in Brampton's Sustainable Community Program: New Development manual.

The Sustainable Community Program: New Development Manual includes the following tree establishment-related metrics:

- 2.1.9 - Urban Tree Diversity (Plan of Subdivision only): To create a diversity of urban trees along streets, parking areas, parks, etc.
    - Mandatory target (0 pts.): Tree species planted in a row alternate every two trees or in accordance with City's applicable standards.
    - Minimum target: N/A
    - Aspiration target: N/A

- 2.1.10 - Maintain Existing Healthy Trees (Plan of Subdivision and Site Plan):
    - Mandatory target (0 pts.): Provide a Tree Evaluation Report that identifies and evaluates where on-site healthy trees will be protected or removed, and compensation for removal of healthy tableland trees has been proposed in accordance with the City's requirements.
    - Minimum target (2 pts.): Where healthy tableland trees are proposed for removal, enhanced compensation is provided based on basal area.
    - Aspiration target (3 pts.): 75% of healthy, tableland trees greater than 20 cm DBH are preserved in-situ, on site.

- 2.1.11 - Soil Quantity and Quality (Plan of Subdivision and Site Plan):
    - Mandatory target (0 pts.): Satisfy City's applicable standards
    - Minimum target (2 pts.): Pits, trenches, or planting beds have a topsoil layer with an organic matter content of 10 to 15% by dry weight and a PH of 6.0 to 8.0; Topsoil layer should have a minimum depth of 60 cm; Subsoil should have a total uncompacted soil depth of 90 cm; Minimum soil volume of 30 m^3 per tree
    - Aspiration target (0 pts.): N/A

- 2.1.12 - Percent (%) Tree Canopy within Proximity to Building/Pedestrian Infrastructure (Site Plan only)
    - Mandatory target (0 pts.): Satisfy the City's tree planting requirements
    - Minimum target (2 pts.): Planted trees will provide shade within 10 years to at least 50% of the walkways or sidewalk lengths
    - Aspiration target (2 pts.): Planted trees provide shade within 10 years to at least 75% of the walkways or sidewalk lengths

- 2.1.13 - Percent (%) Canopy Coverage (Block Plan, Plan of Subdivision, Site Plan)
    - Mandatory target (0 pts.): Provide street trees on both sides of streets according to City's standards
    - Minimum target (1 pt.): Street trees provided on both sides of new and existing streets within the project; Street trees provided on the project side of bordering streets, between the vehicle travel lane and walkway at intervals of no more than 8 meters; Within 10 years of planting, street trees provide shade to at least 50% of sidewalk lengths; Note: If spacing is not feasible, street trees may be placed

elsewhere on the site to maintain the proposed tree canopy to the satisfaction of the City (e.g. additional park trees, front or backyard trees)

- Aspiration target (2 pts.): Street trees provided on both sides of new and existing streets within the project; Street trees provided on the project side of bordering streets, between the vehicle travel lane and walkway at intervals of no more than 6 meters; Within 10 years of planting, street trees provide shade to at least 75% of sidewalk lengths; Note: All trees should be selected from the City's applicable trees list and to be provided at intervals of not more than 6 m spacing. If spacing is not feasible, street trees to be placed elsewhere on the site to maintain the proposed tree canopy (e.g. additional park trees, front or backyard trees)

Additional Sustainability Metrics related to Natural Heritage, Natural Heritage System, and Soils and Topography, which all relate to the urban forest but are not specific to tree establishment, are also outlined in the Manual.

Brampton planning and urban forestry staff have indicated that the Sustainable Community Program: New Development, including the Sustainability Metrics and Sustainability Assessment Tool, has been effective in promoting tree protection and tree establishment through new development. However, elements of the Sustainability Metrics, including some of the voluntary higher-end targets, may conflict with other City of Brampton guidance or may not align with best practices for urban forest management. Examples include:

- 2.1.9 – Mandatory target conflicts with Landscape Development Guidelines for tree species mix and arrangement
- 2.1.11 – Minimum target specifies excessive soil organic matter content (optimum is 2-5% by dry weight); conflicts with Landscape Development Guidelines for minimum soil depth, does not reference provision for 20 m^3 soil volume if shared by two or more trees
- 2.1.13 – Aspiration target equates denser tree spacing (6.0 m) with better performance; however, the specified spacing is likely too close to enable development of wide-spreading, large-stature canopy of mature trees and may actually represent poorer performance or lost opportunity if optimum growing conditions are provided

3.2.2.8 Complete Streets Guide, 2021

The recently completed City of Brampton Complete Streets Guide (BCSG) is intended to guide the design, construction, operation and maintenance of all public and private roads in Brampton using a complete streets approach. The BCSG takes an "outside-in" approach to street design, and defines complete streets as a holistic approach to street planning and design that safely and comfortably accommodates all users.

In relation to Brampton's urban forest, the BCSG identifies street trees a "highly desirable" component of sustainable infrastructure, and includes supporting healthy street tree growth as a design objective for various street typologies. "Large open tree pits and planters" are the preferred design option for tree growing environments, though "covered tree pits" are acceptable space is constrained. Notably, the BCSG states that "street trees… are suitable for

all streets in Brampton", and includes a recommended action item to "develop new standards for tree planting" that consider various important growing environment factors.

A vitally important component of the BCSG is a series of Complete Street cross-sections which, wherever feasible, provides for the separation of tree growing environments (i.e., rooting areas) and below-ground utilities. Such separation (see Section 3.2.3.3 and Figure 13, below), facilitated through joint use trenches and duct banks, may promote long-term tree health, longevity and function by reducing the likelihood of root damage associated with more conventional utility installation, maintenance, and upgrading practices, which may not effectively separate trees and utilities.

3.2.3 Standards and specifications

Municipal and contracted operations, capital projects and new development in Brampton must adhere to various City of Brampton standards and specifications. Several of these standards and specifications, developed and maintained by various City departments, relate to tree establishment and are described below.

3.2.3.1 Parks Construction Standard Details

Brampton's Parks Construction Standard Details guide contractors and developers in designing and implementing streetscape and park development projects in the city. Tree establishment-related standard detail drawings are listed, and notable elements are described, below:

- L010 – Standard Subdivision Notes for Landscape Development: this detail includes a series of standard notes to accompany landscape submittals.
    - The standard notes include detailed technical and procedural guidance for tree establishment in new subdivision developments in Brampton, matching or even exceeding the Landscape Design Guidelines and other guidelines and specifications in the level of detail. Important elements related to tree establishment include planting soil technical requirements, tree planting offsets and spacing guidelines, tree planting procedural guidance, and post-planting maintenance and inspection requirements.
    - Notable strengths of the standard notes include reasonable tree/utility offsets, basic nursery stock quality standards, and clear procedural guidance.
    - Notable shortcomings of the standard notes include suboptimal tree planting soil requirements and potentially excessive tree spacing requirements that conflict with other City guidelines and standards (e.g., Landscape Development Guidelines).
- L212 – Irrigated Median Bed (Cross Section) and other irrigation details
- L710 – Naturalized Landscape Concept (Section 'A'-Two Valley Banks)
- L711 – Naturalized Landscape Concept (Section 'B'-One Valley Bank)
- L724 – Woodlot Edge Management
- L910 – Deciduous Tree Planting

- L911 – Coniferous Tree Planting
- L912 – Multi-Stem Shrub and Mass Shrub Planting
- L913 – Tree Planting on Slope
- L915 – Buffer Planting Module 'A' 36.0 M. ROW, Arterial Rd., Reverse Frontage
- L916 – Buffer Planting Module 'B' Opt. 1 - Narrow Form Trees 36.0 M. ROW, Arterial Rd., Reverse Frontage
- L916a – Buffer Planting Module 'B' Opt. 2 - Broad Full Form Trees 36.0 M. ROW, Arterial Rd., Reverse Frontage
- L917 – Buffer Planting Module 'C' Opt. 1 36.0 M ROW, Arterial Rd., Window Rd.
- L917a – Buffer Planting Module 'C' Opt. 2 36.0 M ROW, Arterial Rd., Window Rd.
- L918 – Traffic-Island
- L919 – Clearances from O/H Conductors and Cables to Tree Canopies

The 900-series drawings outline standard planting details for a range of typical tree planting scenarios. The details generally align with best practices for tree establishment. However, as noted above, some technical elements of the standard notes, such as tree planting soil requirements, do not reflect best practices. Notably absent from this series are standards for tree growing environments, including enhanced growing environments such as soil cells or structural soils.

3.2.3.2 Landscape Specifications series

Adherence to City of Brampton standard specifications, including the Landscape Specifications series, is required for all contractors and developers undertaking development and city capital projects. Key tree establishment-related Landscape Specifications include:

- 02232 – Tree Pruning
- 02311 – Site Grading
- 02906 – Planting of Trees, Shrubs, Groundcovers and Transplanting
- 02911 – Site Topsoil and Finish Grading

Other specifications for landscape elements and practices, such as irrigation and surface preparation, may also influence tree growing environments and tree establishment.

Specification No. 02906 - Planting of Trees, Shrubs, Groundcovers and Transplanting largely meets or exceeds recognized best practices for tree establishment. For example, the specified root ball diameter for common-sized stock exceed minimum sizes established in the Canadian Nursery Stock Standard. However, some elements, such as specified painting of cut roots with asphalt emulsion, do not meet best practices. Furthermore, some specification elements are ambiguous and should be clarified (e.g., the specification to situate top of wire basket 100 mm + below grade may be misinterpreted and result in burying of the trunk flare).

Specification No. 02911 – Site Topsoil and Finish Grading includes multiple specifications that are not optimal for tree planting soils. Among these include the requirement that soils be mechanically shredded and screened prior to installation, which destroys soil structure

heterogeneity that is conducive to optimal tree growth. The specifications also appear to favour the use of imported or amended soil mixes, reserve the use of native undisturbed soils for "special conditions", and do not outline specifications for testing native soils to determine planting suitability. Perhaps most notably, Specification No. 02911 outlines testing and component specifications for individual soil mix constituents (e.g. topsoil, manure, peat moss), but no preparation or testing requirements or procedures are specified for final soil mix products. This may result in the installation of poor-quality soils in tree growing environments.

Best practices – Tree planting soil specifications

The Urban Tree Foundation (www.urbantree.org) has developed a series of modern, up-to-date and peer reviewed details and specifications related to tree establishment, including a comprehensive tree planting soil specification. The scope of this specification includes soil procurement, modification of existing topsoil, drainage, grading, and organic matter amendment. This specification should serve as a model for municipal tree planting soil specifications.

Recently, York Region developed a high-quality specification for planting soils used in enhanced tree growing environments, such as soil cells.

Multiple technical elements of the tree establishment-related Landscape Specifications conflict with other City of Brampton guidelines and specifications. While these conflicts are generally minor in nature, they may result in inconsistent and sub-optimal implementation of tree establishment and sow confusion or disagreement among staff, contractors and development applicants about required and appropriate practices.

3.2.3.3 Engineering & Design Standard Drawings and Brampton Standard Specifications (BSS)

Adherence to City of Brampton Engineering & Design Standard Drawings and Brampton Standard Specifications (BSS) is required for all contractors and developers undertaking municipal road construction and development projects within Brampton. The Engineering Standards and Specifications relate to roadway cross-sections, sewers, street lighting and miscellaneous elements.

The 200-series – Above Ground – Roads standards include twelve roadway cross-sections, which all depict trees as roadway elements and specify setbacks as measured from both property line and right-of-way centreline. Most cross-sections depict joint use utility trenches and/or duct banks which consolidate below-ground utilities and help to reduce the adverse impacts of utility installation and maintenance upon tree roots by concentrating activities to a prescribed zone. However, the location of the joint use trenches is typically shown between the tree growing environment and adjacent sidewalks. Ideally, placement of joint use trenches or duct banks directly beneath sidewalks or between property lines and sidewalks could increase tree and utility separations, provide more available soil volume for tree growth, and further reduce impacts (Figure 13) associated with utility servicing.

The Brampton Standard Specifications (BSS) are local amendments to specific Ontario Provincial Standard Specifications (OPSS). BSS 802 outlines specifications for topsoil, including material content and testing procedures, some of which vary in a relatively minor degree from technical requirements outlined in other City standards or specifications.

There are currently no engineering standards or specifications in Brampton for the design or construction of enhanced tree growing environments, such as soil cells or structural soils.

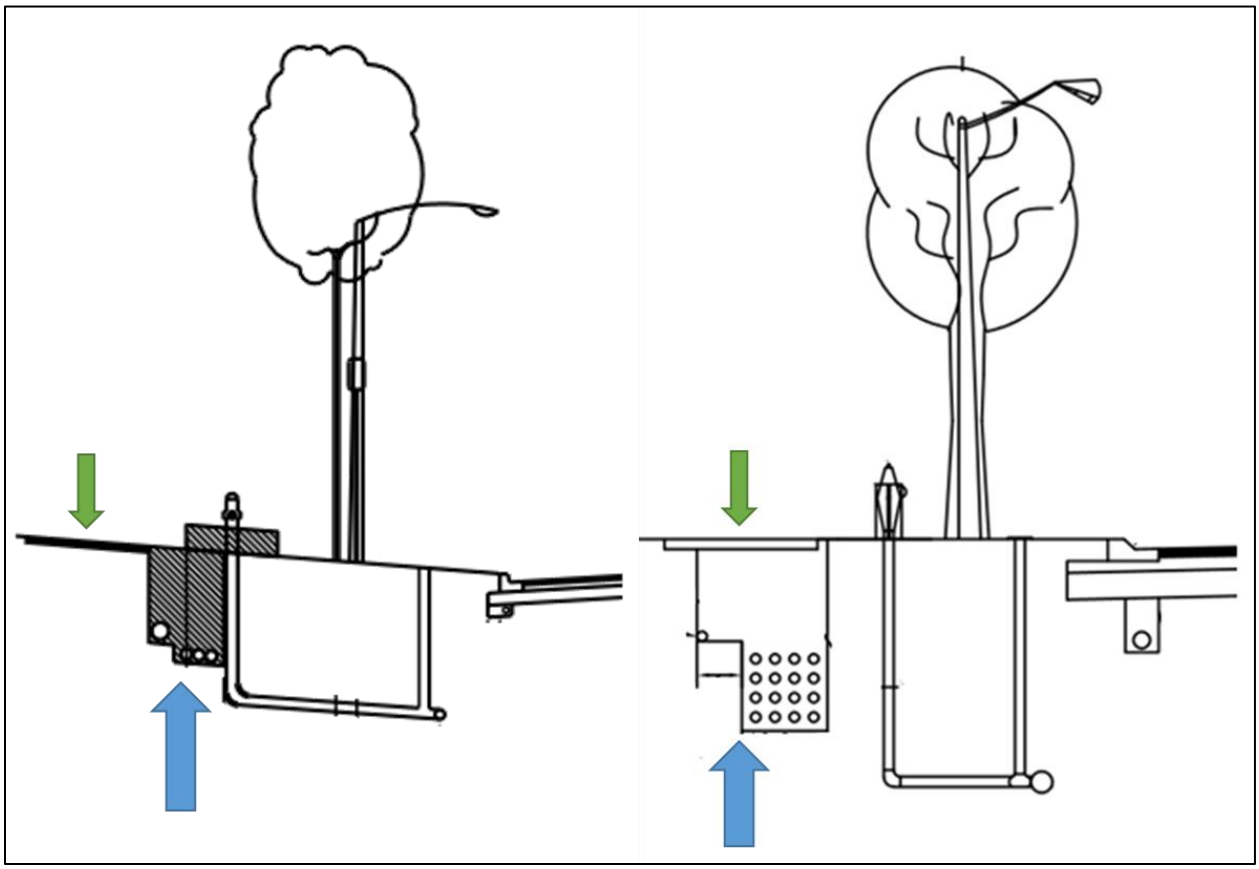


Figure 13: Selected details of standard local road cross-sections in Brampton (left) and Innisfil (right) (not to scale). Note the position of the joint utility trench (blue arrow) relative to the sidewalk (green arrow). Positioning the joint utility trench directly or even partly below the sidewalk (as shown), or between the property line and sidewalk, can increase available soil volume and minimize adverse impacts upon trees during utility installation or maintenance.

Best practices – Tree growing environment solutions and minimum soil volumes

Large soil volumes are required to support healthy mature trees, and municipal street design guidelines and standards are increasingly recognizing this fact. 30 m^3 of high-quality soil per tree has become the 'industry standard' for minimum soil volumes for large trees, although municipal guidelines vary.

As outlined in the City's "Development Manual – Urban Forest Appendix" Kitchener (ON) requires a minimum of 45 m^3 for large-stature, 28 m^3 for medium-stature, and 17 m^3 for small-stature trees, and establishes minimum required proportions of each tree type for different developments. Soil volumes can be reduced if shared by two or more trees, and soils must be decompacted prior to installation. Additional requirements include an "urban forest soils report", root pathways and, in some circumstances, soil cells.

A wide range of growing environment solutions are available to provide adequate soil volumes for trees, and include soil cells, suspended pavements, structural soils, root break-out zones, among others. Among other important considerations for planting site design include irrigation (including stormwater capture), drainage, and soil texture and pH.

In 2013, the City of Toronto developed the leading-edge 'Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual'. This manual is intended to address the various challenges related to tree establishment in highly urbanized road cross-sections through the application of innovative engineered tree planting solutions and best practices for a wide range of tree establishment activities. Toronto's Green Standard (v4), effective 2022, requires a minimum of 30m3 of soil per street tree and establishes minimum site-wide soil volumes.

The EPA Stormwater Trees Technical Memorandum (2016) provides a comprehensive guide for designing tree growing environments with a focus on stormwater mitigation functions.

3.2.3.4 Contract specifications

Contracted tree planting operations, administered by the Parks Maintenance and Forestry division, are guided by the Scope of Work specifications of tree supply and planting contracts, which are typically tendered on a three-year basis (with options for extension).

The tree planting contract specifications exhibit notable shortcomings, including among others:

- the absence of tree nursery stock quality standards
- sub-optimal soil specifications for tree planting soils (e.g., soil mixes are likely to be highly excessive in organic matter content due to the large volume of cow manure specified)
- internal inconsistencies (e.g., two separate and technically inconsistent sections for tree staking and tree support)
- vague language (e.g., reference to "industry standards"), and
- lack of alignment of multiple technical elements with the City's Landscape Development Guidelines and Landscape Specifications.

3.2.4 Targets

In the context of growing the urban forest, targets are quantifiable performance metrics to be achieved through tree establishment. The most common tree establishment targets adopted by municipalities include urban forest canopy cover (see Section 1.4.2) and the number of trees planted.

3.2.4.1 Urban forest canopy cover

As described in Section 1.4.2, many municipalities have established urban forest canopy cover (or urban tree cover – UTC) targets on a jurisdiction-wide basis, and some have also established such targets on a land use or even site-specific basis. To date, Brampton, which currently has an estimated urban forest canopy cover of 18 percent (based on a 2017 analysis of 2015 data), has not established a long-term city-wide urban forest canopy cover target or canopy cover targets based on any other geographic scales.

The 2011 Brampton Urban Forest Study, which determined a pre-ice storm and EAB infestation UTC of 11 percent, did not recommend a canopy cover target nor that one be established. However, the Study report included a range of "grow out" simulations to estimate future urban forest canopy cover under two different scenarios over 50 years, including maintaining existing cover and increasing cover to 25 percent. The Study estimated that the planting of just 580 new trees per year would be required to maintain 11 percent UTC, while 3,300 new trees per year would be required to increase canopy cover to 25 percent (both scenarios assume a 4% annual tree mortality rate). For the purposes of this UFMP, these estimates are considered erroneous and likely significantly underestimate the number of trees required to be planted to maintain or increase urban forest canopy cover (note: the study estimated ±3.6 million trees in Brampton's urban forest at 11% canopy cover, whereas the 2017 analysis of 2015 geospatial data determined a canopy cover of 18%.)

3.2.4.2 Number of trees

As part of the Brampton 2040 Vision strategic initiative launched in 2018, the City has established the One Million Trees program to plant one million trees by 2040. Achieving this target will require planting 50,000 trees in the city every year for the next twenty years, and this planting target was endorsed by Brampton City Council in February 2020. It must be noted that achieving this level of planting will require the support of various City partners, including, including Conservation Authorities, the Region of Peel, school boards, the development industry and residents, among others, as the City itself has planted an annual average of approximately 7,000 trees 2014 to 2018. The One Million Trees program is described in greater detail in Sections 3.2.1.3 and 4.2.3.7.

The City's tree planting efforts are tracked on Brampton's online City dashboard/GeoHub portal[3], which reports on the number of trees planted annually by the City between 2014 and 2018 through operations, community programs, and capital projects. This publicly available

[3] Available online at: https://geohub.brampton.ca/pages/urban-form-tree-canopy. Last accessed May 12, 2020.

tracking tool also serves an educational and engagement function by providing a brief description of the “environmental sustainability benefits” provided by “a rich tree canopy”.

3.2.5 Tree establishment processes

3.2.5.1 Overview

Trees in Brampton’s urban forest are planted by a range of different stakeholders on both public and private lands. This section primarily focuses on processes related to City-led and developer-initiated tree establishment, as the City of Brampton is most able to influence these two major drivers of tree establishment in the city.

3.2.5.1.1 City operations

The City plants new trees through urban forestry operations (replacement of removed trees and stocking of available planting sites), parks development and other capital projects, naturalization, restoration, and community engagement programs, and in response to resident-initiated service requests. Urban forestry tree planting operations (administered by the Parks Maintenance and Forestry division) are almost entirely undertaken by City contractors (see Section 2.2.1).

Since 2014, the City has planted an annual average of approximately 7,000 trees, including approximately 4,000 replacement street trees per year to replace ash trees lost to EAB infestation and the 2013 ice storm. As street tree replacement plantings are projected to be completed over the next few years, the anticipated number of replacement trees will likely decrease to an annual average of approximately 1,500 trees. As described in Section 3.2.1.3, the City has recently committed to its One Million Trees Program goal of planting 50,000 trees per year until 2040, and will begin to proactively plant trees in parks, valley lands and woodlots in support of this goal. However, achieving this target will require significant and ongoing support from partners such as Conservation Authorities, private landowners, the institutional, commercial and industrial (ICI) sector, and others, and will also require the City to increase its operations-based planting efforts.

3.2.5.1.2 Development

Street trees in new communities are planted by either the developer or the builder in accordance with City-approved landscape plans. Street trees are usually planted in new subdivisions shortly after building lots are sodded, but are not permitted to be planted in July or August due to the typically hot and dry weather conditions. On average, some 13,000 trees are planted in new communities per year, representing a significant portion of annual tree planting in the city. This level of tree planting is expected to continue given the significant population growth and associated development that are projected in Brampton over the next twenty years.

Best practices – Municipally-led tree establishment in developments

In most municipalities, developers are responsible for planting trees in new communities in accordance with applicable municipal standards and approved plans. However, some municipalities provide the option for, or require, developers to remit a fee for tree planting in new developments. Trees are then planted and maintained by municipal staff or contractors. The primary benefit of this approach is that the municipality can exercise greater control over plant material quality, installation, and post-planting maintenance. Developers are also relieved of the responsibility to maintain or replace trees and the associated administrative burdens and financial security obligations. Remitted fees should be sufficient to cover the full cost of plant material, installation, warranty, and maintenance. Examples of municipalities that may plant trees on behalf of developers include London, Mississauga, and Woodstock.

Best practices – Sequencing of planting in new communities

In Mississauga, the City's Forestry Section plants trees in new subdivisions based upon agreements between the Developer and the City. Street trees are planted when all homes are built, roadways have at least one coat of asphalt, curbs and driveways have been installed and sodding has been completed. New homeowners may find a tree related charge on the closing purchase price of their home; this charge has been incurred by the developer to plant community trees and may be passed on to the homebuyer.

Guelph's Subdivision Assumption Guidance Manual identifies a clear staging process for Stage 1 and Stage 2 subdivision servicing. Street trees are identified as Stage 2 services, and require completion of Stage 1 and 1B servicing before installation is permitted.

3.2.5.2 Nursery stock size and quality requirements

3.2.5.2.1 City operations

Trees planted as part of Brampton's urban forestry operations are typically 50 to 60 mm caliper ball-and-burlap stock, which is typical for many municipal urban forestry planting operations.

Nursery stock quality, which is determined by characteristics such as root ball size, trunk flare/top root depth, root form, trunk and branch structure, wounding, health, and others, is not specified in Brampton's tree planting contract specifications. Landscape Specification No. 02906 includes stock quality specifications (see Section 3.2.3.2), but it is unlikely that these specifications are referenced by contractors due to the provision of specifications in the tree supply and planting contract. Landscape Specification No. 02906 is also applicable to City capital projects.

3.2.5.2.2 Development

Landscape Specification No. 02906, which is applicable to development projects, includes basic stock quality specifications (see Section 3.2.3.2). Stock quality specifications are also included in the Standard Subdivision Notes for Landscape Development (Parks Construction Standard Detail No. L010). Although different levels of detail are provided in these documents, they are generally consistent in their technical requirements.

The Landscape Development Guidelines (LDGs) specify a minimum tree size and type of "70 mm caliper at breast height (dbh), with a wire basket and burlap only". "Caliper at breast height" is not a standard nursery or arboricultural industry measurement; this specification may therefore lead to confusion around tree procurement and should be corrected. The LDGs do not contain any specifications related to nursery stock quality.

Best practices - Nursery stock quality

All nursery stock should meet or exceed the Canadian Nursery Landscape Association (CNLA) Canadian Nursery Stock Standard (9th or latest edition), which outlines minimum standards for root ball and container size, branching, and other quality indicators. The Clean Plants certification program aims to produce plants that meet high phytosanitary standards and are free of regulated pests and diseases; nursery stock should be certified.

The Urban Tree Foundation "Tree Quality Cue Card" (2010) illustrates desirable and undesirable characteristics for nursery stock and should be used by urban forestry managers to assess trees prior to planting.

Best practices – Long-term tree growing contracts

To address issues of inconsistent quality of the nursery stock procured by tree supply and installation contractors, New York City has created long-term contracts with nearby nurseries to grow desired tree species to meet the City's exacting standards. These contracts have resulted in a steady supply of high-quality trees, and the City has been able to enhance urban forest diversity by ensuring an adequate supply of previously uncommon and underutilized species. In addition to securing a steady supply of desired species, tree growing contracts can also specify production and delivery methods that meet the municipality's requirements. Ottawa's UFMP directs the City to investigate establishing similar long-term tree growing contracts.

3.2.5.3 Tree species and planting site selection

3.2.5.3.1 City operations

According to Brampton's tree-related webpage, the most common residential street trees planted by the City are:

1. Red oak (*Quercus rubra*)
2. Chanticleer pear (*Pyrus calleryana* 'Chanticleer')
3. Little-leaf linden (*Tilia cordata*)
4. Shademaster honey locust (*Gleditsia triacanthos* 'Shademaster')
5. Sugar maple (*Acer saccharum*)
6. Red maple (*Acer rubrum*)
7. Japanese ivory-silk lilac (*Syringa reticulata*)

Due in part to the absence of a complete tree inventory, tree species selection for operations-based tree establishment is not currently guided by diversity targets or similar analyses. Species are typically selected by Forestry Inspectors based upon local context, and species may be matched to their planting sites according to guidance outlined in the Plant Chart (Appendix B of the Landscape Development Guidelines).

Assessment of planting sites prior to species selection is generally limited to visual inspection, and physical characteristics such as soil texture or drainage are not assessed for individual planting sites prior to species selection. There is currently no inventory of vacant plantable spaces along streets or in parks in Brampton.

Best practices – Planting site inventory and assessments

Some municipalities maintain a GIS database of suitable vacant sites for tree establishment, commonly referred to as a planting site inventory. A planting site inventory should contain the information necessary to guide appropriate tree species selection, such as site size, soil texture, drainage and other conditions, and potential infrastructure conflicts. Integration with a broader asset management system or GIS network can identify the presence of below-ground utilities in proximity to planting sites, which may inform tree establishment planning and implementation.

In 2009, the Ohio Division of Forestry developed the Urban Site Index (USI), an assessment methodology that uses eight observations (four soil, four street) to classify planting site quality. This was refined into the Rapid Urban Site Index (RUSI) (Scharenbroch *et al*., 2017), which allows a site to be classified in approximately five minutes and matched to suitable tree species. A planting site's RUSI score can be used for priority-setting, and should be included in a plantable spaces inventory and to inform tree establishment planning.

3.2.5.3.2 Development

Appendix B of the Landscape Development Guidelines (LDGs) outlines a list of approved deciduous and coniferous trees for planting as street trees and in roadside buffers, entry features, stormwater management ponds, neighbourhood parks, valley lands and site plans. The list includes a relatively wide range of tree species and cultivars, but provides limited detail about important tree characteristics such as cultural requirements and site tolerances. Instead, the list is largely focused on the aesthetic qualities of trees, including form, texture, flowering time, leaf/fall colour, and whether the tree is a "foliage plant". Multiple species on the list are considered often undesirable for urban planting for various reasons, such as invasive potential (e.g., *Acer negundo, Acer platanoides, Euonymus europaeus, etc.*), poor structural characteristics (e.g., *Pyrus calleryana*), or others. Furthermore, several species that are commonly or occasionally used as street trees in other jurisdictions are excluded from street tree planting in the Plant Chart (e.g., *Gymnocladus dioicus*, *Ostrya virginiana,* etc.), or are not included in the list at all. Overall, the list does not provide adequate detail to guide or review tree species selection based on site characteristics, and may result in the establishment of poorly-performing or otherwise inappropriate trees.

The Landscape Development Guidelines also provide guidance for species selection, but the guidance is internally conflicting – Section 1.1.1 of the LDGs specifies that "each street should have a dominant species… comprising at least **50%** of the overall mix" while the notes to Table 1 in the same section, which categorizes trees by form and texture, state that "trees in bold represent dominant species and are to represent at least **40%** of overall species mix" [emphasis added]. The same section also specifies that each street should include two sub-dominant species, while Table 1 and notes state that certain species (highlighted in bold in Table 1) should comprise no more than 8% of the total tree quantity. In this scenario, use of any of the 'small quantity' species and adherence to the other species quantity guidelines would leave just two tree species to account for no less than 92% of the tree population on a given street segment. This low level of diversity could contribute to catastrophic losses in the event of pest or disease infestation or other stressors, as was experienced in many ash-dominated areas of the City following the 2013 ice storm. Overall, the Landscape Development Guidelines and other tree species selection guidance for new development appears to place a significant emphasis on aesthetic concerns such as tree form, texture, and uniformity, at the expense of urban forest genetic and functional diversity, resilience, and sustainability. The LDGs are also insufficient to enable effective matching of tree species to growing site conditions, or to serve as basis for review of the landscape plan components of development applications.

Best practices – Tree species selection

Richmond Hill and Toronto have developed tree species selection matrix tools that allow users to filter an extensive tree species list based upon multiple species tolerances/requirements and site conditions. The Virginia Street Tree Assessment Project compiles a list of tree species selection tools online at https://www.urbanforestry.frec.vt.edu/STREETS/treeselection.html.

Best practices for tree selection for urban forest diversity are highlighted in Section 1.4.3.

Best practices – Tree species trials

Municipalities should increase the usage of underutilized tree species to increase diversity and prepare for climate change effects. Red Deer, AB undertakes trials of unproven species by planting small numbers in various (and challenging) locations and routinely monitoring success rates; successful species are incorporated into operations-based planting programs. Various approaches to undertaking tree species performance trials, including suggested experimental design and evaluation criteria, are outlined in McPherson *et al.* 2018.

3.2.5.4 Inspection and post-planting maintenance

3.2.5.4.1 City operations

Pre-planting inspection of trees nursery stock to be established through municipal operations in Brampton is inconsistent. Staff report that trees are typically inspected by the contractor prior to installation and by City staff following planting, but that staff may also occasionally inspect trees prior to planting. Failure to inspect trees prior to planting may result in the establishment of substandard trees, particularly as root-related issues (e.g., poor form, insufficient root mass) cannot be adequately inspected after planting. Such issues may manifest as problematic many years following planting and long after the expiry of the tree warranty period.

Following planting, trees are subject to three rounds of inspection – preliminary, interim, and final inspection for acceptance. The preliminary inspection commences the two-year tree warranty period, during which time the planting contractor is expected to undertake “general maintenance”, including pruning, watering, and mulching. Most notably, tree watering is specified in the tree supply and planting contract specifications on an as-needed basis – “It is the responsibility of the Contractor to monitor/inspect their trees to ensure they are receiving adequate amount of water.” There is no explicit obligation for tree planting contractors to document or otherwise demonstrate that adequate tree maintenance has been performed during the warranty period. This may provide a disincentive for contractors to adequately water trees during the warranty period, as watering may be more costly than replacing trees which fail to meet the City’s standards for acceptance upon final inspection. Trees that do survive beyond the warranty period with inadequate watering or other maintenance may be smaller, more susceptible to long-term stressors or prone to poor structural development, or provide fewer functional services than properly watered trees.

Best practices – Engaging residents in post-planting care

Post-planting watering is critical to the successful establishment of young trees, and municipal watering programs are rarely sufficient. Markham and Milton both provide an informational door hanger notification with every newly planted tree that requests resident assistance with watering and mulching. Kitchener's Community Stewardship and Tree Watering Program enables residents to register if they are willing to water the City-owned tree(s) fronting their properties. Residents receive a tree watering bag and registered trees are marked with blue flagging tape to signify that they are under stewardship. Each week, the City notifies residents via social media and email about the week's tree watering requirements, which may vary depending upon rainfall, temperature, and other factors.

The City of Toronto reports significantly better tree establishment and performance in parks where volunteers are engaged to water and mulch trees. In partnership with the City of Toronto and Trees for Life, Park People and LEAF (two Toronto-area environmental NGOs) have developed the "Adopt-a-Park-Tree" manual for individuals and groups interested in watering park trees. This manual can be used to inform the development of a basic resident tree watering engagement program. In Toronto, residents can also engage the services of City-approved arborists to maintain City-owned trees outside their residences, potentially providing more timely maintenance than would be afforded by the standard tree pruning cycle.

3.2.5.4.2 Development

Trees planted in new communities are not inspected by City staff prior to planting; there is instead an implicit expectation that nursery stock is to be inspected by the developer's landscape consultant to ensure that it meets the City's quality specifications. Like other subdivision landscape works and contract-planted trees, trees in new developments are subject to three inspections and a two-year warranty period. The warranty period is effective from the date of preliminary acceptance, and trees which require replacement within the two-year warranty period are subject to a new one-year warranty.

There is no obligation for developers to document or otherwise demonstrate that adequate tree maintenance has been performed during the warranty period. This may provide a disincentive for developers to properly maintain trees throughout this period, as properly maintaining trees may be more costly than replacing trees which fail to meet the City's standards upon final inspection for acceptance.

Best practices – Planting stock inspection

The Town of New Tecumseth occasionally contracts ISA Certified Arborists to inspect developer-planted trees in new communities prior to assumption by the municipality. In Ottawa, the developer's Landscape Architect or arborist must submit a tree inspection report form to the City prior to municipal assumption, which is verified by City Forestry inspectors.

Upon assumption of trees in new communities, municipalities should require developers to submit tree inventory data for all new trees. This facilitates integration with tree inventories and broader asset management systems, and support maintenance planning and implementation.

For its tree planting programs, York Region inspects and selects trees at the nursery prior to procurement to ensure stock quality. Many municipalities reserve the right to inspect trees and reject poor specimens prior to installation. In Ajax, ON, all contract-planted trees are delivered for inspection to a municipal yard prior to planting to enable detailed quality inspection. Calgary's Standard Specifications for Landscape Construction (2012) outline detailed requirements for plant material quality. Vaughan, ON includes clear acceptance/rejection criteria for nursery stock in its tree planting contract specifications.

Best practices – Post-planting maintenance

In York Region, newly planted trees are watered 14 times per year for the first three years following planting. This increased level of watering has significantly improved tree survival rates compared to watering at planting contractor discretion. The Region requires watering contractors to verify performance using GPS tracking logs of watering truck activity, and watering is included in the planting (capital) rather than maintenance (operating) budgets to ensure sustainable funding for the entire duration of the watering program.

City of Winnipeg Tree Planting and Maintenance Specifications require contractors to submit routine watering progress reports to the City; failure to provide adequate records may result in the contractor being responsible for supply, planting and maintenance of replacement trees outside of the warranty period.

Young trees should be inspected and, if necessary, pruned a minimum of three times within the first 10 years following planting. Young tree structural pruning can be undertaken using hand tools by staff with basic arboricultural training. The objective of young tree structural pruning is the development of good long-term tree structure, including a single central leader and well-spaced and attached branches.

Best practices – Tracking maintenance in new developments

Few municipalities are known to require developers to demonstrate and document that trees planted in new developments are routinely and adequately maintained prior to assumption, partly due to the difficulty of enforcing compliance with such requirements. The City of Ottawa's UFMP directs the City to begin requiring developers to track and report basic tree maintenance, such as watering and mulching, within the pre-assumption warranty period to ensure that trees are in good health and condition upon assumption.

3.2.5.5 Request-based planting

Brampton residents can request the planting of a new or replacement tree through the City's 311 call centre or the 311brampton.ca online portal. Unlike in most other municipalities, where tree request programs are typically restricted to boulevards or the municipally-owned portion of residential front yards, Brampton's tree planting request portal enables the selection of several potential locations, including a boulevard, traffic median, park, trail, pathway, or other. As with other urban forestry Services Requests in Brampton, planting requests are reviewed within 90 days. Species are typically selected by the Forestry Inspector responsible for the Service Request. There is no formal process for residents to request specific tree species, subject to City approval, although informal opportunities to do so may be available.

The City also administers the Tree Dedication Program, whereby residents can request and pay for the planting of a tree (and, if desired, a commemorative plaque at an additional cost) in a city park. Residents can select the species and planting location, subject to City approval. The species list includes Austrian pine (*Pinus nigra*), which is generally considered an undesirable species due to disease problems.

The request-based tree planting programs account for a relatively small portion of trees planted annually by the City. Increasing the profile and uptake of these programs, and broadening their scope while enhancing the City's capacity to administer them, will support the City's commitment to planting 50,000 trees per year.

Best practices – Municipal 'free tree' programs

Most municipalities administer request-based 'free tree' programs, whereby residents can request tree planting within the municipal road right-of-way fronting residential properties. Ottawa is exploring an 'opt-out' model, whereby more vacant plantable spaces will be proactively planted unless adjacent residents object. Hamilton's Street Tree Planting Program is actively promoted by the City and supported by an easy-to-use online request interface, clear guidelines, a list of 40 tree species, and instructions for post-planting care. Toronto's request-based planting program also allows residents to select from a variety of species, subject to City approval. Vaughan allows residents to plant trees in the City right-of-way, subject to an approved application and adherence to certain stipulations.

3.2.6 Private land tree establishment

Since 2009, the City has partnered with TRCA, CVC and the Region of Peel in the development and implementation of Sustainable Neighbourhood Action Plans (SNAP), which include a private land tree planting component (see Section 5.2.1.3.6). However, the City does not routinely administer any programs to support residents, businesses, or other landowners in establishing trees on privately-owned lands in Brampton.

The City's "Trees" portal includes a "Plant a Tree" webpage, which outlines several effective "tree planting tips" for landowners.

Best practices – Support for private land tree establishment

Some municipalities provide direct support for tree planting on private property. Toronto's new tree planting strategy recognizes that the greatest potential for growing the urban forest is on private lands, and the City offers the Community Planting and Stewardship Grant, the Greening Partnership Grant, and the Neighbourhood Tree Giveaway Program to support private land planting at various scales.

London's "Plant More" tree planting strategy identifies 89% of the potential opportunities for tree planting as occurring on privately-owned lands. The strategy proposes increasing funding for private tree planting incentives to $800,000 per year by the 2028 budget cycle. Funding for the Council-approved strategy has been accommodated within the 10-year capital budget forecast.

Carleton Place recognizes that post-planting survival rates are higher if program participants pay a nominal fee for their trees, as residents feel a sense of investment in the tree's survival. Ottawa's UFMP directs the City to reinstate the Urban Tree Islands Program, which supported planting on private properties adjacent to road rights-of-way if the property owner committed to maintaining the tree in its planted location.

Best practice - Tree subsidies

The Town of New Tecumseth offers residents a one-time rebate (up to $75) for the purchase of a hardwood tree from a recognized nursery, and offers up to $250 in rebates for arborist services on private property. Ajax, Markham, Newmarket, Toronto and York Region support Local Enhancement and Appreciation of Forests (LEAF), an urban forestry advocacy and engagement-focused NGO, in the delivery of its Backyard Tree Planting Program, which provides residential property owners with tree planting services and trees at a subsidized cost. A similar program is offered for multi-unit residences and businesses in several partner municipalities. Richmond Hill's Healthy Yards program offers residents trees and shrubs at a subsidized cost.

3.3 Strategic direction for growing Brampton's urban forest

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) assessment matrix for Brampton's approaches to growing the urban forest.

The section also assesses Brampton's performance in three criteria related to growing the urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool - the most recent iteration of the established Criteria and Indicators of Urban Forest Sustainability assessment framework (C&I) (Clark et al., 1997; Kenney, van Wassenaer and Satel, 2011; Leff, 2016).

The SWOT matrix and C&I assessments inform the development of strategic directions for Brampton's Urban Forest Management Plan, presented at the end of the section. The strategic directions will be addressed through UFMP strategic goals, objectives, and action items.

3.3.1 SWOT matrix analysis

Table 7: SWOT matrix for growing Brampton's urban forest.

Strengths	Weaknesses
Policies, strategies, plans and studies: • One Million Trees program is supported by February 2020 Council commitment. ***Guidelines and reference manuals*** • Guidelines for soil volume and depth in LDGs generally align with best practices. • Some other LDGs guidelines also align with best practices. • Site Plan Review User Guide encourages tree planting. • DDGs are overall highly supporting of integrating trees into new communities. • Subdivision manual allows flexibility to adjust tree planting locations to minimize conflicts. • SCMP includes some progressive tree establishment guidance. • SCP:ND, including Sustainability Metrics, has effectively promoted tree establishment and preservation. ***Standards and specifications*** • Standard Subdivision Notes include some good technical guidance (offsets, stock quality, process). • Most other standard details align with best practices. • Specification No. 02906 meets or exceeds many best practices (e.g., root ball size). • All standard roadway cross-sections include trees and many depict joint use utility trenches. ***Targets:*** • No canopy cover target currently established; establishing a target may not be appropriate at this time due to a lack of current and comprehensive assessment of potential and planting opportunities. • City's tree planting efforts are transparently tracked on Brampton City dashboard/GeoHub portal, providing promotional and education function. ***Tree establishment processes:*** • Staff occasionally (but not consistently) inspect trees for quality prior to planting. • Trees typically subject to three rounds of inspection. • Unlike in most municipalities, City allows residents to request tree planting in a variety of locations; requests are not limited to front yard plantings. ***Private land tree establishment:*** • Residential Tree Planting Program recently initiated • "Plant a Tree" webpage provides useful and effective tree planting tips for landowners.	***Policies, strategies, plans and studies:*** • Limited implementation of 2011 Urban Forest Study recommendations to date. • Available decision-support tools (PPI, hot spot mapping, TPPT) have not been effectively integrated into urban forest establishment programs and practices. • Heavy reliance on partners to support One Million Trees target; City only plants average of 7,000 trees annually. ***Guidelines and reference manuals*** • Some technical guidance elements of Landscape Development Guidelines do not align with best practices. • DDG shortcomings include emphasis on visual uniformity and aesthetics at the expense of urban forest diversity and resilience. • Transit-Supportive Townhouse Design Guidelines allow exemptions for tree planting for narrow streets. • Subdivision manual can be interpreted as prioritizing "grey" over "green" infrastructure and may result in trees not being planted instead of solutions to minimize conflicts. • DCDG planting configuration are somewhat inconsistent with best practices (spacing/amenity zones too narrow). • Some SCMP technical guidance for tree establishment does not align with best practices. • Some Sustainability Metrics do not align with other guidelines/standards (species mix, soil depth, soil volumes); too-close spacing in Canopy Cover metric. ***Standards and specifications*** • Standard Subdivision Notes include some poor technical guidance (soil requirements, excessive spacing, conflict with other guidelines). • Some elements of standard details do note align with best practices (e.g., soil requirements). • No standard details available for enhanced tree growing environments (e.g., soil cells, structural soils, break-out zones). • Some aspects of Specification No. 02906 do not align with best practices (e.g., painting over cuts) or are ambiguous. • Specification No. 02911 includes specifications that do not align with best practices for soil (e.g., screening, lack of testing spec. for mixed product). • Multiple (minor) technical conflicts between Landscape Specifications and other City guidelines or specifications. • Joint use utility trenches on roadway cross-sections typically depicted between tree and sidewalk, reducing soil volumes and increasing potential for conflicts. • Minor conflicts between Brampton Standard Specifications (BSS) for soil and other City standards/specifications. • No engineering standards or specifications for enhanced tree growing environments. • Multiple shortcomings in tree supply and planting contract specifications (e.g., no stock quality standards, sub-optimal soil specifications, internal inconsistency, vague language, lack of alignment with other City documents). • Several tree species in LDG Appendix B: Plant Chart (City species list) are undesirable for variety of reasons; other desirable species are not included. • Plant Chart lacks guidance for effectively matching trees to planting sites; chart is largely focused on aesthetic characteristics. • LDG species selection guidance is internally conflicting. ***Targets:*** • 50,000 tree per year target requires significant partner support. • Number of trees planted by external partners annually may decrease in future years as City is built-out and development focus shifts towards intensification. • Lack of knowledge/assessments to support effective canopy target setting; "grow-out" simulations in 2011 Urban Forest Study are erroneous. ***Tree establishment processes:*** • Unlikely that higher-quality tree specification (No. 23906) is adhered to by planting contractors. • Tree species selection for operations-based tree establishment is not guided by diversity targets or other analyses. • Assessment of planting sites is generally limited to visual inspection; physical characteristics are not assessed. • No planting site inventory available. • Inconsistent pre-planting selection of nursery stock quality. • No requirement for contractors or developers to document or demonstrate adequate post-planting maintenance. • Tree watering and other maintenance specified on an as-needed basis and may not be consistently provided. ***Private land tree establishment:*** • Residential Tree Planting Program is currently limited in scope to small "free tree" giveaway

Table 7, cont'd: SWOT matrix for growing Brampton's urban forest.

Opportunities	Threats
Policies, strategies, plans and studies: • TBC ***Guidelines and reference manuals*** • Periodic review/revision of LDGs and DDGs will provide opportunity to improve technical guidance elements. • Many tree establishment elements of Transit-Supportive Townhouse Design Guidelines are high-quality and should be carried forward into new/revised guidelines. ***Standards and specifications*** • TBC ***Targets:*** • TBC ***Tree establishment processes:*** • Capital projects provide opportunity to develop high-quality tree growing environments and establish long-term, functional and healthy trees. • Region of Peel Tree Planting Prioritization Tool (TPPT) and other decision-support tools can support tree establishment planning. • Increasing the profile/broadening scope of request-based tree establishment programs will support the City's commitment to planting 50,000 trees per year. ***Private land tree establishment:*** • Increasing collaboration with partners can promote private land tree establishment. • Providing incentives and other supports can promote private land tree establishment. promote private land tree establishment.	***Policies, strategies, plans and studies:*** • N/A ***Guidelines and reference manuals*** • N/A ***Standards and specifications*** • N/A ***Targets:*** • N/A ***Tree establishment processes:*** • N/A ***Private land tree establishment:*** • N/A

3.3.2 Criteria and Indicators assessment

Table 8: Criteria and Indicators assessment of three criteria related to growing Brampton's urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (0)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Engaging Peers and Residents in Process	ENVIRONMENTAL EQUITY	Ensure that the benefits of urban forests are made available to all, especially to those in greatest need of tree benefits.	Tree planting and outreach is not determined equitably by canopy cover or need for benefits.	Planting and outreach includes attention to low canopy neighborhoods or areas.	Planting and outreach targets neighborhoods with low canopy and a high need for tree benefits.	Equitable planting and outreach at the neighborhood level is guided by strong resident involvement in low canopy/high need areas. Residents participate actively in identifying needs for their neighborhoods, planning. implementation and monitoring.	Some data and analysis regarding low canopy areas available through 2011 Urban Forest Study Priority Planting Index and Peel TPPT. SNAP programs address two priority neighbourhoods, but canopy cover is not the main driver. Consideration of canopy in planting programs is very limited, but may be an occasional factor.
Resource Management: Implementation	GROWING SITE SUITABILITY	All publicly owned trees are selected for each site and planted in conditions that are modified *as* needed to ensure survival and maximize current and future tree benefits.	Trees selected and planted without consideration of site conditions.	Appropriate tree species are considered in site selection.	Municipality-wide guidelines for the improvement of planting site conditions and selection of suitable species.	All trees planted in sites with adequate soil quality and quantity, and with sufficient growing space and overall site conditions to achieve their genetic potential and thus provide maximum ecosystem services. Where growing conditions are poor, guidance provided on how to improve soil volume, quality, other factors.	Some efforts to match species and site, but limited guidance for appropriate matching is available. Various guidelines/standards do not provide guidance; selection is based on Urban Forest Inspector assessment (for operations) or developer plans (as approved by City).
Resource Management: Implementation	TREE ESTABLISHMENT AND MAINTENANCE	Comprehensive and effective tree planting and establishment program is driven by canopy cover and goals and other considerations according to plan.	Some tree planting and establishment occurs, but with limited overall municipality-wide planning and post-planting care.	Limited planning and post-planting care. Planting takes place on plan-identified sites. None or only fragmentary planting and maintenance protocols.	Planting and post-planting care and maintenance protocols in place.	Comprehensive tree establishment plan provides concrete guidance on most of the following criteria: site selection, size, age class, diversity of species, native plant choice; planting protocols [e.g. minimum soil volumes, soil conditions]; young tree care, including region appropriate irrigation requirements. Includes provisions and funding for maintenance.	Post-planting care and maintenance are generally the responsibility of the contractor on an as-needed basis. No requirement to demonstrate adequate maintenance provided that trees meet requirements upon assumption. Some structural pruning may be undertaken following assumption of trees.

3.3.2.1 Criteria and Indicators assessment summary

Using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, Brampton's performance in three criteria related to growing the urban forest scores 3 out of 12 (25%). Key shortcomings include the limited use of decision-support tools and data to support prioritization of tree planting and outreach efforts based upon urban forest canopy or environmental equity, inadequate guidance for matching tree species to their planting sites, and limited post-planting maintenance for newly planted trees.

It should be noted that in the absence of a vision, goals and objectives for the urban forest (to be established in Part 2 of the UFMP), this assessment assigns the Optimal performance level as the performance target for each criterion. However, Brampton's actual performance target levels will be established in Part 2 of the Urban Forest Management Plan, and may be lower than the Optimal level for some or all criteria. In this case, although the number of points awarded for the City's current status will not change, Brampton's relative performance in this series of criteria may increase.

3.3.3 UFMP direction

Like other aspects of the City's approach to urban forest management, Brampton's policies, guidelines, standards, targets and processes for establishing the urban forest include both notable shortcomings and considerable strengths. The Urban Forest Management Plan Framework and Implementation Plan should reflect the need to support and build on existing strengths, while implementing policy and practice enhancements to improve a range of tree-establishment related outcomes. Strategic directions for the UFMP based upon an assessment of the City's current status are outlined below.

3.3.3.1 Improve and consolidate tree establishment guidance

Multiple elements of the City's various tree establishment-related guidelines, standards and specifications conflict or contradict each other across documents and do not align with recognized best practices for tree planting and post-planting maintenance. Several examples of such inconsistencies and suboptimal guidance have been outlined in this section of the UFMP, and others may be revealed upon further close scrutiny of the various guiding documents.

While many of the internal conflicts and contradictions are relatively minor in impact and technical in nature, they may result in inconsistent and sub-optimal tree establishment and sow confusion among staff, contractors, and development applicants. Moreover, technical guidance that does not align with recognized best practices may significantly compromise the diversity, resilience, functional capacity, longevity or even safety of the urban forest, and must be addressed through revised and improved guidance.

As such, the UFMP should outline strategies to support a detailed review, revision and consolidation of all tree establishment-related guidelines, standards and specifications. A single set of internally consistent and updated tree establishment guidelines, standards and specifications should be developed to reflect current best practices and guide tree establishment across the full range of planting scenarios in Brampton. These consolidated

guidelines should be situated atop the City's hierarchy of tree establishment-related guiding documents, and should reference related policies (e.g., Sustainable Community Program, etc.) as necessary. Future reviews and revisions of the Landscape Development Guidelines may provide a suitable opportunity for this undertaking.

3.3.3.2 Establish and pursue appropriate urban forest targets

Urban forest targets represent the desired state of different urban forest metrics at a point in the future. The most commonly established and readily measurable urban forest targets include urban forest canopy cover (jurisdiction-wide or site-specific), urban tree diversity, or the number of trees planted. Other targets may include metrics such as community/volunteer engagement, area restored or naturalized, or others. Brampton has already established the major target of planting 50,000 trees per year.

Strategic guidance for establishing and pursuing appropriate urban forest targets is outlined in Section 1.9.3. As described, establishing a canopy cover target or targets requires an understanding of potential and likely canopy cover under various planting scenarios, and an understanding of the resources required to achieve these targets. Establishing other targets may require a similar level of analysis, and the UFMP should provide the necessary guidance for such assessments and analyses. Urban forest targets, whether established directly in the UFMP or upon implementation of its action items, should be area-specific and based on appropriate scales, such as neighbourhoods, where possible.

It is essential that any established targets are aspirational but also realistic – targets that are excessive and cannot be achieved with reasonably-anticipated resources (even if resource expenditures are increased) sets the urban forest management program up for failure, and doing so may carry reputational risk for the City. Conversely, targets that are too low will not result in meaningful improvements in urban forest condition and function and resultant services to the community.

3.3.3.3 Integrate decision-support tools into tree establishment planning

Several valuable decision-support tools are already available to facilitate several important elements of tree establishment planning, such as area prioritization (e.g., by canopy cover or targeted benefits) and pursuit of urban forest species diversity targets. These tools include the 2011 Urban Forest Study and associated Priority Planting Index (PPI) and thermal 'hot spot' mapping, and the Region of Peel's Tree Planting Prioritization Tool (TPPT). To date, tree establishment planning and implementation by the City of Brampton has made little use of these tools to facilitate both tree establishment operations and tree establishment programs, such as restoration or naturalization plantings or community planting events. The City's tree inventory will also become a valuable decision-support tool upon its completion, and will assist the City in establishing area-based urban forest diversity targets and tree establishment plans. A plantable spaces inventory would serve a similar function.

The UFMP should outline strategies and actions to better integrate these existing, upcoming and potential decision support tools into tree establishment planning. In doing so, the City will be able to achieve improved outcomes such as increased and targeted provision of urban forest services, neighbourhood-level urban forest structural and functional diversity and resilience, and tree succession planning for mature treed neighbourhoods.

3.3.3.4 Improve tree establishment processes

The critical assessment presented in this section suggests that there are multiple opportunities available to improve tree establishment processes in Brampton, such as nursery stock procurement, tree species and planting site selection, pre- and post-planting tree inspection, post-planting maintenance, and the request-based planting programs. The UFMP should outline strategies and actions to enhance these processes, resulting in reduced tree mortality, improved tree health, structure and function, and lower management costs for future tree removal and replacement.

3.3.3.5 Enhance tree growing environments

Urban growing conditions pose significant challenges to tree health and longevity. Even if a tree is successfully established, its health, condition, functional capacity and lifespan may be considerably reduced due to multiple stressors associated with urban growing site conditions. These may include, among others, insufficient/excessive soil moisture, inadequate soil nutrients and other chemical properties, soil compaction, incompatible soil texture, and inadequate soil volume. In most planting situations in Brampton, tree growing sites are not enhanced or even adequately assessed for factors which may be detrimental to tree health, function and longevity. Growing site-related challenges can largely be mitigated through improved site assessment, better matching of species tolerances, requirements and other characteristics to tree growing sites, and the design and provision of enhanced tree growing environments (particularly with increased and uncompacted soil volumes). The UFMP should guide the City in adopting practices to enhance growing site assessment and species selection, and developing policies, standards and specifications for the provision of enhanced tree growing environments through development, capital projects, and other tree establishment scenarios.

3.3.3.6 Increase supports for private land tree establishment

Together, private landowners control the largest portion of the city's land area and, consequently, of potential plantable area and opportunities to enhance and expand the urban forest. However, Brampton currently provides little if any meaningful support for residents and other landowners to engage in tree establishment on privately-owned lands. Encouraging and supporting private landowners in planting and maintaining trees will therefore be an important strategy to support the City's commitment to planting 50,000 trees per year, especially as the number of trees planted through development declines over time and ice storm/EAB tree replacement plantings are concluded. The UFMP should therefore guide outline strategies and actions to support private land tree establishment, such as providing incentives, subsidies, educational outreach, and other supportive mechanisms.

4 Planning and Brampton's urban forest

4.1 Overview

The City of Brampton has a range of strategic plans, policies, master plans, guidelines, standards, and specifications pertaining to the protection of existing trees, management and restoration of wooded natural areas, and establishment of new trees. Together, and with the added support of the Region of Peel's policy framework and leadership related to climate change, they provide comprehensive planning guidance at all levels and scales of planning, from City-wide to site-specific.

Key planning policies and other guiding documents related to the urban forest are described and assessed below, with a specific focus on protecting the urban forest (guidance for growing the urban forest is reviewed in Section 3.3). Key gaps and opportunities for improving the current policy framework to better support urban forest sustainability and enhancement are also reviewed.

4.2 Current status and best practices

4.2.1 Federal and Provincial framework

The Federal and Provincial legislative and policy framework for urban forest management is reviewed in Section 1.8.

4.2.2 Regional planning framework

The City of Brampton is (along with Caledon and Mississauga) one of three local municipalities in the Region of Peel and as such must have policies that are consistent with or build on Regional policy direction. Since 2009, the Region (with the support of its municipal and agency partners) has taken a leadership role on climate change and has also played a lead role in advancing urban forest collaboration and initiatives in Peel. Key strategic level planning direction related to both urban forestry and climate change provided in Region-wide documents is summarized in this sub-section. This direction provides a framework for urban forest management and planning in Brampton.

4.2.2.1.1 Region of Peel Official Plan

Region of Peel's current Official Plan (2018 consolidation) includes one policy specifically mentioning the urban forest and a range of policies that centre around the identification, protection and enhancement of wooded natural areas (referred to as Core, Natural Areas and Corridors (NACs), and Potential Natural Areas and Corridors (PNACs)). Chapter 2 of the Official Plan provides policies for the protection and restoration of Peel Region's Greenlands System, while policy 2.5.2.9 specifically directs the Region to "*work jointly with agencies and area municipalities to develop urban forest strategies and to encourage and support programs and initiatives that maintain and enhance the Greenland System in Peel*". Peel Region's Official Plan

also includes definitions for woodlands and plantations, and criteria for Cores, NACs and PNACs that define what types of wooded natural areas qualify for protection.

Overall, the policies related to natural wooded area protection in Peel's Official Plan are comprehensive, while policies specifically related to the urban forest are lacking. However, this gap is being addressed through the Regional Official Plan review, currently in progress. New policies specifically related to the urban forest are being developed based on policy recommendations made in the *Best Practices Guide to Urban Forest Planning in Peel,* currently under development for Peel Region and expected to be finalized in 2020.

4.2.2.1.2 Region of Peel Climate Change Master Plan, 2019

Peel Region recently released its *Climate Change Master Plan 2020-2030*, which builds on and supersedes the 2011 *Peel Climate Change Strategy*. This corporate-wide plan aims to build capacity, reduce GHG emissions, prepare for future climate conditions and invest in climate change action within Peel Region's operations.

As part of the plan, Peel Region aims to protect and expand green infrastructure (such as trees) across Regional assets, including the Regional road network. The Master Plan includes specific direction supportive of protecting, managing and expanding the urban forest as one of a range of actions identified to help the community mitigate and adapt to climate change:

- 14.2 - Develop and implement a Green Infrastructure Asset Management Plan to support the preservation and expansion of green infrastructure
- 14.3 - Implement tree planting and management program for new and existing trees, and
- 14.4 - Implement green infrastructure elements of future Storm Servicing Master Plan for Regional Road Infrastructure.

In conjunction with this Master Plan, Peel Region is currently working with Brampton, Mississauga, Caledon, TRCA and CVC through the Community Climate Change Partnership, whose mandate is: "Working together to adapt to and mitigate the effects of climate change as we transition to low carbon and resilient communities within Peel Region". One of the four overarching strategies identified in this document is to "increase the number of healthy trees in priority areas to reduce public health risk and enhance social and environmental outcomes".

4.2.2.1.3 Peel Region Urban Forest Strategy, 2011

The Peel Region Urban Forest Strategy (2011) remains the primary source of guidance related to urban forest management at the regional level. Of the 26 action items identified in the Strategy, many have been completed or are underway, and many others remain relevant. The status of, and comments on, these actions are provided in Table 9.

Table 9: Overview of Peel's Urban Forest Strategy Goals and Actions.

Strategic Goal	Action	Status and Comments
Goal 1: Facilitate partnerships and coordinate action across Peel Region	a. Develop and lead an interagency Urban Forest Working Group that will build focus and consistency across departments and agencies. b. Develop annual work plans for the purpose of achieving the goals outlined in the Strategy. c. Conduct a comprehensive review of the Strategy at regular five year intervals.	a. Completed and ongoing b. Completed and ongoing (through UFWG) c. Incomplete
Goal 2: Develop urban forest targets	a. Develop regional and area municipal urban forest targets.	a. Incomplete
Goal 3: Develop and implement urban forest management plans	a. Develop and implement comprehensive Urban Forest Management Plans that fully addresses the operational actions and resources required to achieve a healthy and resilient urban forest. b. Review and update Management Plans at regular five year intervals.	a. Incomplete at Regional level; completed in Mississauga and in progress in Brampton b. In progress in Mississauga
Goal 4: Create a comprehensive urban forest policy framework	a. Integrate the strategic goals identified in the Strategy and targets, once defined, into Regional and Area Municipal Official Plans to recognize the contribution of the urban forest to local quality of life. b. Integrate the goals identified in the Strategy, as well as targets and directions from Urban Forest Management plans into public initiatives. c. Develop new municipal standards and guidelines for sustainable streetscape and subdivision design.	a. Completed in Mississauga; in progress in Peel and Brampton b. In progress c. Completed in Caledon, Brampton and Mississauga; in progress in Peel
Goal 5: Gain formal support from upper levels of government for sustainable management of the urban forest as natural infrastructure	a. Encourage the Association of Municipalities of Ontario (AMO) and the Federation of Canadian Municipalities (FCM) to approach provincial and federal agencies to provide stronger support and direction for urban forest policies, programs and initiatives. b. Engage the Provincial and Federal Governments to provide funding for urban forest research and development. c. Engage the Provincial Government to provide policy direction within the Planning Act as well as guidance to support a healthy urban forest for the full range of ecosystem services it provides to the community.	a. Completed and ongoing b. Incomplete c. Completed and ongoing

Strategic Goal	Action	Status and Comments
Goal 6: Implement effective monitoring and research programs	a. Monitor the structure, distribution and function of the urban forest using the methods and parameters applied in the baseline assessments conducted in 2008 for each area municipality in Peel Region. b. Report on status and trends publicly in order to build and retain public support for urban forest conservation. c. Identify critical research questions and information gaps that must be addressed in order to manage the urban forest effectively and mitigate the threats and impacts to this resource. d. Identify potential research partners and explore new means of building connections among researchers, practitioners and community members. e. Identify new techniques and technologies through on-going communication with local, national and international research facilities and professional organizations with an urban forest mandate.	a. Completed and ongoing b. Completed and ongoing c. Completed (through climate change planning) d. Incomplete e. Incomplete
Goal 7: Secure long-term funding for urban forest management	a. Develop a business case for the urban forest as natural infrastructure to secure funding and support from all levels of government. b. Research funding opportunities and partnerships. c. Develop an incentive program for tree planting and establishment on private property.	a. In progress (with CVC) b. In progress c. Incomplete
Goal 8: Provide comprehensive training, education, and support for residents and members of the public and private sector	a. Conduct a detailed assessment of opportunities to enhance urban forest stewardship through public outreach programs. b. Facilitate training, education and professional development for all public sector staff. c. Identify and pursue opportunities to build and expand partnerships with business owners and industry members for the purpose of increasing tree cover ad improving tree health in the commercial and industrial areas of Peel. d. Identify and pursue opportunities to work with Landscape Ontario to increase awareness among members of the horticultural and landscaping industry of threats, trends and new research in urban forestry. e. Engage hospitals, universities and colleges in Peel in urban forest management. f. Work collaboratively with School Boards to increase tree cover on school grounds.	a. Incomplete b. Incomplete c. In progress d. Incomplete e. Incomplete f. Incomplete

4.2.3 Local City-wide strategies, policies and master plans

At the municipal level, the City of Brampton has developed and implemented a range of planning tools and initiatives intended to protect and enhance the urban forest on both public and private lands. In addition to the overarching direction provided by the Official Plan, the City has developed the Environmental Master Plan (2014), Natural Heritage and Environmental Management Strategy (NHEMS) (2015), Eco Park Strategy (2019), One Million Trees Program (2019) and a Natural Heritage Restoration Plan (NHRP) (2018). With the exception of the One Million Trees Program strategy (see Sections 3.2.1.3 and 4.2.3.7), these important guiding documents are described in this sub-section. These various documents complement each other and work together as illustrated in Figure 14.

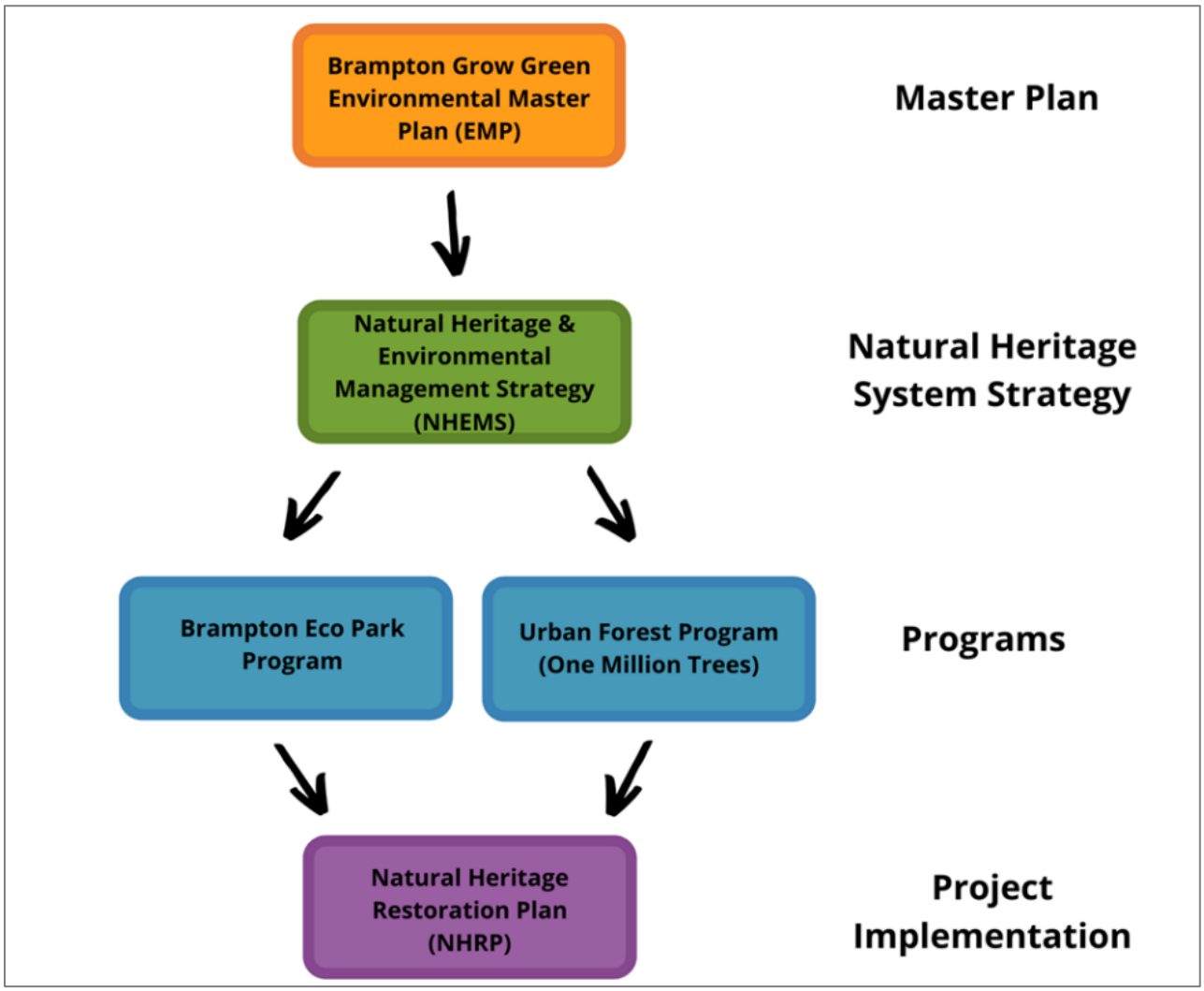


Figure 14: Brampton's Natural Heritage Project Implementation Framework, Brampton Eco Park Strategy.

4.2.3.1 Living the Mosaic Brampton 2040 Vision, 2018

The Living the Mosaic Brampton 2040 Vision (Beasley and Associates *et al.,* 2018) strategic plan reflects, among other things, the Term of Council priority to make Brampton a Green City and the broad community support for Brampton's urban forest that emerged through the extensive engagement undertaken as part of the strategic visioning process.

The tree canopy is lush as a refreshed urban forest. Over a million trees have been planted in public places and citizens have doubled this by planting more trees on private property. Virtually all streets have street trees, sometimes a double row, grown within the latest technology of soils culture.

- Component of the Vision for Brampton 2040

Actions directly and indirectly relevant to the urban forest in Brampton 2040 Vision under 'Vision 1 - Sustainability and the Environment' include:

- Action #1-1 Institute for Sustainable Brampton: Found a public-private facilitator for local environmental progress to position Brampton in the vanguard of suburban sustainability.
- Action #1-2 Brampton Eco-Park: Constitute the green park network into one grand designated municipal park and nature reserve.
- Action #1-3 Brampton Trees Project: Plant one million trees in the public and semi-public realm of Brampton, particularly along streets and roads and in parking lots, to enhance the green canopy.

Figure 15: Green Framework of the Brampton 2040 Vision.

4.2.3.2 City of Brampton Official Plan

Brampton's current Official Plan was adopted by City Council in October 2006 and approved by the Ontario Municipal Board (OMB) in October 2008. The updated September 2020 Office Consolidation includes OMB and LPAT decisions that have resolved several of the appeals to the 2006 Official Plan, as well as amendments made to reflect Council decisions.

With respect to the urban forest, the current Official Plan includes a range of policies related to trees both within and outside of natural areas, and has been amended to include policy direction supportive of green infrastructure, green development incentives and sustainable best management practices.

Policies that are supportive of the protection of trees within and outside of natural areas can be found in the section entitled "Woodlands and the Urban Forest" (s. 4.5.8).

It is the objective of the Natural Heritage and Environmental Management policies to: Recognize the environmental/ecosystem benefits, habitat function, microclimates, urban design and general aesthetics that the City's woodland and urban forest provides and in this regard maximize the protection, retention, restoration, enhancement and linkages between existing woodlands, trees, hedgerows to other natural heritage and other vegetative features such as valleys, watercourses, wetlands etc. within the City…

S. 4.6, City of Brampton Official Plan, 2006

Specific policies in the current Official Plan that support tree protection, replacement, and planting outside or within natural areas are found in Section 4.6 – Natural Heritage and Environmental Management and Section 4.6.8 – 'Woodlands and the Urban Forest', and include:

- Defining the urban forest as including all trees on public and private lands in the City and recognizing the value of individual trees and the ecological, social and economic benefits trees provide within the broader urban forest (policy 4.6.8).
- Permitting requirements under the City's woodlands by-law (policy 4.6.8.5) before undertaking any removals in a woodland of at least 0.2 ha.
- Requirements for "proponents of new developments … to re-forest their development areas through the planting of trees on boulevards, buffers and stormwater management ponds" (policy 4.6.8.7).
- Support for "a naturalistic approach to restoration, enhancement and landscaping through native species selection" including "the identification, retention or transport and re-use of local biomass materials such as seedbanks, topsoil or mulches for the subject lands" (policies 4.6.6.23 and 4.6.8.8).

- Support for land use planning that recognizes potential complementary functions supportive of urban forest protection and sustainability: “When considering the location of parks, the City shall examine the potential for the integration of natural features such as woodlands, hedgerows, significant natural features, undulating topography and areas performing an important ecosystem function” (policy 4.7.4.2).

- Support for securement of wooded natural areas through planning tools and incentives:
    - “… the City may consider … a landowner cost share agreement, density bonusing or density transfers...” (policy 4.6.6.25), and
    - “Development proponents may be credited through the development charges for planting in new parks and valleylands that are associated with their development” (policy 4.6.8.14).

Woodlands must be assessed through the planning process and any woodland to be assumed by the City requires a plan in accordance with the City’s Woodland Management Plan Guidelines (2018), described in Sections 4.6.8.2.

The current Official Plan also includes policies that support the protection, maintenance and establishment of trees outside of natural areas through the planning process (policies 4.1.8.4, 4.2.1.15, 4.2.7.4, 4.3.1.5, 4.4.2.22, 4.4.3.9); additional trees in ROWs (policy 4.6.8.15); and the protection of “rare and important trees” in cultural heritage landscapes such as cemeteries (policy 4.10.5).

In addition, there are policies related to the Open Space System (s. 3.2.11) supportive of using green infrastructure (including trees) to enhance, restore and help connect both parks and natural heritage features.

While the City’s Official Plan is generally consistent with the current Provincial and Regional direction related to significant woodlands and protection of wooded natural areas, and includes some progressive policies related to natural wooded areas restoration, it requires review and updating to ensure it is aligned with the current strategic and policy direction at the local (e.g., Vision 2040, EcoPark System, One Million Trees Program), Regional (e.g., Peel Official Plan updates) and Provincial levels (e.g., the 2020 Provincial Policy Statement, 2017 Greenbelt Plan), as well current City and higher-tier directions and policies related to climate change and municipal natural asset management. These directions, as well as best practices identified at the Regional scale, are being considered as part of the development of the new Brampton Official Plan, which is in progress.

Best practices – Official Plan urban forest policies

Official Plan policies should strongly and explicitly recognize the linkages between urban forest services and healthy and livable communities. For example, Mississauga's Official Plan recognizes that "trees in urban settings provide environmental, social and economic benefits." Through its Official Plan, the Town of Ajax "recognizes the value of tree cover in improving air quality and lowering air temperature during summer months. Expanding and providing a more robust tree cover creates bird and wildlife habitat, reduces the urban heat island effect, improves air quality, and connects open spaces and other natural areas." The Ajax Official Plan clearly outlines policy direction to "maintain, protect and enhance the existing tree canopy."

Official Plan policy recognition of urban forest services lends strength and support for planning decisions that favour urban forest protection and tree establishment.

4.2.3.3 Grow Green Environmental Master Plan, 2014

Brampton's Grow Green Environmental Master Plan (EMP) comprises the Green Paper (2013), the Background Report (2014) and the Implementation Action Plan (2014). The EMP focuses on conserving, balancing and enhancing the City's natural and built environments to create a healthy, resilient and environmentally sustainable city through actions related to six core components: People, Air, Water, Land, Energy and Waste.

The EMP Background Report includes a review of the environmental initiatives underway and completed at the time of writing, relevant best practices, draft direction (i.e., a vision, guiding principles and goals) and initial directions for moving forward.

With respect to the urban forest, the EMP describes some activities being undertaken (e.g., Street and Park Tree Replacement Program, the Sustainable Neighbourhood Retrofit Action Plan in County Court) and identifies additional goals and objectives, including:

- Continue to participate in the Region of Peel Greenland Securement Program
- Develop a Naturalization Engagement Strategy to improve community acceptance of naturalization programs on City-owned lands, and
- Develop Official Plan policies for new development to require mitigation and compensation for the loss of tableland vegetation to facilitate development

The EMP is the umbrella document for the City's natural heritage system strategy and is being implemented through the Natural Heritage and Environmental Management Strategy (NHEMS, 2015), Natural Heritage Restoration Program (NHRP, 2019), Eco Park Strategy (2019), and One Million Trees Program (2019), as described below.

4.2.3.4 Natural Heritage and Environmental Management Strategy, 2015

The City's Natural Heritage and Environmental Management Strategy (NHEMS, 2015) is intended to ensure that the natural heritage and built green spaces in Brampton are protected, enhanced, and restored. This document includes several objectives directly relevant to the urban forest, including:

- Objective 1.1: Review and strengthen Official Plan policies to improve the protection, restoration and enhancement of the Natural Heritage System, urban forest, recreational open space, green infrastructure, connected water features (e.g. wetlands, creeks) and green development standards.
- Objective 1.3: Expand on Official Plan policies to address the mitigation and compensation for loss of natural heritage features, functions and linkages, and urban forest vegetation to facilitate development.
- Objective 2.2: Actively restore natural features, functions and linkages in the natural heritage and open space systems, green infrastructure and urban forest.
- Objective 2.3: Develop and implement an Urban Forest Management Strategy.

The NHEMS also establishes the importance of guidelines for the assessment of existing vegetation, identifies opportunities to integrate natural heritage with open space systems and green infrastructure, and highlights the need for solutions centred on collaboration, partnership and stewardship.

4.2.3.5 Natural Heritage Restoration Program, 2019

The Natural Heritage Restoration Program (NHRP, 2019) was established to restore and naturalize areas within the natural heritage system, parks, and infrastructure to help address historical conditions and current impacts on the natural heritage system. It focuses on actions to restore currently degraded natural areas to improve their ecological function and emphasizes tree planting in public spaces (such as parks, boulevards, and other open spaces) as an important restoration approach.

4.2.3.6 Brampton Eco Park Strategy, 2019

Brampton's Eco Park Strategy (2019) is intended to enhance the City's natural heritage by creating a matrix of "Eco Spaces" across the municipality, as shown in Figure 16. The implementation of this program is expected to enhance the extent and the quality of the City's urban forest canopy along with the related ecosystem services.

Figure 16: Conceptualized growth of Brampton's proposed Eco Park over time, Brampton Eco Park Strategy.

4.2.3.7 Brampton One Million Trees program

The One Million Trees program is reviewed in Sections 3.2.1.3 and 4.2.4.1.

4.2.3.8 Other relevant City of Brampton documents

Two additional documents also provide important guidance related to trees and treed natural areas even though they do not include specific reference to the urban forest. These are:

- The Parks and Recreation Master Plan (PRMP, 2017) guides the provision of a sustainable system of parks, facilities and programs. The PRMP contains over one hundred recommendations related to the delivery of parks and recreation facilities and services. In addition to providing recreational and social opportunities and spaces, one of its primary goals is to protect and enhance Brampton's natural heritage features through initiatives including the naturalization of park spaces. This PRMP is a strong guiding document for the implementation of the Eco Park Strategy within City parks.

- The Valley Naturalization Program (2002) is intended to restore indigenous plant communities in Brampton valleylands impacted by past agricultural practices and development. A key program goal is to enhance the ecological services provided by the City's valleys, including improving fish habitat, flood plain stabilization, and attractiveness of these lands for use by hikers, naturalists, and community groups.

4.2.4 Tree protection by-laws

The City of Brampton has four by-laws currently in effect related to the protection of trees. These include:

- **Woodlot Conservation By-law (316-2012):** regulates private woodlots of at least 0.2 ha
- **Tree Preservation By-law (317-2012):** regulates private trees of at least 30 cm dbh
- **Boulevard Maintenance and Highway Obstruction By-law (163-2013):** prohibits the removal or damage of trees on any portion of a highway without City approval, and
- **Parks Lands By-law (161-183), as amended:** prohibits any person from climbing, removing or damaging a tree in a park without City approval

The City has also enacted “a by-law to protect and conserve topsoil within the City of Brampton” (30-92) which requires a permit for any topsoil removal on lots adjacent to a water body, where drainage patterns may be altered, or where topsoil is proposed to be removed on a lot greater than 1 ha. As part of such a permit application the proponent is required to identify all existing trees, thereby potentially affording an opportunity to regulate their removal and, if needed, replacement and/or compensation.

The two by by-laws regulating trees on private property are described below.

4.2.4.1 Woodlot Conservation By-law (316-2012)

Brampton’s Woodlot Conservation By-law (316-2012) prohibits any injury to trees in “woodlots” on private lands in the City without a permit, with the exception of trees deemed hazardous, injury necessary for emergency work, or as part of exempt agricultural practices. For the purposes of the by-law, the definition of “woodlot” is adapted from the Provincial *Municipal Act* and *Forestry Act* definitions of “woodlands” to regulate land at least 0.2 ha in area with a defined density of trees.

A standard permit may be approved if the applicant demonstrates that tree injury will be in accordance with good forestry practices and replacement trees are identified along with measures to mitigate impacts on the natural environment, in addition to any other conditions being addressed, to the City’s satisfaction.

4.2.4.2 Tree Preservation By-law (317-2012)

Brampton’s Tree Preservation By-law (317-2012) regulates trees of at least 30 cm dbh on private lands throughout the City. Exemptions to this by-law for which a permit is not required include trees in woodlots regulated under By-law 316-2012, hazardous trees (as defined), trees within 2 m of a building, injury to a tree necessary for emergency work, and trees exempted by Council pursuant to the provisions of this by-law.

Under both by-laws, a landowner may request an exemption from Council; Council may deny or grant such a request with or without conditions but cannot approve activities that do not comply with the City’s applicable policies.

4.2.4.3 Assessment of Brampton's tree by-laws

It is difficult to identify specific best practices for tree protection by-laws in Ontario as no two tree by-laws are the same and each one is tailored to address local concerns or issues. Additionally, there have not been any systematic or comprehensive studies of the effectiveness of these by-laws in relation to specific objectives. Gaps in the City of Brampton's tree protection by-laws that should be considered during future reviews include:

- Most private tree by-laws in Ontario municipalities regulate trees with diameters between 15 and 30 cm dbh. Brampton could consider reducing the minimum size of regulated trees.
- Neither Brampton's tree nor woodland by-laws define or provide specific guidance for addressing "boundary trees" which can result in implementation challenges when trees straddle property boundaries.
- Tree by-laws in Brampton could specify how compensatory trees should be planted. For example, the City of Ottawa's municipal tree by-law states that trees in hard surface areas must be planted as per the City's Hard Surface Tree Well Design Standards.
- Brampton's Boulevard Maintenance and Highway Obstruction By-law (163-2013) prohibits but does not define "damage" to trees in the context of the by-law. This may pose enforcement challenges.
- Permit application fees ($50 per application) in Brampton are significantly lower than in comparable municipalities, where fees may be assessed per tree (not application) and may therefore help to offset the administrative costs associated with permit review and issuance.

According to City staff, the current suite of by-laws is generally effective in protecting regulated private trees in Brampton. However, operational staff responsible for implementation indicate that more comprehensive education and enforcement regarding these by-laws would encourage increased compliance. To address internal communication gaps, the City has implemented measures to ensure key staff in the Building Division, Open Space and Parks Maintenance and Forestry are notified at the time of tree by-law permit issuance.

Best practices – Private tree protection by-laws

Many municipalities in southern Ontario and beyond have enacted by-laws to regulate the injury and removal of privately-owned trees. Examples include Brampton, Burlington, Guelph, Mississauga, Oakville, Richmond Hill, Toronto, and others. Numerous factors must be considered when developing or updating a tree protection by-law, or assessing its effectiveness. Among these include:

- *Scope of regulation:* Most private tree protection by-laws establish a minimum tree size for regulation, usually based on dbh. Regulation limits generally range from 15 cm to 30 cm dbh. In Toronto, the minimum diameter limit is 30 cm, whereas in Oakville, all private trees greater than 15 cm dbh are regulated. Ottawa's tree protection by-law regulates trees of

different sizes depending upon the size and location of the subject property; to restrict woodlot clearing, the by-law is more restrictive on properties greater than 1 hectare in area.

- *Permit categories and fees:* Toronto categorizes construction-related and non-construction tree injury or removal permit applications separately. The application fee schedule is dependent upon the nature of the application, with considerably higher fees for construction-related, City, or boundary tree applications and with no maximum application fee. In Burlington, permit application fees are assessed per property, and a higher fee is charged for development-related applications ($680 vs. $390). In Richmond Hill, the maximum application fee is $400 irrespective of the number of trees subject to the application. Mississauga levies a base permit fee of $434 with additional per-tree fees of $98.

- *Arborist reporting:* Toronto requires an arborist report to accompany any application for tree injury or removal. Other municipalities typically require, at minimum, a basic inventory and mapping of trees subject to the application.

- *Ensuring awareness and compliance:* Municipalities including Toronto, Mississauga, Richmond Hill and Vaughan, among others, require applicants for various permits issued outside of the planning process (e.g., building, enclosure, grading, pool, etc.) to complete a tree declaration or questionnaire. This step in the permit application process ensures that potentially affected trees are identified and that necessary tree-related permits are obtained prior to the undertaking of site works.

- *Site inspection:* In many municipalities, urban forestry staff undertake site inspections prior to permit approval to ensure application accuracy and completeness. Burlington has established a level of service of three weeks to complete site inspections; in Markham, the LoS for application processing is 30 days.

- *Compensation:* Permits issued under municipal tree protection by-laws are commonly subject to conditions, most notably including compensation for tree removal. Various approaches for assessing compensation value are applied by municipalities, such as amenity value, aggregate caliper, cash-in-lieu, stems per unit, and others (see table, below).

- *Exemptions and allowances:* Most by-laws exempt dead, terminally diseased, or hazardous trees from permitting requirements, although some municipalities require evidence of qualification for such an exemption. Permit fees are also typically waived for such trees. Mississauga allows for the removal of up to two regulated trees per property per calendar year without a permit.

- *Enforcement and education:* While enforcement and fines are important tools to encourage compliance with tree protection by-laws, education about urban forest benefits and the importance and application of by-laws is a more effective strategy. Several municipalities have developed informational videos about their tree protection by-laws, and Ottawa has developed a user-friendly decision tree to assist prospective applicants in understanding the by-law. Many opportunities for community education about tree protection by-laws are available and should be used by urban forestry and community outreach staff.

4.2.5 Development guidelines related to tree protection

Two key development guideline documents address tree protection in Brampton; these include the Woodland Management Plan Guidelines (2018) and the Tableland Tree Assessment Guideline (2019). Several other guidelines and tools also include elements supportive of urban forest protection, as summarized in this sub-section.

4.2.5.1 Woodland Management Plan Guidelines, 2018

The Woodland Management Plan Guidelines (City of Brampton 2018) prescribes the methods and deliverables for evaluating and recommending mitigative measures for woodlands being protected as part of the land use planning process. Management plans for woodlands being conveyed to the City must be completed by a Registered Professional Forester (RPF) and/or ecologist specialized in terrestrial ecosystem restoration. The approved Woodland Management Plan forms part of the Draft Plan of Subdivision agreement between the developer and the City, and the proponent is required to implement the recommended actions to ensure the short and long-term health of the woodland. Examples of management elements to be considered include use of perimeter fencing, enhancement plantings between the feature edge and fencing, management of access with appropriately sited trails, and other supplemental works (such as invasive species control and native replacement plantings). These guidelines are described in greater detail in Section 2.2.5.

4.2.5.2 Tableland Tree Assessment Guidelines, 2018

Brampton's Tableland Tree Assessment Guidelines (2018) guide the assessment and provision of compensation for trees approved for removal both within and outside of wooded natural areas.

Pursuant to the Guidelines, Vegetation Assessments are required for applications for any Official Plan or Zoning By-law Amendments, and are to:

- include a survey (or acceptable alternative) of all vegetation on site and within 10 m of the property boundary, including identification of all trees of at least 15 cm dbh outside of the proposed Natural Heritage System (NHS)
- include an inventory, mapping and photo-documentation of all trees of at least 30 cm dbh, and of tree groupings (e.g., hedgerows) outside of the NHS
- special consideration for trees of special cultural or environmental significance, as well as groupings of trees that could be integrated into the proposed development
- identification of functional relationships between the preliminary NHS and tree groupings outside the NHS
- rationale for proposed removal of trees outside the NHS, and
- management recommendations to ensure that trees identified for retention are protected during and following the development process

The Tableland Tree Assessment Guidelines update the previous 3:1 replacement requirement for all healthy trees of at least 15 cm dbh with diameter class-based compensation ratios (Table 12). Tree planting must meet or exceed the City standards summarized in this document. Cash-in-lieu (currently valued at $500 per tree) may be accepted for healthy individual trees approved for removal that cannot be accommodated on site, but is not accepted for trees in wooded natural areas.

Table 10: Tree removal compensation ratios for healthy tableland trees, outlined in the Tableland Tree Assessment Guidelines (2018).

DBH (cm)	Ratio
15-20	1:1
21-35	2:1
36-50	3:1
51-65	4:1
>65	5:1

Best practices – Tree protection policy

Many municipalities have adopted tree protection policies to guide the preservation of the urban forest both within and outside of the development process. Common elements of such policies include a purpose statement and objectives, delineation of responsibilities, outlining of processes and procedures, tree protection specifications, and provisions for securities, compensation, and penalties. A principal benefit of such a policy is the clear consolidation of all of the municipality's tree protection requirements in one document for the benefit of both development applicants and staff in separate departments, thereby ensuring a consistent and effective approach to plan review and oversight.

To be effective, a tree protection policy must be integrated with tree protection bylaws and the development application review and approval process. Inclusion of technical specifications and standards for tree protection, and a program of stakeholder outreach and education, both help to ensure effective policy implementation. Adequate staffing levels and resources are also necessary to administer the policy and enforce compliance.

Examples of municipalities with leading tree protection polices include Edmonton, Oakville, Ottawa, Regina, Toronto and York Region. The City of Vaughan recently developed a highly detailed Tree Protection Protocol document. Saskatoon recently undertook a comprehensive review of its tree protection policies and is expected to adopt a revised policy in the near future.

Best practices - Incentives for tree protection

Some municipalities provide developers with innovative incentives to encourage tree protection. For example, Edmonton has introduced an incentive program promoting the retention of existing mature trees during construction wherein new developments can receive credits towards their tree requirements for preserving existing trees. The incentive structure is depicted in Figure 17. The City of New Westminster provides a Retained Tree Incentive of a 50% discount off retained tree securities if the applicant revises the Site Plan to protect trees in response to a City request. It is also important to avoid disincentives to tree protection – for example, requiring cash security deposits or payment of both compensation value and tree planting may encourage applicants to withhold information about existing trees on site plans.

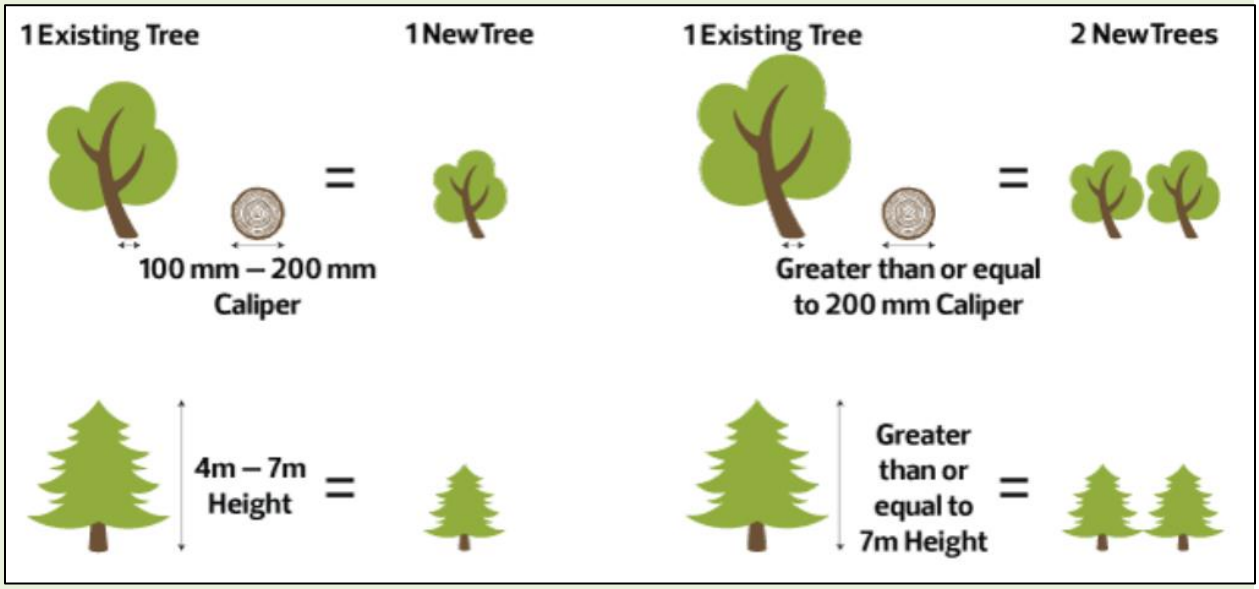


Figure 17: Tree protection incentive structure in Edmonton, Alberta, whereby retention of existing trees reduces site tree planting requirements.

Best practices – Tree protection brochure

Several municipalities have developed tree protection brochures that summarize important aspects of the tree protection process in a single user-friendly document, and direct users to more detailed guidance documents if required. Calgary's "Tree Protection Plan: A step-by-step guide" outlines the entire tree protection process, from the public tree disclosure statement to implementing the approved tree protection plan. Edmonton's "Trees and Construction" brochure summarises the City's general requirements for tree protection during construction in a user-friendly manner. Halifax, Langley, Nanaimo and Saskatoon have similar brochures.

Best practices – Tree removal compensation

Municipalities can employ any of a variety of approaches for assessing the value of and obtaining compensation for the removal of regulated trees. Various options are summarized below.

Compensation Method/ *Municipalities where Applied*	**Description**	**Pros**	**Cons**
Aggregate Caliper ***(Ajax, Burlington, Guelph, Newmarket, Oakville)***	Area of removed tree's stem at DBH is replaced by equal combined caliper of planted trees.	Easy to calculate and implement. Large number of trees are typically planted.	May be costly if large number of trees are removed. Does not necessarily account for condition of removed trees.
Amenity Value, e.g., CTLA Trunk Formula Technique ***(Toronto, for City-owned trees)***	A standard formula is used to appraise the value of a tree. Compensation equal to that value is paid for tree removal.	Defensible and widely accepted as a reasonable method. Well-suited to individual amenity trees.	Poorly suited to woodland, forest or tree stand valuation. Assessments are subject to interpretation and bias. Does not replace lost canopy, leaf area or function.
Cash-in-lieu ***(Many municipalities)***	Used in conjunction other methods; a monetary sum is paid instead of actual tree planting. Most effective if funds deposited in tree planting-directed accounts. Values range from $350 to $700.	Easy to calculate and implement if standard formula for determining replacement cost is used.	Like ratio-based compensation, rarely accounts for true value of tree(s) being removed. Results in fewer trees planted. Funds may "disappear" in general accounts.
Leaf Area Replacement **(*None currently known)***	The leaf area of removed tree(s) is calculated using a standard formula. Equivalent leaf area is replaced with new trees.	Benefits lost by removing leaf area are replaced. Ensures increase in leaf area and canopy cover as planted trees grow.	May be highly costly if large number of trees are removed, and require additional land. Calculating leaf area can be complex.
Stems per Unit Area Replacement ***(None currently known)***	A certain number of trees are planted per unit area (e.g., stems/hectare).	Applicable to woodlands, forests and plantations.	Not applicable to individual trees or low-density sites.
Canopy Cover Replacement ***(Oakville, for development)***	The area of lost canopy cover is replaced. Best suited to natural / naturalized area compensation.	Well-suited to plantations or forests where tree density is high. Allows for a more diverse stand in terms of species and structure to be established.	Will not result in immediate canopy replacement. Requires active management of regeneration. Highly costly.

Tree Replacement Ratio ***(Brampton, Markham, Mississauga, Toronto)***	A ratio of replacement trees must be established to compensate for injury or removal (e.g., 3:1 replacement to removal ratio.) Typically allows cash-in-lieu if trees cannot be planted on-site.	Easy to calculate and implement. May result in increased leaf area and canopy over time, but only if planted trees survive.	Often does not adequately replace lost canopy, leaf area or function/value.

4.2.5.3 Community Development Guidelines or Design Briefs

These guidelines support planning for the retention of existing trees and the establishment of new trees at the Block Plan scale (comparable to Secondary Plans in some communities). These are informed by both the Official Plan direction and the applicable site-specific guidelines.

4.2.5.4 Sustainable Community Program: New Development

The Sustainable Community Program: New Development, including the core components of the Sustainable Community Development Guidelines (SCDGs) and the Sustainability Assessment Tool (SAT) are described in detail in Section 3.2.2.7.

The Sustainable Community Program: New Development Manual includes one tree protection-related metric:

- 2.1.10 - Maintain Existing Healthy Trees (Plan of Subdivision and Site Plan):
    - Mandatory target (0 pts.): Provide a Tree Evaluation Report that identifies and evaluates where on-site healthy trees will be protected or removed, and compensation for removal of healthy tableland trees has been proposed in accordance with the City's requirements.
    - Minimum target (2 pts.): Where healthy tableland trees are proposed for removal, enhanced compensation is provided based on basal area.
    - Aspiration target (3 pts.): 75% of healthy, tableland trees greater than 20 cm DBH are preserved in-situ, on site.

Additional Sustainability Metrics related to Natural Heritage, Natural Heritage System, and Soils and Topography, which all relate but are not specific to the urban forest are also outlined in the Manual.

4.2.5.5 Landscape Development Guidelines, 2019

In addition to providing tree establishment-related guidance (see Section 3.2.2.1), the Landscape Development Guidelines provide guidance for assessing and protecting existing trees. This guidance includes requiring that landowners "make every effort to retain significant existing vegetation as identified by a professional Arborist's report, through careful arrangement of buildings and other site facilities" (1.7.6.a). Trees identified for protection are to have snow fence hoarding erected and grades retained in their vicinity so as not to negatively impact the

trees, as detailed in a Tree Preservation Plan. Hoarding is to be at the dripline or beyond e.g., along the edge of the buffer block or property boundary) as appropriate for the given site. The landowner's consulting Landscape Architect or Arborist is to provide a letter confirming protective measures have been installed as per the approved plans, and are to certify such installation prior to the issuance of a topsoil stripping permit. In practice, there is limited third-party arborist monitoring of and reporting on tree protection measures on development sites, and limited overview and compliance monitoring by the City of Brampton.

4.2.5.6 Site Plan Review User Guide, 2018

The Site Plan Review User Guide requires existing trees and shrubs to be identified on drawings, including trees within "and around" the site (although no minimum tree diameter is specified). It also specifies that:

- tree protection hoarding be placed at the drip line of trees
- no materials be stockpiled within the hoarding area
- snow storage must not be located around existing (or planted) trees, and
- any City trees damaged or removed be replaced with at least one 70 mm caliper tree, to the City's satisfaction.

Best practices – Subdivision and Site Plan Control

Approaches identified in the Best Practices Guide to Urban Forest Planning in Peel (2020) at the subdivision and site plan control level that could be considered in Brampton include:

- (a) Carrying official plan policies related to trees and wooded areas beyond the zoning by-law and into site plan control and conditions of approval (e.g., Region of Halton)
- (b) Developing and implementing shade guidelines on a site-specific basis as part of park planning or redevelopment of public open spaces to maximize shade benefits (e.g., City of Toronto), and
- (c) Requiring a canopy cover plan as part of all Plans of Subdivision and Site Plans to demonstrate the development's contribution to the urban forest and Town-wide canopy coverage target of 40% as well as compliance with the applicable regulations and standards (e.g., Town of Oakville).

4.2.6 Tree protections standards and specifications

Several City of Brampton standards and specifications outline requirements for tree and woodlot protection. These include:

- **Parks Construction Standard Detail L110 – Temporary Tree Protection Fencing:** This detail requires wire fencing to be established at the drip line for trees up to 30 cm dbh, and at a radius of at least twice the dripline for trees greater than 30 cm dbh.
- **Parks Construction Standard Detail L724 – Woodlot Edge Management:** This detail outlines a typical cross-section for edge management of retained woodlot, and includes a min. 9.4 m buffer zone with a min. 7.0 m rooting area for edge planting and natural regeneration. Planting materials and methods are to be specified according to local conditions. This detail also specifies selective thinning (if required based on a Woodlot Management Report) within the outer 10 m of the woodlot and fencing around the feature and its min. 9.4 m edge management zone (L724).
- **Parks Construction Standard Detail L725 – Woodlot Protective Measures:** This detail relates to protecting woodlot areas with both permanent fencing and temporary hoarding. It specifies a minimum 7 m buffer zone, demarcated by permanent fencing a minimum of 7 m from the edge of the woodlot, temporary hoarding and silt fencing a minimum of 3 m from the edge, and a minimum 4 m turf strip in between.
- **Landscape Specification No. 02901 – Tree and Shrub Preservation:** This specification requires the establishment of a temporary protective fencing “beyond the dripline” of protected trees, and that existing grades be maintained within the dripline. The undisturbed area is also required to remain free of debris, building materials and equipment. The specifications also include provisions for root excavation by hand, fertilization, and specific protections during grade changes.

Brampton’s tree protection standards and specifications generally reflect common approaches to tree protection. However, the common approach among many municipalities of determining tree protection zone (TPZ) radius by tree diameter, instead of dripline, may be more effective in securing tree protection and facilitating plan preparation and review.

Several other elements of the City’s tree protection standards and specifications are inappropriate and should be revised. For example, Specification No. 02901 specifies that, if excavation is necessary within root systems, “roots are to be cut with a sharp axe, and all cuts [are] to be sealed with approved Tree Surgeons paint”. The specification also requires pruning to “to compensate for root loss then treat[ment] with tree paint.” These approaches are wholly inconsistent with basic arboricultural standards, and the specification must be revised accordingly. Parks Construction Standard Details L724 and L725 are inconsistent with regard to the minimum size of the buffer area (9.4 m in L724 and 7 m in L725) and should be aligned.

There is also inconsistency between the Site Plan Review User Guide, the Landscape Development Guidelines, and Landscape Specifications No. 02901 with regard to the required type of tree protection fencing (wire versus snow fence) and its location relative to the dripline of protected trees (at, beyond or double the dripline).

Best practices – Tree protection specifications

Tree protection should be guided by detailed and comprehensive technical specifications for a range of tree protection measures. The most commonly specified tree protection measures in municipal tree protection policies and specifications manuals include:

- Tree Protection Zones (TPZs): which delineate the area around the tree subject to the implementation of other tree protection measures. At minimum, TPZs should be sized to account for tree size (dbh), and should ideally consider the species' tolerance for disturbance, tree health or condition, significance, and other factors.
- Tree protection barriers: Fencing or hoarding that encloses the TPZ.
- Soil compaction protection: Load-dissipating materials over the root zone to protect against impacts of vehicular traffic or materials storage.
- Root-sensitive excavation and root pruning: Methods to expose roots and minimize damage prior to conventional excavation.

Municipalities with exemplary tree protection specifications include Barrie, Palo Alto (CA), Thunder Bay, Toronto, and York Region.

4.2.7 Tree protection process

Input from City staff suggests that appropriate staff are usually circulated on planning applications to ensure adequate review of tree-related aspects, and adequate tree protection measures are typically proposed and approved through the application review process. The City has also recently begun to require that tree protection measures be identified for projects not subject to *Planning Act* applications (e.g., capital projects) where trees may be impacted. However, not all staff appear to be aware that the tree protection standards and specifications already in place are now to be applied to all projects.

It appears that while some staff recognize the City's ability to require securities for the protection of existing trees, this practice is only occasionally implemented. When securities are collected, they are valued on the basis of cost estimates submitted by proponents and held for a period of up to two years.

The City typically requires that compensation be made for the removal of "healthy tableland trees" approved through the planning process or the City's tree or woodland by-laws. These requirements are generally made in accordance with the *Tableland Tree Assessment Guidelines* (2018), which favour on-site tree replacement planting over cash-in-lieu payment.

Although the tree City's tree protection by-laws and guidelines are considered relatively robust, it appears that City staff currently lack the capacity to be adequately involved in pre-, during or post-construction site inspections to ensure compliance with approved tree preservation plans.

While the proponent's consultants are required to certify that plans have been implemented as approved, more staffing resources are required for targeted inspections and follow-up enforcement by the City. In addition, staff have also indicated that the process for identifying opportunities for tree protection and/or replacement through the Building Permit process should be improved by strengthening internal communication processes, and that enforcement of tree protection on capital projects could also be enhanced. There also appears to be a lack of clarity about the "ownership" of the tree protection process, as staff from both Parks Maintenance and Forestry and Environmental Planning have some level of involvement in tree protection review. The administration of the tree protection review process through all stages of all types of tree-related applications (tree by-law, development, building permit, driveway, etc.) should be streamlined under the direction of staff with tree-specific knowledge, working closely as part of an integrated application review team where necessary.

Best practices – Use of Site Plan control, conditions of subdivision and securities

Tools identified in the *Best Practices Guide to Urban Forest Planning in Peel* project (2020) related to Site Plan and Plan of Subdivision processes include Site Plan guidelines that include requirements for tree protection and compensation, as well as requirements for securities related to trees identified for protection (e.g., Mississauga, Guelph). Conditions of subdivision provide a strong source of leverage to influence tree protection as municipalities can withhold approvals or securities related to specific conditions until they have been met.

Best practices – Securities for tree protection

Some municipalities collect securities for tree protection, which are refundable upon completion of site works if trees have been appropriately protected. Commonly, municipalities will apply a tree value appraisal formula and/or a replanting ratio to determine the value of securities to be retained. Early release of securities may be an effective incentive for enhanced tree protection. Irrevocable letters of credit may be preferable to cash securities, as they reduce pressure for rapid return of security deposits and allow the municipality to collect compensation even if the onset of decline or mortality in response to site impacts is delayed. Saskatoon collects 120% of a tree's appraised value as securities as a "damage holdback" to account for additional costs which may be incurred (administration, removal, etc.). Toronto appraises securities using a modified version of the CTLA Trunk Formula Method for tree value appraisal, and only retains securities for the protection of City-owned trees.

Best practices – Tree disclosure/declaration

Many municipalities require the submission of a tree disclosure along with any Building Permit or other application, requesting applicants to declare whether any municipally owned or otherwise regulated trees may be affected by proposed site works. Declarations can ensure that applications are circulated to appropriate departments and staff with oversight over tree protection by-laws and policies, and provide early opportunities to discuss or negotiate approaches to tree protection with applicants.

Best practices - Permit integration

Tree protection conditions imposed in the early stages of the site development process (e.g., demolition permits) should be carried forward to subsequent stages. At minimum, sites with previous tree protection requirements should be 'red-flagged' upon initial building permit or development application review to inform reviewers that further tree protection may be required during construction phases. In Saskatoon, this is undertaken through staff comments on applications through the City's centralized building and development permit application management system, which is accessible to all development application review staff.

Best practices - Team integration

Integrating municipal staff with planning and arboricultural knowledge at the earliest stages of development promotes successful tree protection outcomes. Ottawa has integrated professional foresters into its planning department through a 'Planning Forester' position, whose role is to review tree protection plans submitted as part of planning applications; a similar approach is undertaken in Richmond Hill. Edmonton has created "infill teams" to coordinate all aspects of infill development, and is working to improve the team's integration with the Urban Forestry section to promote more effective tree protection on development sites.

Best practices - Tree protection plan agreement/acknowledgement

Calgary requires applicants to sign and submit a Tree Protection Plan Agreement, which commits applicants to compliance with approved tree protection plans throughout the development process. Edmonton requires that developers working around City-owned trees sign a Construction Site Management Practices Acknowledgement form, thereby acknowledging their tree protection obligations. In Regina, property owners are requested to enter into a voluntary agreement with the City to protect City trees in proximity to works on private property, which may include allowing access for necessary branch or root pruning.

Best practices – Tree protection inspection and enforcement

Inspection and enforcement of compliance with approved tree protection plans can be significantly strengthened by requiring self-reporting by development applicants on a regular schedule or at pre-determined phases of development. This can reduce the need for field-based compliance inspection by municipal staff. Mississauga requires the development applicant's arborist to submit regular tree inspection reports, including photographs, to provide evidence of compliance with tree protection measures. Failure to submit such reports may trigger field inspections by City staff or other enforcement actions.

4.3 Strategic direction for planning and Brampton's urban forest

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) assessment matrix for Brampton's approaches land use planning and the urban forest, with a particular focus on tree protection policies, standards and practices.

The section also assesses Brampton's performance in two criteria related to tree protection, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool - the most recent iteration of the established Criteria and Indicators of Urban Forest Sustainability assessment framework (C&I) (Clark et al., 1997; Kenney, van Wassenaer and Satel, 2011; Leff, 2016).

The SWOT matrix and C&I assessments inform the development of strategic directions for Brampton's Urban Forest Management Plan, presented at the end of the section. The strategic directions will be addressed through UFMP strategic goals, objectives, and action items.

4.3.1 SWOT matrix analysis

Table 11: SWOT matrix for planning and Brampton's urban forest.

Strengths	Weaknesses
Regional Planning: • Strong policy framework for protection of significant wooded natural areas • Identification of a healthy and well-distributed urban forest as a key tool for climate change mitigation and adaptation • Tree Planting Prioritization Tool available to prioritize areas for planning based on environmental, social, and economic considerations **Local City-wide Planning:** • Strong policy framework for protection and restoration of significant wooded natural areas • Complement of progressive programs for enhancement and expansion of the urban forest on public and private lands (e.g., Eco Parks Strategy, One Million Trees Program) • Defensible tree compensation guidelines • Requirements for tree removal compensation on both public and private lands • Progressive standards for tree protection and establishment on private lands in Sustainability Assessment Tool (SAT)	**Federal and Provincial Support:** • Very limited federal and/or provincial support for urban forestry research and management **Regional Planning:** • Limited Region-wide monitoring of the structure, distribution and functions of Peel's urban forest • Lack of regular reporting (to decision-makers and the public) of key urban forest metrics at the Regional and local scales **Local City-wide Planning:** • Lack of linkages to between the urban forest and human health, or the urban forest as green infrastructure in the current Official Plan • Technical issues and inconsistencies among some elements of tree protection standards and specifications • Insufficient education and enforcement of the City's private tree by-laws • Limited incentives for tree establishment on private property – SAT "gold" level is voluntary and without recognition
Opportunities	**Threats**
Federal and Provincial Support: • Advocate for federal and/or provincial support for urban forestry research and management **Regional Planning:** • Regular Region-wide monitoring of the structure, distribution and functions of Peel's urban forest in partnership with local municipalities • Regular reporting (to decision-makers and the public) of key urban forest metrics at the Regional and local scales **Local City-wide Planning:** • Updated Official Plan policies that make linkages to between the urban forest and human health, and to the urban forest as green infrastructure • Research and implementation of a framework for incorporating the municipally owned and managed urban forest into Brampton's asset management planning • Investment into broader education and enforcement of the City's private tree by-laws • Identification and offer of incentives for tree protection • Leverage synergies between existing programs for enhancement and expansion of the urban forest on public and private lands (e.g., Eco Parks Strategy, One Million Trees Program) to gain more support within and outside the municipality • Review of tree protection specifications in all guidance documents to ensure consistency and implementation of the best practices across the board	**Federal and Provincial Level:** • Loss of growing support for significant woodland protection, green infrastructure and natural asset management in provincial policies in response to short-term economic pressures, resulting in weaker planning framework for the urban forest **Regional Level:** • Shift away from good urban forest planning as one of the cornerstones of climate change mitigation and adaptation • Loss of existing regional support and partnership on urban forest matters, increasing the resource burden at the local level **Local Level:** • Lack of corporate support for implementation and enforcement of approved policies and guidelines supporting the urban forest resulting in missed opportunities for protection and enhancement • Lack or support among the private sector and industry to implement more progressive urban forest policies, standards and specifications resulting in reduced protection and longevity of established trees • Inconsistencies among City guidance documents can cause confusion for staff and proponents, and result in missed opportunities to implement the best practices

4.3.2 Criteria and Indicators assessment

Table 12: Criteria and Indicators assessment of two criteria related to planning and Brampton's urban forest, with specific focus on tree protection, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (-1)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Resource Management: Implementation	POLICIES THAT FOSTER GOOD URBAN FORESTRY ON PRIVATE LANDS	Because private lands comprise the majority of canopy cover for most municipalities, plans and policies should address- through rules, fees and incentives- how owners contribute to the overall health of the urban forest and the benefits it delivers.	No tree protection ordinance, or one that's weak and rarely enforced.	Strong tree protection ordinance focused on maintaining mature trees with effective procedures.	Policies regarding stormwater, site and subdivision planning, zoning and other issues that affect private forests are included in management plan.	All relevant municipal policies require or incentivize adherence by private owners to standards incorporated in the plan. Incentives and sanctions applied when appropriate.	Although no urban forest management plan in place yet, multiple policies already exist related to planning and the urban forest, and tree protection.
Resource Management: Monitoring and Maintenance	TREE PROTECTION POLICY AND ENFORCEMENT	The benefits derived from trees on public and private land are ensured by the enforcement of municipality-wide policies, including tree care "best management practices."	No tree protection policy	Policies in place to protect public trees and employ industry best management practices, but rare or inconsistent enforcement.	Policies and practices in place to protect public trees, generally enforced. As a companion to the Public tree care policy, community issues a guide to aid compliance for all affected agency staffs and contractors.	Integrated municipality-wide policies and practices to protect public and private trees, consistently enforced and with penalties sufficient to deter violations.	Performance indicator not wholly applicable to Brampton situation. No tree protection policy in place (Low); however, public trees are protected by by-laws. Enforcement is somewhat inconsistent.

4.3.2.1 Criteria and Indicators assessment summary

Using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, Brampton's performance in two criteria related to planning and the urban forest, with a specific focus on tree protection, scores 3 out of 8 (38%). Key shortcomings include the absence of a comprehensive suite of tree protection-related policies applicable to private lands, and the occasionally inconsistent enforcement of tree protection policies and measures.

It should be noted that in the absence of a vision, goals and objectives for the urban forest (to be established in Part 2 of the UFMP), this assessment assigns the Optimal performance level as the performance target for each criterion. However, Brampton's actual performance target levels will be established in Part 2 of the Urban Forest Management Plan, and may be lower than the Optimal level for some or all criteria. In this case, although the number of points awarded for the City's current status will not change, Brampton's relative performance in this series of criteria may increase.

4.3.3 UFMP direction

Based on the review of the relevant documents pertaining to urban forest planning and protection, as well as analysis of the gaps and opportunities, the following preliminary planning directions, specifically in relation to protecting trees, have been identified for the UFMP.

4.3.3.1 Federal and Provincial support

- Undertake, with Peel Region and other municipal partners, advocacy for federal and/or provincial support for urban forestry research and management through organizations such as the Federation of Canadian Municipalities (FCM).

4.3.3.2 Regional planning

- Work with Peel Region to undertake regular Region-wide monitoring of the structure, distribution and functions of Peel's urban forest in partnership with other local municipalities.
- Work with Peel Region to provide input to and share regular reporting with decision-makers and the public related to key urban forest metrics at the Regional and local scales.

4.3.3.3 Local planning

- Expand urban forest policies as part of the City's next Official Plan update (see more detailed suggestions below).
- Incorporating tree and wooded areas protection into conditions of approval for subdivisions and site plans to help ensure their implementation.
- Establishing land-use type specific canopy cover targets (as in the Town of Oakville) and requiring that site-specific canopy cover plans developed as part of Plans of Subdivision and Site Plans are able to meet the established targets to demonstrate the development's contribution to the City's urban forest.
- Consider the development of a tree protection policy.

- Improve guidelines, standards and specifications related to tree protection.
- Increase municipal resources for education and enforcement of the City's private tree by-laws and tree-related guidelines and specifications.
- Develop incentives for tree protection on private property.
- Develop and implement standards for woodland management following assumption.
- Enhance processes related to development and building permit application submission, circulation and review, and for pre-, during or post-construction site inspections, to ensure compliance with tree protection by-laws, guidelines and approved tree preservation plans/arborist reports.

A series of best practices related to integration of urban forest policies into municipal Official Plans were identified in the *Best Practices Guide to Urban Forest Planning in Peel* (in progress) developed for Peel Region and its partners. Direction in this document potentially suitable for Brampton include:

- Include goals related to the urban forest in the overall plan direction.
- Clarify the relationship between natural heritage and urban forest policies.
- Include urban forest policies as a stand-alone section and integrate urban forest policies in other sections.
- Commit to working towards equitably distributed canopy cover and urban forest services.
- Recognize urban forest environmental, economic, and societal and health services provided by the urban forest, and Include policies specifically intended to help communities maximize these services in the context of climate change.
- Support ongoing inventory, maintenance and monitoring of the urban forest.
- Support an adaptive management approach to urban forest planning.
- Provide strong and/or creative approaches for supporting protection of established trees, particularly mature and healthy trees.
- Require replacement of trees approved for removal on private lands and require replacement of trees approved for removal on municipal lands, possibly based on a net gain principle.
- Include policies related to improving urban forest resilience through diversity.
- Support for sustained outreach and stewardship initiatives targeting public and private lands.
- Seek and pursue opportunities for wooded natural areas securement where feasible.
- Commit to building on existing engagement and partnership opportunities, including existing inter-agency and community partnerships
- Support for pursuit of funding, targeted research opportunities, and developing incentives for urban forest stewardship on private lands.
- Recognize the urban forest as a valued green infrastructure component.
- Provide direction to incorporate the urban forest into municipal asset management planning.
- Include Key Definitions: in addition to "woodland" and "significant woodland" include a definition of the "urban forest", "tree", "green infrastructure" and "impacts of a changing climate" from the Provincial Policy statement (2020); and potentially other definitions depending on the policies adopted.

5 Engagement and partnerships in Brampton's urban forest

"Any urban forestry program has to integrate people as part of the program itself."

– Canadian Urban Forest Network (CUFN) Compendium of Best Management Practices

5.1 Overview

The City of Brampton recognizes that outreach, engagement, partnerships, and funding are critical to sustaining the local urban forest and fostering a healthy community. The City has a long history of engaging the community and building such partnerships, and over the past decade has expanded its online and in-person engagement related to sustainability and has also been gradually increasing its investment in engagement activities related to the urban forest. This shift has included developing and implementing various programs to educate local youth and expanding partnerships and funding intended to support the City's new One Million Trees program.

This section provides an overview of the current status of outreach, programs and partnerships, and identifies a range of targeted opportunities for improving them. Strategic directions for the UFMP related to engagement and partnerships draw heavily on the strategies and actions identified in the City's One Million Trees Program launched in 2019.

5.2 Current status and best practices

5.2.1 Community outreach and engagement

5.2.1.1 Online and social media

5.2.1.1.1 "Trees" portal

The City of Brampton recently unveiled a new "Trees" portal on the City website. The portal provides comprehensive information related to the urban forest, including the following sections:

- **Brampton's urban forest**: which defines Brampton's urban forest, reviews important urban forest services, and serves as the home page for the UFMP project.
- **One Million Trees program:** which provides an overview of the One Million Trees program and includes a "Count My Tree" online tracking tool, which enables residents and others who have planted a tree in Brampton to add it to the record of trees planted (note: the counter is currently empty). The counter allows respondents to identify where and why the tree was planted, and allows them to sign up for additional information about environmental sustainability initiatives in Brampton.
- **Community Tree Events:** which provides information and sign-up opportunities for regular City-led community tree planting events (Earth Day, National Tree Day, Community Parks Day, Scouts/Guides planting events), information about partner (CVC and TRCA) events, and links to the City's Tree Dedication Program.

- **Residential Tree Planting and Care:** which outlines the recently established Residential Tree Program and includes resources such as a tree planting guide brochure, tree planting and maintenance instructional videos, external fact sheets, and links to the City's "Tree Pests and Diseases" webpage.
- **Tree Removal:** which provides information about the City's tree and woodlot by-laws and permit application processes, and about tree-related regulations and plans. This page has recently been updated to include online tree injury/removal permit submission functionality.
- **Tree Regulations and Plans:** which summarizes the City's private tree protection and woodlot conservation by-laws, tree standards and guidelines, and tree-related plans and strategic documents
- **Tree Education:** which links to the Province of Ontario Tree Atlas, the City's "Tree Pests and Diseases" webpage, and a list of tree-related Frequently Asked Questions (FAQs).
- **Services the City Provides:** which links to the 311 portal for tree maintenance, removal and planting requests, and to the Tree Dedication Program page.
- **Trees on City Property:** which summarizes Brampton's approaches to tree removal and planting on City property (including in new subdivision developments), and
- **Trees on Private Property:** which summarizes property owner requirements, responsibilities and recommendations related to tree removal (including by-law regulations), dead trees, and tree planting.

The "Trees" portal also includes an "Announcements" section and provides a Forestry-specific email contact link.

Best practices – Urban forest residents' guide

Saskatoon has published "Saskatoon's Urban Forest: A Guide to Urban Forestry Services" for. This guide reviews the benefits provided by the urban forest, summarizes current City urban forestry programs, provides tree care information, includes detailed descriptions and photographs of local tree species, outlines tree protection requirements, describes common tree pests, and provides a tree request form.

5.2.1.1.2 "Grow Green" portal

The "Grow Green" portal of the City of Brampton website includes information about initiatives related more broadly to the protection and enhancement of natural areas and greenspaces in the City, but not directly or solely related to the urban forest. The portal is structured around the six environmental goals of the Brampton Grow Green Environmental Master Plan (EMP), and serves as a tool to publicly track and report on the City's achievements in relation to the EMP. The webpage also includes the "Canvas of Environmental Initiatives" (a summary of the EMP initiatives) and provides links to descriptive webpages for all current environmental engagement opportunities (e.g., Adopt-a-Park, Community Tree Planting, Greenland Securement, Woodland

Restoration, etc.) and City programs and operations (e.g., EAB management, Natural Heritage Restoration Program, Environmental Stewardship Education, etc.).

The portal also links to the Grow Green Network – a consortium of organizations and individuals intended to build upon existing community initiatives, increase awareness and involvement, and empower people in supporting the Environmental Master Plan.

Best practices – Comprehensive urban forestry website

Maintaining an active and engaging online presence through websites and social media is a cost-effective and impactful means to reach a large audience. An optimal urban forestry website will serve as a portal with links to urban forest policies, information about municipal programs, data and mapping tools, and regularly updated information about community events. The website should also include service request submission and tracking functionality. Toronto maintains one of the most comprehensive and accessible urban forestry websites of any Canadian municipality. Other examples of comprehensive urban forestry websites include Calgary, Edmonton, Halifax, New Westminster, and Surrey. Brampton's new "Trees" portal is also an exemplary urban forestry webpage.

5.2.1.1.3 Social media

The City also has a broad social media presence on major platforms, including Twitter, Facebook, YouTube, LinkedIn and Instagram accounts (Figure 18) for the City as a whole and for specific service areas. This includes Twitter and Instagram accounts for Brampton Grow Green, which can be used for urban forestry outreach and updates. There is, however, no social media presence for the Parks Maintenance and Forestry division or specifically for urban forestry topics.

Brampton Social Media Accounts

Account	Twitter	Facebook	Youtube	LinkedIn	Instagram
City of Brampton	✓	✓	✓	✓	✓
2040 Vision	✓				✓
Brampton Animal Services		✓			✓
Brampton Emergency Management Office	✓				
Brampton Entrepreneur Centre		✓			✓
Brampton Fire & Emergency Services	✓	✓	✓		
Brampton Grow Green	✓				✓
Brampton Library	✓	✓	✓		✓
Brampton Transit	✓	✓	✓		✓
Cultural Services	✓	✓	✓	✓	✓
Downtown Brampton	✓				✓
Economic Development Office	✓	✓	✓	✓	✓
Experience Brampton	✓	✓			✓
Garden Square	✓	✓	✓		✓
Human Resources				✓	
Rose Theatre Brampton	✓	✓	✓		✓

Figure 18: Overview of the City of Brampton's social media profile.

Best practices – Effective social media presence

Richmond Hill won the Gold AVA Digital Award in 2017 for educational urban forestry videos on its YouTube account. One video was about the City's emerald ash borer (EAB) program, while another promoted the use of free woodchips by residents.

"A Tree of All Trades", a video produced by the Halifax Regional Municipality to educate residents about urban forest benefits, has high quality production values and garnered over 65,000 views on YouTube.

Lethbridge maintains an active social media presence, including a Twitter account with over 20,000 followers. The City's social media accounts (particularly the Instagram account) have repeatedly featured photographs of the urban forest, and are effective and important engagement and awareness-building tools.

Several municipalities have deployed cohesive and well-branded campaigns to promote community engagement in the urban forest. Examples include the One Million Trees Mississauga campaign, Toronto's Every Tree Counts campaign, and Oakville's P.L.A.N.T (Please Let's Add New Trees!) program.

5.2.1.2 Outreach and education

In addition to the information posted on the City's website (described above), Brampton offers several unique educational workshops for local youth related peripherally to urban forestry, including:

- free interactive classroom workshops about pollination, invasive species, tree health and stormwater management to schools across Brampton, providing provide experiential and inquiry-based learning for students from Kindergarten to Grade 8;
- an outdoor community forest at Elgin Woods Park that serves as an educational centre (40-minute workshops can be booked and are provided free of charge) and a recreational space for students and other residents; and
- a Park Hero Program, wherein students learn about stewardship at a two- to three-hour workshop help in a local park in the Fall

Other potential educational resources include the City's Natural Areas Inventory Report (2013) which provides ecological information including topics such as locally occurring tree species at risk and the Natural Heritage Restoration Program (NHRP) online interactive map with links to detailed site information summaries.

Best practices - Diversifying outreach approaches

York Region staff recognized that available resources for supporting tree establishment and woodland restoration on private lands are not always utilized due to lack of interest or knowledge. The York Region Forest Management Plan (2016) includes “awareness and engagement” as one of its five goals, with supporting actions intended to promote sharing information related to urban forest ecosystem services and benefits, increase awareness through marketing initiatives, and develop engagement strategies aligned with the range of demographic and cultural perspectives in the Region.

5.2.1.3 Stewardship

In addition to its website resources and environmental education initiatives, the City supports and leads a range of stewardship activities directly and indirectly related to establishing and sustaining the urban forest.

5.2.1.3.1 One Million Trees Program (2019)

The One Million Trees Program provides a framework for the City and its partners to increase tree planting initiatives and realize the target of planting one million trees by 2040. It includes building on existing community programs (see below), as well as capital and private development projects, to plant approximately 50,000 trees each year in total.

5.2.1.3.2 Residential Tree Program

The Residential Tree Program was implemented in September 2021 as a One Million Trees Program initiative, and is intended to provide resources, opportunities and initiatives to encourage residents to plant and care for trees on their private properties. An important and successful part of this program was a tree giveaway, in which residents could register for and obtain one free tree per household or property. Approximately 1,200 trees were distributed through this initiative, which was launched in conjunction with the newly-proclaimed September Tree Month. Residents were requested to register their planted tree on the City’s Tree Tracker Map, and an increase in tracking submissions was observed following the tree giveaway. The giveaway initiative also afforded an opportunity for resident engagement with Forestry staff, and was supported by informational brochures and web-hosted, City-produced informational videos related to tree planting and maintenance. Overall, both City staff and residents expressed positive feedback on the tree giveaway and related initiatives under the Residential Tree Program.

5.2.1.3.3 Peel Greenlands Securement Program (last updated in 2020)

To assist in protecting environmentally sensitive lands, the City of Brampton has partnered with Peel Region and Conservation Authorities (CVC and TRCA) to implement Peel’s Greenlands Securement Program. This program allocates staffing and funding to support interest in selected landholdings deemed ecologically important. Interest may take the form of acquisition, conservation easements or land donations. With its partners, Brampton identifies priority

properties, and City staff work with Peel Region and its agents to explore potential land securement arrangements.

5.2.1.3.4 Community and Commemorative Tree Planting

The Parks Maintenance and Forestry division leads several school and community-oriented tree planting events throughout the year including:

- Annual Earth Day event (each spring)
- National Tree Day (an event geared towards Grade 4/5 students each September)
- Annual Scouts/Guides tree planting (each spring for the past 25 years in partnership with the TRCA at Valleybrook Park), and
- Community Parks Day (including tree planting and information booths)

The City also administers the Tree Dedication Program, whereby residents can request and pay for the planting of a tree (and, if desired, a commemorative plaque at an additional cost) in a city park (see Section 3.2.5.5).

5.2.1.3.5 Natural Heritage Restoration Program (NHRP)

The NHRP includes a range of activities (such as tree and shrub plantings, reduced mowing, invasive species management and integration of pollinator gardens) that are undertaken by City staff as well as partners and volunteers.

5.2.1.3.6 Massey Woodland Management

Massey Woodland is a four-hectare forest located in Massey Park, between the Spring and Mimico Creek watersheds. The City is developing management plan for the woodland and undertaking a pilot project to engage the community in activities to help sustain and improve the ecological functions of this feature, including invasive species removal, tree planting and garbage pick-up.

5.2.1.3.7 Sustainable Neighbourhood Action Plans (SNAP)

Since 2009, the City has been working with TRCA, CVC and Peel Region to develop and implement environmental improvements in two existing Brampton neighbourhoods (County Court and Fletchers Creek) through the Sustainable Neighbourhood Action Plan (SNAP) program. Activities have included streetscape plantings on both municipal and adjacent private lands, restoration of nearby valleylands, and development of an information sheet of native tree species suitable to the area, among others.

5.2.1.3.8 Green Your Yard and Greening Corporate Grounds (through CVC and TRCA)

CVC offers free workshops for Brampton and Mississauga residents under the Your Green Yard program to educate participants about ecological landscaping, including the use of native trees and shrubs. Participants are eligible for a free tree or shrubs that CVC staff will deliver and help plant. TRCA offers a similar program named Healthy Yards.

For a one-time program enrollment fee, CVC also provides interested local businesses and institutions with support in “greening” their grounds by. Services offered include initial site assessment, one or two conceptual landscaping plan(s) and related recommendations, volunteers to support implementation, presentations to staff, and training for contractors and landscape managers.

There programs are recognized in the Brampton Grow Green Environmental Master Plan Canvas of Environmental Initiatives.

Best practices – Engagement programs

Tree Canada has recognized Richmond Hill’s Community Stewardship Program (CSP), which engages residents in tree planting and invasive species management, as a leading example of a community-based engagement initiative. Other best practices for community engagement in urban forest stewardship are described in Sections 2.2.6 and 3.2.6.

5.2.1.3.9 Brampton Environmental Advisory Committee (BEAC)

The BEAC, whose current session expires in 2022, is intended to act in an advisory capacity to assist, educate, and engage the community to advance the goals and actions of the Grow Green Environmental Master Plan. Although trees and the urban forest are not specifically mentioned in the Committee’s scope of work or responsibilities, urban forest issues fit within the committee’s general environmental mandate, and the BEAC may serve an important supporting role for urban forest management in Brampton.

Best practices – Citizen advisory groups/committees

In London, the Trees and Forests Advisory Committee serves as a resource and information support group to the Planning and Environment Committee, the Municipal Council, and its Committees as required. The committee is composed of members-at-large, representatives of local tree-related businesses, and other local organizations and institutions. The Truro Tree Committee has been active since 1971, and oversees the management of the community’s urban forest on behalf of the Town Council and residents. Many other communities have established Environmental Advisory Committees (EAC), whose role is to provide strategic advice and direction on a range of environmental issues, which can include the urban forest.

Best practices – Tree ambassadors

Through the Forest Health Ambassador program, Oakville engages residents to help monitor neighbourhood street trees for invasive insects, disease and other issues related to forest health. Participants in Seattle’s Tree Ambassador program guide neighbourhood tree walks and perform basic tree maintenance, such as weeding and mulching. Cambridge, Massachusetts employs seasonal ‘Water-by-Bike Tree Ambassadors’ to inspect and water trees and interact with residents and businesses to promote tree care and urban forest benefits.

5.2.2 Partnerships and funding

5.2.2.1 Interagency cooperation and partnerships

Brampton maintains a wide range of partnerships with local agencies, environmental organizations, Peel Region, and other municipalities related to urban forest management. Recent and ongoing examples of bot public sector and non-governmental partnerships include:

- Partnerships with Peel Region, TRCA, CVC, Evergreen, LEAF, the Association for Canadian Educational Resources (ACER), EcoSource and Tree Canada to implement the City's One Million Trees Program
- The Peel Urban Forest Working Group (UFWG), which was established with Peel Region, CVC, TRCA, Town of Caledon and City of Mississauga through the Region's Urban Forest Strategy in 2011, and which remains active
- Partnerships with TRCA and CVC to undertake valleyland restoration plantings, community and corporate planting events, and native planting workshops
- Project and program-based partnership with Peel Region, CVC and TRCA on the Peel Region Urban Forest Strategy and tree canopy assessment, the Peel Tree Planting Prioritization Tool (TPPT), the Water Smart Peel Fusion Landscaping program, regional road tree establishment, support of SNAPs, and (ongoing) development of urban forest best practices guides in the context of climate change
- Past partnership with the City of Vaughan and the former Town of Richmond Hill to develop the Sustainability Metrics to evaluate and score the environmental sustainability performance of new Block Plans, Plans of Subdivision and Site Plans, including metrics for tree establishment (see Sections 3.2.2.7 and 4.2.5.4)
- Cooperative working relationships with the Canadian Food Inspection Agency (CFIA) on pest monitoring and management, including the emerald ash borer (EAB) infestation
- Leading the Grow Green Network, is a consortium of local individuals and organizations (including the: Brampton Environmental Advisory Committee (BEAC), Bike Brampton, Brampton Blue Dot, Brampton Cycling Advisory Committee, Brampton Homegrown Park Rangers, Community Environment Alliance, Council of Canadians, CVC, Peel Environmental Youth Alliance, Sheridan College, Sierra Club Peel, TRCA and Unifor West GTA Regional Environmental Council) to help implement Brampton's Environmental Master Plan, and

Examples of private sector partnerships include a partnership with BILD to help implement the City's One Million Trees Program, and occasional support for environmental initiatives from the Brampton Board of Trade.

City staff occasionally participate in educational and training opportunities available through the Ontario Urban Forest Council (OUFC) and International Society of Arboriculture (ISA).

Best practices – Green industry engagement

Engaging members of the local green industry, such as tree service providers, landscape architects and landscapers, and related others, can encourage compliance with municipal by-laws and standards and promote support for urban forest goals and initiatives. Oakville periodically hosts green industry engagement sessions, which help local arborists understand the Town's requirements for arborist reports, municipal tree protection bylaws, and the municipal arborist licensing system.

5.2.2.2 Program funding

Organizations such as TRCA, CVC, EcoSource, Evergreen, TD Friends of the Environment, ACER, Tree Canada, and citizen groups and volunteers have, in the past, provided financial or in-kind support for various tree establishment and urban forest management activities in Brampton. However, as described in Section 2.2.1.2, urban forest management in Brampton is primarily funded by tax- and fee-supported operating and capital budgets, and external funding is not a significant source of program resources.

The City also collects cash-in-lieu that is directed to tree establishment as part of the City's Tableland Tree Compensation requirements, when developers are unable to meet established compensation replanting requirements within their properties.

5.2.2.3 Incentives

The "Minimum" and "Aspirational" target metrics in the Sustainability Metrics and Sustainability Assessment Tool (SAT) may incentivize tree protection and establishment by increasing a development application's Sustainability Score and apparent environmental sustainability. Aside from these metrics, which are voluntary, the City does not currently offer any incentives to support urban management, protection, enhancement or stewardship on private lands.

Best practices – Tree-related incentives for private lands

Incentives for tree management, protection or establishment on private lands may include direct financial or in-kind support (e.g., grants, free trees, labour), subsidies, rebates, awards, or other recognition.

Best practices for tree-related incentives for private lands are described in Sections 3.2.6 and 4.2.5.2.

5.3 Strategic direction for engagement and partnerships in Brampton's urban forest

This section presents a Strengths, Weaknesses, Opportunities and Threats (SWOT) assessment matrix for engagement and partnerships in Brampton's urban forest.

The section also assesses Brampton's performance in four criteria related to tree protection, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool - the most recent iteration of the established Criteria and Indicators of Urban Forest Sustainability assessment framework (C&I) (Clark et al., 1997; Kenney, van Wassenaer and Satel, 2011; Leff, 2016).

The SWOT matrix and C&I assessments inform the development of strategic directions for Brampton's Urban Forest Management Plan, presented at the end of the section. The strategic directions will be addressed through UFMP strategic goals, objectives, and action items.

5.3.1 SWOT matrix analysis

Table 13: SWOT matrix for engagement and partnerships in Brampton's urban forest.

Strengths	Weaknesses
Outreach and engagement: • Comprehensive website and some social media presence • Effective educational programs targeted at schools/youth aligned with established curricula ***Partnerships and funding:*** • Well-established partnerships with local municipalities (Region of Peel, Town of Caledon and City of Mississauga) and local conservation authorities (TRCA, CVC) • Building partnerships with non-governmental organizations (NGOs) (e.g., Evergreen, LEAF, ACER, EcoSource and Tree Canada) • Building partnerships with local private sector (e.g., Board of Trade, BILD) • Some municipal funding supplemented by partner resources	***Outreach and engagement:*** • Limited social media content related to the urban forest and urban forest programming • Limited engagement and/or communication with the public about the value and importance of the urban forest • Little engagement with businesses about potential benefits or investing in the urban forest on their lands or as part of their corporate mission ***Partnerships and funding:*** • Engagement with schools does not include tree establishment activities • Engagement with local businesses regarding tree establishment on their lands is limited • Few incentives/supports for of private land urban forest stewardship • Potential external resources to support urban forestry are not being fully explored or pursued
Opportunities	**Threats**
Outreach and engagement: • Website could provide include more engaging elements (such as video clips and interactive access to tree-related data) • A broader marketing campaign under the umbrella of the One Million Trees Program could be undertaken • Website, social media and other outreach could better highlight links between human health and urban forest health • Marketing tactics could be tailored to Brampton's diverse communities • Partner platforms could be leveraged for outreach about the value of Brampton's urban forest ***Partnerships and funding:*** • Collaboration with current corporate, NGO (e.g., Evergreen, Tree Canada, EcoSource), and Conservation Authority partners (CVC, TRCA) could eb expanded • New partnerships with local schools and institutions (e.g., Credit River Anglers' Association (CRAA), Local Enhancement and Appreciation of Forests (LEAF), TreeMobile, etc.) could be pursued • New sources of funding (e.g., TD Green Streets, Tree Canada, Federation of Canadian Municipalities) could be pursued • A range of incentives for tree establishment on private lands across the City (e.g., residential, commercial, industrial) could be explored and implemented • Existing programs (e.g., Nurturing Neighbourhoods, SNAP program, TRCA and CVC Healthy Yards programs) could be better resourced to expand and reach more participants	***Outreach and engagement:*** • Failing to adequately educate and engage a broad cross-section of the community and decision-makers in Brampton can result in less support for urban forest initiatives on public and private lands • Less understanding and support in the community is likely to result in loss of canopy cover and ecosystem benefits, including negative impacts to human mental and physical health ***Partnerships and funding:*** • Lack of adequate and sustained financial support is likely to result in loss of canopy cover and the associated services that cover provides • Failure to support and expand existing partnerships is likely to result in Brampton not meeting its tree establishment target (currently 50,000 trees per year) and sustaining or enhancing its urban forest • Lack of incentives for tree establishment on private lands is likely to keep efforts focused on limited spaces available on municipal/public lands

5.3.2 Criteria and Indicators assessment

Table 14: Criteria and Indicators assessment of four criteria related to engagement and partnerships in Brampton's urban forest, using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool**.**

Section	Sub-section	Descriptor	Low (0)	Fair (1)	Good (2)	Optimal (4)	Assessment Notes
Engaging Peers and Residents in Process	ENGAGE RESIDENTS IN PLANNING AND IMPLEMENTATION	Enable community stakeholders to participate in and help shape planning process.	Little or no citizen involvement or neighborhood action.	Some neighborhood groups engaged across the community but no/minimal outreach to assure underserved neighborhoods participate effectively.	Many active neighborhood groups engaged in advancing urban forest goals, but with little or no overall coordination with municipality or its partnering NGOs.	Proactive outreach and coordination efforts by municipality and NGO partners resulting in widespread citizen involvement and structured engagement among diverse neighborhood groups.	
Engaging Peers and Residents in Process	TREES ACKNOWLEDGED AS VITAL COMMUNITY RESOURCE	Stakeholders from all sectors and constituencies within municipality - private and public, commercial and nonprofit, entrepreneurs and elected officials, community groups and individual citizens - understand, appreciate, and advocate for the role and importance of the urban forest as a resource.	General ambivalence or negative attitudes about trees, which are perceived as neutral at best or as the source of problems. Actions harmful to trees may be taken deliberately.	Trees generally recognized as important and beneficial.	Trees widely acknowledged as providing environmental, social, and economic services - resulting in some action or advocacy in support of the urban forest.	Urban forest recognized as vital to the community's environmental, social, and economic well-being.	Large gap between Low and Fair performance levels. Current situation likely falls between the two levels.
Creating Essential/ Effective Public/Private Partnerships	ENGAGE LARGE PRIVATE LANDOWNERS AND INSTITUTIONS	Large private landholders - including school systems, universities and corporate campuses - embrace and advance municipality-wide urban forest goals and objectives by implementing specific resource management plans.	Large private landholders are generally uninformed about urban forest issues and opportunities.	Municipality educates landowners, provides technical assistance, sets goals and provides incentives for managing resources in accordance with plan.	Landowners develop tree management plans that advance municipal urban forest goals.	Tree management plans developed with input from community, and public access to the property's forest resource.	No formal or regular outreach program to large private landowners.
Creating Essential/ Effective Public/Private Partnerships	GREEN INDUSTRY EMBRACES GOALS, HIGH STANDARDS	Green industry works together to advance municipality-wide urban forest goals and objectives, and adheres to high professional standards.	Little or no cooperation among segments of green industry or awareness of municipality-wide urban forest goals and objectives.	Some cooperation among green industry as well as general awareness and acceptance of municipality-wide goals and objectives.	Specific collaborative arrangements across segments of green industry in support of municipality-wide goals and objectives.	Shared vision and goals and extensive committed partnerships in place. Solid adherence to high professional standards, and commitment to credentialing and continuing education.	No active engagement of green industry in partnership with the City on urban forest management.

5.3.2.1 Criteria and Indicators assessment summary

Using the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, Brampton's performance in four criteria related to engagement and partnerships in the urban forest scores 2 out of 16 (13%). Key shortcomings include limited community and neighbourhood-level engagement, limited if any engagement of large private landholders, and limited active engagement of the green industry in partnership on urban forest management.

It should be noted that in the absence of a vision, goals and objectives for the urban forest (to be established in Part 2 of the UFMP), this assessment assigns the Optimal performance level as the performance target for each criterion. However, Brampton's actual performance target levels will be established in Part 2 of the Urban Forest Management Plan, and may be lower than the Optimal level for some or all criteria. In this case, although the number of points awarded for the City's current status will not change, Brampton's relative performance in this series of criteria may increase.

5.3.3 UFMP direction

The following direction from the One Million Trees Program applies to urban forest engagement, outreach, partnerships, and funding in Brampton. This direction is considered current, comprehensive and detailed, and little has been added based on the analyses completed for this part of the UFMP. Strategies and related actions have been separated into the categories of: (a) outreach and engagement and (b) partnerships and funding.

5.3.3.1 Outreach and engagement

- Strategy 2.4: Partner with schools to increase tree cover on school grounds.
    - Action 2.4.3: Collaborate with organizations such as LEAF, EcoSource, Evergreen, and ACER to develop and distribute education, awareness, and stewardship material to schools.

- Strategy 2.6: Encourage residents to undertake tree planting through incentives for planting on residential property (e.g. subsidized or free trees, planting assistance services, etc.).
    - Action 2.6.3: Continue to promote private property tree planting efforts of partner organizations, such as TRCA's Healthy Yards program and CVC's Green Your Garden program.

- Strategy 3.1: Increase the number of participants in tree planting events across the city.
    - Action 3.1.1: Develop a Brampton One Million Trees Program Awareness and Engagement Strategy.
    - Action 3.1.2: Create education and engagement tactics for City staff to increase awareness of and participation in tree planting.
    - Action 3.1.3: Develop awareness and education tactics for the public to promote native tree species and tree care/maintenance requirements.
    - Action 3.1.4: Establish communication tactics for the public regarding the environmental, social, and economic benefits of trees.

- Strategy 3.2: Develop a Brampton One Million Trees recognition program to celebrate community and staff leaders in Brampton.

- Strategy 3.4: Develop, maintain, and publish an inventory of tree planting programs in Brampton.
    - Action 3.4.1: Provide a comprehensive app and associated website where the public can record new trees planted, log the loss of trees, request a street tree, and learn about tree species, tree care, tree planting events, and other tree-related resources.

- Strategy 3.5: Continue to develop lesson plans on the importance of trees for teachers of Grades 1-12.

- Strategy 3.6: Designate the month of September as “Tree Month” to coincide with National Forest Week and National Tree Day.

In addition, municipal staff should continue to leverage the online resources and networking opportunities available through the Ontario Urban Forest Council (OUFC) and encourage this group to continue to advocate for sustained Provincial support for urban forest planning and management.

5.3.3.2 Partnerships and funding

- Strategy 2.1: Develop a tree planting program for existing parks and open spaces.
    - Action 2.1.4: Continue to work with Conservation Authorities to facilitate community planting events in parks.

- Strategy 2.4: Partner with schools to increase tree cover on school grounds.
    - Action 2.4.1: Develop a list of priority schools sites to be planted in consultation with Peel District School Board (PDSB), Dufferin-Peel Catholic District School Board (DPCDSB), and Eco Schools.
    - Action 2.4.2: Work with the Conservation Authorities school boards to facilitate School Tree Planting Days for students to plant trees on their school’s property.

- Strategy 2.5: Partner with places of worship to support tree planting on their properties.
    - Action 2.5.1: Develop a list of priority places of worship to be planted based on the identified priority neighbourhoods.
    - Action 2.5.2: Collaborate with Conservation Authorities and places of worship to facilitate Tree Planting Days.
    - Action 2.5.3: Continue to work with faith-based organizations to support tree planting efforts.
    - Action 2.5.4: Foster partnerships with new faith-based organizations to support tree planting efforts.

- Strategy 2.6: Encourage residents to undertake tree planting through incentives for planting on residential property (e.g. subsidized or free trees, planting assistance services, etc.).
    - Action 2.6.1: Identify sources of funding for subsidized and/or free trees and shrubs and planting services for residential properties.

  - Action 2.6.2: Host “Tree Giveaway Days”, where residents can receive free or discounted trees and/or shrubs and other resources to facilitate tree planting and tree care.
  - Action 2.6.4: Foster new partnerships with organizations such as LEAF, Tree for Me, and TreeMobile.

- Strategy 2.7: Encourage industrial and commercial property owners to plant trees and cultivate green spaces on their properties.
  - Action 2.7.1: Support the Conservation Authorities’ ‘Greening Corporate Grounds’ and ‘Partners in Project Green’ programs for tree planting on industrial properties, including greening parking lots.
  - Action 2.7.2: Foster new partnerships with organizations, such as LEAF, to facilitate tree planting on commercial and industrial sites.

- Strategy 3.1: Increase the number of participants in tree planting events across the city.
  - Action 3.1.5: Host an annual Brampton One Million Trees Program city-wide tree planting event.
  - Action 3.1.6: Host Staff Planting Days to plant trees on City facility grounds.

- Strategy 3.3: Establish a Brampton Million Trees Donation Program that accepts donations to support the City’s Brampton One Million Trees Program.

- Strategy 3.7: Establish a Green City Working Group that will be a collaborative, interdepartmental team that coordinates and facilitates city greening projects that support the Brampton One Million Trees Program and Brampton Eco Park Strategy.

In addition, incentives to encourage broader tree establishment on private residential, commercial and institutional lands that should be explored include:

- providing landowners (including developers, builders, etc.) with formal and public recognition for urban forest stewardship

- providing opportunities for recognition through the naming of parklands/open space, buildings/rooms, multi-use trails, and/or gardens

- supporting local NGOs and/or conservation authorities already involved in tree establishment to expand their tree planting education/services to residential, institutional, commercial and industrial lands

- providing subsidies, rebates or other incentives to landowners and businesses for tree establishment (and potentially other stewardship), and

- considering a stormwater charge as a dedicated mechanism for funding stormwater management-related expenses and an associated stormwater credit for maintaining tree canopy or a certain percentage of a site in permeable surface suitable for tree establishment (likely beyond the scope of the UFMP).

City of Brampton

Urban Forest Management Plan (2022-2032)

Strategic Framework

FINAL

Prepared by:

Urban Forest Innovations Inc.
Beacon Environmental Ltd.
A. Kennedy Consulting Ltd.

Contents

1 Introduction to the Strategic Framework

The Strategic Framework for the City of Brampton UFMP outlines:

- a long-term vision for Brampton's urban forest
- a mission statement and guiding principles for urban forest management
- strategic goals, objectives, and targets to be pursued during the planning horizon, and
- a framework for monitoring the urban forest and applying adaptive management principles to urban forest management in Brampton.

The Strategic Framework builds upon the opportunities for improvement, best practices, and emerging strategic directions identified in the Background Review and Analysis component of the UFMP, and also reflects the considerable input provided by both internal (City staff) and external (e.g., agencies, organizations, residents, etc.) stakeholders through Phase 1 of the UFMP engagement process (summarized in the Phase 1 Engagement Summary report).

The overall intent of the Strategic Framework is to establish the strategic foundation underlying the detailed action items outlined in the UFMP Implementation Plan. The success of the overall UFMP will be determined by the level at which the guiding principles articulated in the Strategic Framework inform urban forest planning and management throughout the planning horizon, and by the extent to which its strategic goals, objectives, and targets are realized through the implementation of the UFMP action items. Success of the UFMP will also require the commitment of new resources, including additional dedicated staff and funding, to support action item implementation.

1.1 Planning horizon

Brampton's Urban Forest Management Plan (UFMP) is based on a ten-year planning horizon (2022-2032). It must be recognized that significant and impactful change in the urban forest can take considerable time and effort to materialize, and desired outcomes may not be fully achievable within this relatively brief planning horizon. However, the UFMP will ensure that key plan components, including its vision, guiding principles, strategic goals, objectives, and targets, become firmly embedded in the urban forest policies, programs, and practices of the City of Brampton, its partners, and the community as a whole.

As described in Section 5 of the Strategic Framework and outlined in the UFMP Implementation Plan, the UFMP includes a built-in review and updating process, which is necessary to enable the process of adaptive management and to support a strategic approach to urban forest management beyond the UFMP's ten-year horizon.

1.2 Description of Strategic Framework components

The vision, guiding principles, strategic goals, objectives, and targets outlined in the Strategic Framework provide the strategic foundation for managing Brampton's urban forest, and establish what the City and its partners intend to achieve over the UFMP's ten-year horizon. These strategic plan elements are described below.

1.2.1 Vision

The UFMP vision is an aspirational statement that is intended to reflect the community's values and priorities for Brampton's urban forest. The purpose of the vision statement is to establish a shared and common understanding about the desired outcomes for the urban forest by the end of the UFMP planning horizon.

The UFMP vision will be realized through application of the guiding principles to both long-term planning and day-to-day operations; pursuit of the mission statement, strategic goals, objectives, and targets; implementation of recommended actions; and application of monitoring and adaptive management approaches. The UFMP will be considered successful if, when read in 2032, the UFMP vision statement accurately reflects the state of the urban forest at that time. The UFMP vision is established in Section 2.

1.2.2 Mission statement

The UFMP mission statement reflects the fundamental purpose of Brampton's urban forest management efforts; in other words – *why does the City of Brampton manage the urban forest?* It is intended to clearly communicate the purpose of and key approaches to urban forest management Brampton city staff, external partners, and members of the broader community. The mission statement is outlined in Section 3.

1.2.3 Guiding principles

Guiding principles are high-level statements that express the core values of the City of Brampton and its community members as they relate to the urban forest. The guiding principles are enduring statements to be held irrespective of changes in internal and external circumstances, management approaches, or resource availability. These principles have guided the development of all elements of the UFMP and are also intended to guide UFMP action item implementation the City and its partners in managing the urban forest throughout the planning horizon. UFMP guiding principles are established in Section 3.

1.2.4 Strategic goals

Strategic goals are broad statements that describe the general outcomes to be achieved within the UFMP's planning horizon in support of the plan's vision statement. The Strategic Framework outlines five strategic goals corresponding to the main urban forest management focus areas outlined in the Background Review and Analysis component of the UFMP (the urban forest resource, urban forest maintenance, growing the urban forest, planning and the urban forest, and engagement and partnerships). The UFMP strategic goals have been developed to align

with strategic guidance provided by other City of Brampton plans and programs. UFMP strategic goals are established in Section 4.1.

1.2.5 Objectives

Each of the five strategic goals for Brampton's urban forest is supported by multiple objectives, which will be pursued through the implementation of action items outlined in the UFMP Implementation Plan. Objectives are more detailed statements that describe the specific desired outcomes emerging from a strategic goal. UFMP objectives associated with each strategic goal are outlined in Section 4.1.

1.2.6 Targets

For the purposes of this UFMP, targets are defined as performance metrics that can be quantified (measured, ranked, or scored). Two sets of targets are established in the Strategic Framework, including performance indicator level/score targets based on the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, and Brampton-specific urban forest and performance targets. UFMP targets are established in Section 4.2.

1.2.7 Action items

Urban forest management action items (i.e., recommendations) are presented in the UFMP Implementation Plan. The UFMP Implementation Plan presents detailed and priority-ranked guidance for a wide range of actions to support adherence to the guiding principles and the realization of the strategic goals, objectives, and targets.

Defining urban forest sustainability

The core concept of sustainability is the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. However, there is no universally agreed-upon definition of sustainability, and there are many views on how sustainability can be defined or achieved.

Similarly, urban forest sustainability can mean different things to different people. For the purposes of the Brampton UFMP, urban forest sustainability will be achieved when *all* of the following conditions are met:

- The UFMP vision statement accurately reflects the status of Brampton's urban forest and its management when read in 2032
- UFMP guiding principles are reflected in all aspects of urban forest management, from long-term strategic planning, to policies and programs, to day-to-day maintenance operations
- UFMP strategic goals and objectives are realized, and their achievement can be verified through the various metrics and assessment methods established in the Strategic Framework and Implementation Plan

- UFMP targets are achieved, can be verified, and can be sustained through City policies, programs, practices, and resources.

It must be recognized that urban forest sustainability, as defined above, may not be fully realized within the ten-year horizon of this urban forest management plan. However, the UFMP is intended to serve as a roadmap to position the City of Brampton, its partners, and the community, on a clear trajectory towards achieving urban forest sustainability.

2 The vision for Brampton's urban forest

The vision for Brampton's urban forest, and the guiding vision statement for this Urban Forest Management Plan, is that in 2032:

The Urban Forest is a keystone component of a healthy, sustainable, equitable and resilient community. Our policies and infrastructure are designed to support and protect trees, forests, and healthy ecosystems in the urban environment. The City of Brampton recognizes the urban forest is essential to healthy neighbourhoods, clean air and water, and natural ecosystems, while creating opportunities for recreation, education, and a prosperous economy.

3 Mission statement and guiding principles

3.1 Mission

The City of Brampton's mission statement for urban forest management is:

The City of Brampton is committed to strategic and sustained investment in the urban forest as vital green infrastructure that plays a critical role in supporting public health and wellness, ecological integrity, meaningful connections, and a sense of place. We work with partners across our community to establish trees that will grow to maturity, manage forests proactively, and build a thriving canopy—now and for future generations.

3.2 Guiding principles

The following seven principles have guided the development of all other strategic components of this UFMP, and should inform the actions and decisions undertaken by the City of Brampton, its partners, and members of the community in managing the city's urban forest throughout the planning horizon and beyond.

- **Principle 1: Recognition as essential infrastructure**

Principle statement: The urban forest must be recognized across departments and throughout policies and practices as an essential municipal infrastructure asset, and should be considered as important to the health and livability of Brampton as other built infrastructure.

The valuable environmental, economic, and societal and health services provided by urban forests are well-known and supported by an extensive body of scientific and technical research,

and trees can also complement or enhance the services provided by conventional infrastructure. While significant resources are dedicated to the planning, construction, maintenance and replacement of conventional infrastructure, urban trees are still all-too-often considered expendable amenity features rather than essential elements of a livable community. City of Brampton policies and practices must evolve to recognize and support the urban forest's role as a relatively low-cost, renewable, highly functional and vital component of the city's infrastructure network – the city's "green infrastructure". All City departments should consider trees equally as important as other infrastructure assets in their project plans, strategic decisions, and day-to-day operations, with respect to both the integration of new trees and the protection of the existing urban forest.

- **Principle 2: Collaboration and engagement**

Principle statement: Realizing Brampton's vision for its urban forest will require the engaged participation of a diverse group of partners, working in collaboration to achieve shared goals and support each others' efforts.

While the City of Brampton owns and manages the highest-profile parts of the urban forest, such as street and park trees, other partners and community members also make decisions that affect the urban forest every day, both on public and private property. While some members of the community may have competing interests, most are likely to be supportive of the City's efforts to manage, protect and enhance Brampton's urban forest. While City urban forestry staff are experts in the management of trees, community members have their own unique skills, knowledge, experience, values, and resources to contribute, and should be embraced as partners in the management of the urban forest in its entirety.

In sharing responsibility for Brampton's urban forest, it is incumbent upon all partners to recognize both the positive and adverse implications their actions may have upon trees. Partners must work collaboratively and in a spirit of transparency and mutual respect to find innovative and practical solutions to the challenges of sustaining Brampton's urban forest, particularly in the context of a growing and increasingly urbanizing community.

- **Principle 3: Urban forestry is more than planting trees**

Principle statement: Sustainable urban forest management is much more than planting trees – it encompasses a wide range of actions by many different partners.

Tree planting is a significant urban forestry focus area for many communities, including Brampton, which has committed to planting one million trees by 2040. However, sustainable urban forest management encompasses much more than just tree establishment or maintenance. To succeed, urban forest managers must be proficient in multiple disciplines such as arboriculture, contract administration, information technology, land use planning, community engagement and education, among many others. They must also work together with other urban forest partners, who may occasionally have competing interests, to ensure a balanced and coordinated approach to achieving desired outcomes. The success of an urban forestry program must therefore not be judged by singular metrics, such as the number of trees planted

or the extent of canopy cover, but rather by the progress made towards realizing the vision, strategic goals and objectives set out in the UFMP. Urban forest management programs must also be sufficiently resourced to support the full range of necessary actions, including the increased levels of maintenance and monitoring that will be required as more trees are planted.

- **Principle 4: Preservation over replacement**

Principle statement: In most situations, preservation of existing trees is preferable to their removal and replacement or compensation.

The preservation of existing trees, especially mature trees, is essential to achieving a broad range of urban forest objectives and targets – every tree lost moves the community incrementally further away from benchmarks of urban forest sustainability. Furthermore, the challenges posed by urban growing conditions in both new communities and infill areas mean that significant effort is required to successfully establish new trees, and that many planted trees may never reach the same size and functional capacity of the existing mature trees they are intended to replace. As such, protection of existing mature trees in favour of removal and replacement (or compensation) should be the starting position for all public and private projects which may affect trees. The City should collaborate with land developers and other partners to explore feasible alternatives to tree removal on all projects, and should incentivise and otherwise encourage all community members to favour tree preservation over removal and replacement.

- **Principle 5: Equitable access**

Principle statement: All of Brampton's community members deserve equal opportunities to benefit from the full range of urban forest services.

The spatial distribution of Brampton's urban forest can never be equal across the entire city due to the many constraints imposed by geography, historic land use and development patterns. However, urban forest managers and partners must recognize that socioeconomic inequality often correlates with lower urban forest cover and reduced access to urban forest services, and they should strive to mitigate such inequalities through strategic planning, decision-making, and operational practices. Where possible, urban forest management efforts should aim to increase and improve tree condition, tree canopy cover, and urban forest function in under-served areas and among vulnerable communities, without unduly compromising levels of service in areas with a proportionately greater share of existing urban forest cover.

- **Principle 6: A diverse urban forest is a stronger urban forest**

Principle statement: Urban forest diversity comes in many forms. A diverse urban forest is more resilient to stressors and better able to provide important urban forest services.

Brampton's urban forest is susceptible to a wide range of biotic and abiotic stressors, such as invasive species, pests and diseases, and difficult urban growing conditions. Climate change will only further exacerbate these challenges. Increasing urban forest diversity will be an important approach to strengthening resilience against these and other stressors, spreading risk

and vulnerability among a more varied, and therefore less susceptible, tree population. Additionally, increasing urban forest diversity can also enhance the variety and value of the services provided by the urban forest to the community.

Natural system diversity comes in many forms, such as genetic, species, structural, or functional diversity. It also occurs on different spatial scales, ranging from individual parcels or streets to entire regions. Planning for the maintenance and enhancement of urban forest diversity of all forms and at all applicable scales is a key guiding principle of sustainable urban forest management.

- **Principle 7: Adaptive management and innovation**

Principle statement: Realizing Brampton's vision for its urban forest will require innovation, monitoring and, if necessary, changes to management approaches to better meet emerging needs and challenges.

The urban forest is a complex and dynamic system, and is affected by a wide range of influences, stressors, and opportunities. Strategies to manage the urban forest that work today may need to be significantly adapted, or new strategies may need to be developed and piloted, to meet future urban forest challenges, reflect changing needs or values, or take advantage of new opportunities. Urban forest managers must therefore remain informed about the strengths and vulnerabilities of the urban forest, management practices to successfully address a wide range of challenges, and opportunities to enhance urban forest resilience, functional capacity, and sustainability. They must also be willing to design and evaluate new approaches to urban forest management when necessary, and integrate these findings into long-term planning and daily operations.

4 Strategic goals, objectives, and targets of Brampton's UFMP

4.1 Strategic goals and objectives

Brampton's vision for its urban forest will be realized through the pursuit and achievement of the UFMP's five strategic goals, described in this section.

The strategic goals were developed to align with the five major urban forest management focus areas addressed in the Background Review and Analysis component of the UFMP, as shown in Table 1, below.

Table 1: UFMP focus areas and corresponding strategic goals.

Focus Area	Strategic goal
The urban forest resource	*Understand*
Urban forest maintenance	*Maintain*
Growing the urban forest	*Grow*
Planning and the urban forest	*Protect*
Engagement and partnerships	*Engage*

4.1.1 Strategic goal 1 – ***Understand***

Up-to-date knowledge and accurate and timely data are crucial to understanding the current status of the urban forest resource and its management, identifying and prioritizing needs and challenges, and designing and implementing effective management responses. This, in turn, requires designing and implementing programs, practices and systems to gather, manage, and use information about Brampton's urban forest resources and assets to make better management decisions and enhance the effectiveness of day-to-day urban forestry operations.

Through the implementation of the Urban Forest Management Plan, the City of Brampton and its urban forest partners will:

Develop a better understanding of all aspects of the urban forest and its management, and use this knowledge and data to make better management decisions that help achieve desired outcomes for the urban forest and the community.

The objectives associated with Strategic goal 1 – Understand are to:

- **1.a – Collect and maintain current data about Brampton's urban forest:** The City and its partners will ensure that urban forest management is informed by a comprehensive understanding of the condition, structure, function, opportunities, challenges, and other facets of the urban forest, and that this information is kept up-to-date, shared amongst partners, and useful for urban forest management and strategic planning.

- **1.b – Monitor Brampton's urban forest to track progress towards targets:** The City and its partners will monitor the urban forest at different scales to track progress towards performance targets established in the UFMP. Monitoring findings will inform day-to-day operations and long-term management decisions, and will be used to refine and optimize practices, targets, programs, and budgets through a process of active adaptive management.

4.1.2 Strategic goal 2 – ***Maintain***

The urban forest requires an ongoing and adequately resourced commitment to proactive tree and tree growing environment maintenance to improve tree health and structural condition, manage and reduce tree-related risk, and enhance urban forest functional capacity to provide environmental, economic, and societal and health services.

Through the implementation of the Urban Forest Management Plan, the City of Brampton and its urban forest partners will:

Improve the health, condition, longevity, and safety of trees in Brampton's urban forest, improving their functional capacity to provide the full range of urban forest services.

The objectives associated with Strategic goal 2 – Maintain are to:

- **2.a – Ensure adequate and sustained resourcing for all aspects of urban forest management**: The City and its partners will ensure that adequate resources are allocated to urban forest management programs to support the UFMP vision and actions, and that the divisions responsible for managing Brampton's urban forest can deliver the full range of urban forest management services in a sustained manner. Resources will be used efficiently and the benefits of urban forest maintenance will outweigh its costs.

- **2.b – Proactively manage and reduce tree-related risk:** The City will ensure that risk posed by publicly-owned trees is managed at a reasonable level while enabling the conservation of mature trees. Private tree owners will be encouraged to proactively manage and reduce tree-related risk.

- **2.c – Consistently apply best practices for urban forest maintenance:** The City and its partners will ensure that tree maintenance practices are undertaken in an efficient and effective manner throughout the complete life cycle of municipally-owned and

managed trees. Tree maintenance will be optimized towards enhancing the provision of urban forest services.

- **2.d – Improve Brampton's ability to respond to urban forest pests, diseases, and invasive species:** The City and its partners will be positioned to proactively and effectively address a wide range of existing and emergent biotic stressors that threaten trees, and to minimize adverse impacts upon the urban forest.

4.1.3 Strategic goal 3 – ***Grow***

Sustaining and enhancing the extent, quality, diversity, and functional capacity of the urban forest will require active efforts by the City of Brampton and its urban forest partners. Through the One Million Trees program, the City of Brampton has committed to fulfilling the Brampton 2040 Vision action of planting one million trees in the public and semi-public realms by the year 2040. Fulfilling this commitment in a way that meaningfully supports both the Brampton 2040 Vision and the vision of this UFMP will require more than planting 50,000 trees per year: the City and its partners will need to ensure that policies and practices are put in place to ensure that high-quality tree growing environments are designed and built, that the right trees are planted in the right place and for the right reasons, and that trees are adequately maintained until they are fully established.

Growing the urban forest is critical to replenishing leaf area and canopy cover lost through natural tree mortality, storm damage, pests and diseases, development, and other processes. Concerted effort must be made to ensure that young trees planted today, and those that will be planted in the future, are provided the conditions and care necessary to allow them to grow into large, healthy specimens that fulfill their genetic potential to provide valuable urban forest services.

Through the implementation of this Urban Forest Management Plan, the City of Brampton and its urban forest partners will support the City's commitment to the One Million Trees Program and:

Support the City's commitment to planting One Million Trees by 2040, expand the urban forest, strengthen its resilience against a wide range of stressors, and enhance its capacity to provide services to the community.

The objectives associated with Strategic goal 3 – Grow are to:

- **3.1 – Grow the urban forest with a focus on equity, function, and climate change adaptation:** The City and its partners will support Brampton's commitment to planting one million trees in Brampton by the year 2040, and will do so with a focus on ensuring equitable access to urban forest services for all members of the community. Where feasible, tree establishment will be strategically oriented to support both city-wide and site-specific targets for urban forest services in response to local needs and opportunities, and will contribute to the community's broader efforts to adapt to a changing climate.
- **3.2 – Provide all trees with adequate growing environments and effective post-planting care:** The City and its partners will work to ensure that all trees are planted in high-quality growing environments and that all newly planted trees are provided the necessary care to survive, establish, and thrive to maturity.
- **3.3 – Strengthen urban forest resilience through increased diversity:** The City and its partners will support urban forest diversity in various forms through their tree establishment plans and efforts. Building a more genetically, structurally, and functionally diverse tree population will strengthen the urban forest's resiliency against a wide range of stressors, including climate change. Native, non-invasive species will be established to provide wildlife food sources and habitat and to support local ecosystem health.

4.1.4 Strategic goal 4 – ***Protect***

Commercial and residential development are necessary to accommodate Brampton's projected population growth and to support a vibrant and healthy economy. However, the disturbance associated with development may injure or destroy existing trees and compromise growing environments for the future urban forest. As such, planning policies, standards, and guidelines, along with development review and implementation practices, must ensure that existing trees and their growing environments are effectively protected during all types of site disturbance. Wherever possible, protection of existing trees should be favoured over tree removal and replacement, and tree removal should be considered an option of last resort.

Through the implementation of the Urban Forest Management Plan, the City of Brampton and its urban forest partners will:

Protect existing trees and their growing environments against injury and destruction wherever possible through a coordinated and comprehensive approach to land use planning, development review, and tree protection.

The objectives associated with Strategic goal 4 – Protect are to:

- **4.a – Integrate the urban forest into planning policies and guidelines:** The City will ensure that all relevant higher-level strategies, plans, and guidelines recognize the value of trees and support planning decisions that protect and enhance the urban forest.

- **4.b – Enhance tree protection through improved planning practices:** The City will improve internal processes to strengthen planning application review, approval, and inspection practices to promote tree protection, and will work with landowners and the development community to encourage tree protection. Where tree protection cannot be fully accommodated, appropriate mitigation and compensation measures will be put in place to offset the adverse impacts of tree injury or removal.

4.1.5 Strategic goal 5 – ***Engage***

While the City of Brampton owns and manages the highest-profile parts of the urban forest, including trees along streets, in parks, and in many natural areas, much of the existing and future potential urban forest is found on private lands. These lands include commercial properties, institutions, and private residences of all types, and provide invaluable opportunities for enhancing and expanding Brampton's urban forest. Each individual parcel represents an opportunity to engage community members in managing and growing trees on their properties, and to build lasting and successful partnerships to realize the urban forest vision and achieve shared goals and objectives. With guidance, community members can also be effective partners in stewardship of the publicly owned portions of the urban forest traditionally managed by the City.

Through the implementation of the Urban Forest Management Plan, the City of Brampton and its urban forest partners will:

Encourage all members of the community to engage in urban forest stewardship on both public and private lands, and build strong urban forest partnerships to help realize the vision for Brampton's urban forest.

The objectives associated with Strategic goal 5 – Engage are to:

- **5.a – Promote community awareness of and engagement in the urban forest:** The City and its partners will work to increase the community's appreciation of the urban forest, awareness of tree-related regulations, best practices, and opportunities to engage in urban forest stewardship. Community members will be supported and encouraged to play an active role in the establishment and maintenance of trees on public and private lands across Brampton.

- **5.b – Enhance City staff and Council awareness of and engagement in the urban forest:** Urban forestry staff will enhance the profile of the urban forest among other City staff and Council by share regular updates about urban forest initiatives and community engagement, and will encourage staff and Council support for and participation in urban forest programs and initiatives.

- **5.c – Strengthen existing, and develop new, urban forestry partnerships:** The City and its partners will ensure that urban forest programs and activities are effectively coordinated and that partners' unique strengths and knowledge are leveraged to support and achieve the UFMP vision.

4.1.6 Summary of strategic goals and objectives

The UFMP strategic goals and associated objectives are summarized in Table 2, below.

Table 2: City of Brampton Urban Forest Management Plan strategic goals and objectives.

Strategic goal	Objectives
1. Understand	**1.a –** Collect and maintain current data about Brampton's urban forest
	1.b – Monitor Brampton's urban forest to track progress towards targets
2. Maintain	**2.a –** Ensure adequate and sustained resourcing for all aspects of urban forest management
	2.b – Proactively manage and reduce tree-related risk
	2.c – Consistently apply best practices for urban forest maintenance
	2.d – Improve Brampton's ability to respond to urban forest pests, diseases, and invasive species
3. Grow	**3.a –** Grow the urban forest with a focus on equity, function, and climate change adaptation
	3.b – Provide all trees with adequate growing environments and effective post-planting care
	3.c – Strengthen urban forest resilience through increased diversity
4. Protect	**4.a –** Integrate the urban forest into planning policies and guidelines
	4.b – Enhance tree protection through improved planning practices
5. Engage	**5.a –** Promote community awareness of and engagement in the urban forest
	5.b – Enhance City staff and Council awareness of and engagement in the urban forest
	5.c – Strengthen existing, and develop new, urban forestry partnerships

4.2 Targets

Through the implementation of the UFMP action items presented in the Implementation Plan, Brampton will pursue urban forest management performance targets based on the modified Vibrant Cities Lab Community Assessment and Goal-Setting Tool used to inform the urban forest current status assessment presented in the Background Review and Analysis component of the UFMP. This framework establishes performance targets, ranging from Fair to Optimal levels, for 28 different components of urban forest management. It must be recognized that some of the target performance levels may not be achieved within the UFMP's ten-year planning horizon, and improved performance levels should be pursued through future UFMP iterations and ongoing strategic and adaptive urban forest management.

Targets to be considered for establishment in the future are also presented in this section. These targets are not established in the current iteration of the UFMP due to a lack of adequate baseline condition data or the need to fulfill pre-requisite actions prior to target-setting.

4.2.1 Criteria-based performance targets

The Brampton Urban Forest Management Plan establishes urban forest management performance targets based on the Vibrant Cities Lab Community Assessment and Goal-Setting Tool and 28 associated criteria and performance targets. Brampton's overall target performance score for the UFMP planning horizon is 93 points, representing a 63-point performance gap between the existing performance score (30) and target performance levels (see Tables 3 and 4). Performance targets will be pursued through the application of the UFMP guiding principles and implementation of UFMP action items, and Brampton's trajectory towards achieving performance targets will be periodically assessed through the application of the UFMP monitoring and adaptive management framework (see Section 5).

Table 3: Current status and target level of urban forest management performance according to the Vibrant Cities Lab Community Assessment and Goal-Setting Tool, with score modification (see Criteria and Indicators assessment sections in the Background Review and Analysis component of the UFMP).

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
Brampton's Urban Forest / Understand	Canopy cover: no data, no action	Good (2)	The existing canopy is > 75%-100% of desired.	Good (2)	The existing canopy is > 75%-100% of desired.
	Inventory	Fair (1)	Complete or sample-based inventory of publicly owned trees.	Optimal (4)	Systematic comprehensive inventory system of entire urban forest -with information tailored to users and supported by mapping in municipality-wide GIS system. Provides for change analysis.
	Assessment methodology	Fair (1)	Low-resolution and/or point-based sampling of canopy cover using aerial photographs or satellite imagery, for example i-Tree Canopy.	Good (2)	Complete, detailed, and spatially explicit, high-resolution Urban Tree Canopy (UTC) assessment based on enhanced data (such as LIDAR) accompanied by comprehensive set of goals by land use and other parameters.
	Assessment of publicly-owned trees	Low (0)	No Information	Optimal (4)	Complete GIS tree inventory that includes detailed tree condition and risk ratings.
	Assessment of trees on private property	Good (2)	Bottom-up sample based assessment, as well as basic aerial view.	Optimal (4)	Bottom-up sample based assessment, as well as detailed UTC analysis of entire urban forest,

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
					including private property, integrated into municipality-wide [multi-agency] GIS system. LIDAR and hyper-spectral imaging most helpful.
	Relative performance index by species	Low (0)	No Information	N/A	RPI target cannot be set without adequate baseline condition data.
	Use of native vegetation	Fair (1)	Voluntary use of native species on publicly and privately owned lands: invasive species are recognized.	Good (2)	Use of native species is encouraged on a project-appropriate basis in all areas; invasive species are recognized and discouraged on public and private lands.
		7/28 (25%)	**Current performance versus optimal score**	**7/18 (39%), 11**	**Current performance versus target score, score gap**
Maintain	Assessment of publicly-owned natural areas	Fair (1)	Identified only in natural area survey.	Optimal (4)	Management plan focused on sustaining and, where possible, improving overall ecological structure and function while facilitating appropriate public use. Plan should consider impacts on contiguous natural areas [open space corridors] outside the community's borders.
	Align municipal departments	Good (2)	Informal teams among departments and agencies communicate regularly and collaborate on a project-specific basis.	Optimal (4)	Municipal policy implemented by formal interdepartmental/ interagency working teams on all municipal projects.
	All utilities work with municipality, employ best management practices	Good (2)	Utilities employ best management practices, recognize potential municipal conflicts, and reach out to urban forest managers on an ad hoc basis- and vice versa.	Optimal (4)	Utilities are included in informal municipal teams that communicate regularly and collaborate on a project-specific basis.
	Develop urban forest management plan	Low (0)	No urban forest management plan.	Optimal (4)	Assessment tool does not define Good and Optimal indicators. UFMP in development.

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
	Cooperative planning with other municipalities	Good (2)	Some urban forest planning and cooperation across municipalities and regional agencies.	Optimal (4)	Widespread regional cooperation resulting in development of regional urban forestry strategy.
	Forestry plan integrated into other municipal plans	-	N/A	Good (2)	Once completed, urban forestry planning team works with other agencies to align current and future objectives.
	Urban forestry program capacity (applies to in-house and contracted staff)	Good (2)	No descriptor assigned	Optimal (4)	Assessment tool does not define Good and Optimal indicators. However, enhancements to urban forestry program capacity are required.
	Municipality-wide urban forestry funding	Good (2)	Funding sufficient for some proactive management based on urban forest management plan.	Optimal (4)	Sustained, long-term funding from multiple municipal, regional and/or provincial agencies, along with private sources to implement a comprehensive urban forest management plan, and provide for maintenance and adaptive management as circumstances change.
	Management of publicly-owned natural areas	Fair (1)	Only reactive management to facilitate public use. E.g. hazard abatement. Trail maintenance.	Optimal (4)	Management plan for each publicly owned natural area focused on sustaining and, where possible, improving overall ecological integrity (i.e., structure and function -while facilitating appropriate public use.
	Monitoring	Fair (1)	Monitoring is infrequent and reactive to reported changes in tree health, site condition.	Good (2)	Monitoring on a regular basis with rotating schedule for each area. Monitors are professionals or volunteers trained to collect specific data required by municipality. Multi-year data available for trend analyses.
	Tree risk management	Fair (1)	Citizens and city staff report tree safety issues to the forestry department or manager (e.g. 3-1-1 system, online form, etc.). System	Optimal (4)	Includes “better” but with TRAQ-qualified contractors on city projects. Educate tree care companies and

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
			tracks the time between damage report and mitigation action.		public about importance of TRAQ qualifications.
	Urban wood and waste utilization	Fair (1)	While most green waste does not go to landfill, uses are limited to chips or mulch.	Optimal (4)	Comprehensive plan and processes in place to utilize all green waste one way or another, to the fullest extent possible.
		15/44 (34%)	**Current performance versus optimal score**	**15/44 (34%), 29**	**Current performance versus target score, score gap**
Grow	Environmental equity	Fair (1)	Planting and outreach includes attention to low canopy neighborhoods or areas.	Optimal (4)	Equitable planting and outreach at the neighborhood level is guided by strong resident involvement in low canopy/high need areas. Residents participate actively in identifying needs for their neighborhoods, planning. Implementation and monitoring.
	Growing site suitability	Fair (1)	Appropriate tree species are considered in site selection.	Optimal (4)	All trees planted in sites with adequate soil quality and quantity, and with sufficient growing space and overall site conditions to achieve their genetic potential and thus provide maximum ecosystem services. Where growing conditions are poor, guidance provided on how to improve soil volume, quality, other factors.
	Tree establishment and maintenance	Fair (1)	Limited planning and post-planting care. Planting takes place on plan-identified sites. None or only fragmentary planting and maintenance protocols.	Optimal (4)	Comprehensive tree establishment plan provides concrete guidance on most of the following criteria: site selection, size, age class, diversity of species, native plant choice; planting protocols [e.g. minimum soil volumes, soil conditions]; young tree care, including region appropriate irrigation requirements. Includes provisions and funding for maintenance.

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
		3/12 (25%)	**Current performance versus optimal score**	**3/12 (25%), 9**	**Current performance versus target score, score gap**
Protect	Policies that foster good urban forestry on private lands	Good (2)	Policies regarding stormwater, site and subdivision planning, zoning and other issues that affect private forests are included in management plan.	Optimal (4)	All relevant municipal policies require or incentivize adherence by private owners to standards incorporated in the plan. Incentives and sanctions applied when appropriate.
	Tree protection policy and enforcement	Fair (1)	Policies in place to protect public trees and employ industry best management practices, but rare or inconsistent enforcement.	Optimal (4)	Integrated municipality-wide policies and practices to protect public and private trees, consistently enforced and with penalties sufficient to deter violations.
		3/8 (38%)	**Current performance versus optimal score**	**3/8 (38%), 5**	**Current performance versus target score, score gap**
Engage	Engage residents in planning and implementation	Fair (1)	Some neighborhood groups engaged across the community but no/minimal outreach to assure underserved neighborhoods participate effectively.	Optimal (4)	Proactive outreach and coordination efforts by municipality and NGO partners resulting in widespread citizen involvement and structured engagement among diverse neighborhood groups.
	Trees acknowledged as vital community resource	Fair (1)	Trees generally recognized as important and beneficial.	Optimal (4)	Urban forest recognized as vital to the community's environmental, social, and economic well-being.
	Engage large private landowners and institutions	Low (0)	Large private landholders are generally uninformed about urban forest issues and opportunities.	Good (2)	Landowners develop tree management plans that advance municipal urban forest goals.
	Green industry embraces goals, high standards	Low (0)	Little or no cooperation among segments of green industry or awareness of municipality-wide urban forest goals and objectives.	Fair (1)	Some cooperation among green industry as well as general awareness and acceptance of municipality-wide goals and objectives.
		2/16 (13%)	**Current performance versus optimal score**	**2/11 (18%), 9**	**Current performance versus target score, score gap**

UFMP Strategic Goal	Criterion	Current Status		Target	
		Level (Score)	Descriptor	Level (Score)	Descriptor
		30/108 (28%)	Current performance versus optimal score, total	93 (86%), 63	Target score, score gap

Table 4: Summary of Brampton's current and target performance based on the modified Vibrant Cities Lab Community Assessment and Goal-Setting Tool. Solid dots denote current status; dashed dots denote target performance level. Where only a solid dot is present, current status meets target performance level.

	UFMP Goals and Criteria	TBD	Low (0)	Fair (1)	Good (2)	Optimal (4)
	Understand					
1	Canopy cover: no data, no action	-	-	-	●	-
2	Inventory	-	-	●	-	○
3	Assessment methodology	-	-	●	○	-
4	Assessment of publicly-owned trees	-	●	-	-	○
5	Assessment of trees on private property	-	-	-	●	○
6	Relative performance index by species	-	●	-	-	-
7	Use of native vegetation	-	-	●	○	-
	Maintain					
8	Assessment of publicly-owned natural areas	-	-	●	-	○
9	Align municipal departments	-	-	-	●	-
10	All utilities work with municipality, employ best management practices	-	-	-	●	○
11	Develop urban forest management plan	-	●	-	-	○
12	Cooperative planning with other municipalities	-	-	-	●	○
13	Forestry plan integrated into other municipal plans	●	-	-	-	○
14	Urban forestry program capacity (applies to in-house and contracted staff)	-	-	-	●	○
15	Municipality-wide urban forestry funding	-	-	-	●	○
16	Management of publicly-owned natural areas	-	-	●	-	○
17	Monitoring	-	-	●	○	-
18	Tree risk management	-	-	●	-	○
19	Urban wood and waste utilization	-	-	●	-	○
	Grow					
20	Environmental equity	-	-	●	-	○
21	Growing site suitability	-	-	●	-	○
22	Tree establishment and maintenance	-	-	●	-	○
	Protect					
23	Policies that foster good urban forestry on private lands	-	-	-	●	○
24	Tree protection policy and enforcement	-	-	●	-	○
	Engage					
25	Engage residents in planning and implementation	-	-	●	-	○
26	Trees acknowledged as vital community resource	-	-	●	-	○
27	Engage large private landowners and institutions	-	●	-	○	-
28	Green industry embraces goals, high standards	-	●	○	-	-

Figure 1: Summary of current urban forestry performance indicator ratings. Numbers denote total number of indicators within each performance level. Grey arrow denotes current performance score (30 of 108 points, 28%), green arrow denotes target performance score (93 of 108 points, 86%).

4.2.2 Establishing additional targets

As described in Sections 5.1.2 and 5.1.3, below, a wide range of urban forest metrics can inform the establishment of useful targets to orient urban forest management and track progress towards strategic goals and targets over time. However, establishing such targets requires that baseline conditions be known before targets are set, as urban forest management targets must be reasonable in scope and associated resource requirements. Examples of such targets may include urban forest canopy cover, tree health and condition, or urban forest diversity and function, among others. However, existing baseline data to support setting these and other metrics-based targets for Brampton are either incomplete, unavailable, or out-of-date. Therefore, this UFMP does not currently set urban forest targets beyond the criteria-based performance targets described in Section 4.2.1, above. Instead, UFMP actions support the monitoring of key urban forest metrics and the future establishment of targets on the basis of monitoring results and analyses, to be undertaken through the UFMP review process and the adaptive management framework.

5 Urban forest monitoring and adaptive management

Throughout the implementation of the UFMP, Brampton will monitor key urban forest metrics and the overall trajectory and success of its urban forest management program. In a process called adaptive management, the information gathered through urban forest monitoring will be used to inform, refine, and improve management approaches to ensure ongoing progress towards realizing the UFMP vision and achieving strategic goals, objectives, and targets.

5.1 Monitoring

5.1.1 Recommended monitoring metrics

In addition to periodic updating of the criteria-based performance assessment framework, the City should regularly monitor, at minimum, six metrics of urban forest health and management performance. These include:

- Urban tree canopy cover (UTC) – citywide
- Tree health and condition
- Tree species, genus and family diversity
- Tree age/size class distribution
- Tree establishment on public and private lands
- Community engagement

These metrics are described below.

- **Canopy cover – citywide:** Brampton's UFMP does not currently establish a citywide urban tree canopy (UTC) cover target or similar targets at other scales (e.g., ward, neighbourhood.) However, the City should monitor change in citywide canopy cover using a standardized and repeatable assessment methodology. Periodic canopy cover monitoring will help the City assess the relationship between enhanced tree establishment efforts (through the One Million Trees Program commitment) in relation to canopy cover change, reveal other citywide and localized drivers of canopy cover change, inform the establishment of future urban forest canopy targets, and determine necessary management directions and associated resource requirement projections.
- **Tree health and condition:** Basic tree health and condition metrics can be derived from tree inventory data (for public trees) and urban forest studies (e.g., i-Tree Eco) for trees on both public and private lands. Most commonly, tree health and condition metrics are expressed as qualitative assessments (e.g., poor, fair, good, excellent) of tree vitality and structure, but may also include quantitative (score, percentage, or rank-based) assessments of various health and condition factors, or observational data concerning tree pests and diseases. There is currently no known optimal distribution for tree health and condition

metrics; instead, an overarching goal of urban forest management is to improve overall urban forest health and condition. As such, the UFMP does not currently establish a target for tree health and condition. However, these metrics should be monitored to observe overall trends in the tree population, and management should be adjusted in response to findings and emerging priorities.

- **Tree species, genus, and family diversity:** Preliminary analysis of Brampton's currently incomplete street tree inventory suggests that tree species, genus and family diversity among this segment of the tree population are relatively low. For example, just three tree species appear to represent over 50% of the inventoried street tree population. These metrics for other segments of Brampton's urban forest (e.g., parks, private lands) are currently unknown due to an absence of available or up-to-date data. However, it is likely that tree diversity across Brampton's urban forest is relatively low overall, and that diversity metrics do not meet commonly cited targets for optimal urban forest population diversity (e.g., Santamour's '10-20-30' rule or the 'genus limit' rule). Detailed diversity targets to guide tree establishment planning cannot be established based on currently available urban forest data. Upon completion of recommended inventories and assessments, the City and its partners should establish targets for increasing tree species, genus, and family diversity among various segments of the urban forest population (e.g., streets, parks, private lands, woodlands, etc.) and across varying spatial scales (e.g., ward, neighbourhood, land use, etc.)

- **Size/age class distribution:** As described in the Background Review and Analysis report Section 1.4.4, tree size/age class distribution in Brampton's urban forest appears to be skewed towards younger and smaller trees. As with other metrics of urban forest diversity (e.g., species, genus, family, etc.), currently available data are not sufficiently current, granular, or available to establish meaningful targets for size/age class distribution at various scales. However, trends in size/age class distribution should be tracked over time, and increasing the relative proportion of mature and large-statured trees in Brampton should be a priority for urban forest management.

- **Tree establishment:** Through the One Million Trees Program, the City has committed to planting one million trees (or 50,000 trees per year) by 2040 with significant partner support. As directed in several UFMP Implementation Plan actions, the City should closely monitor annual tree establishment trends to determine whether the overall commitment is being met and to assess the relative contributions of the City and its partners to annual tree planting targets. These findings will be instrumental to shaping management, outreach, and engagement actions to encourage increased tree establishment by specific partners and to effectively direct resources to post-planting maintenance (e.g., monitoring, watering, mulching, weeding, etc.)

- **Community engagement:** As directed by action 3.1 of the One Million Trees Program, the City should track the number of overall participants in tree planting events across the city. Additional metrics can also be monitored to track the effectiveness of City and partner community engagement efforts, as described in Section 5.1.2, below.

5.1.2 Additional urban forest metrics

Monitoring other urban forest metrics though field-based assessments, desktop studies, and data analyses can reveal important trends that may influence the direction of urban forest management and inform future target-setting. Many urban forest metrics can be monitored with limited, if any, increases to existing program resources; useful data can be obtained through collation of metrics that should already be routinely collected as part of everyday programs and operations (e.g., permit and service requests), or with relatively small changes to procedures to collect the necessary data.

While the UFMP does not explicitly recommend baseline assessment or routine monitoring of the metrics described below, such efforts can reveal important trends that can be used to forecast future conditions, benchmark existing and establish new performance targets, and inform resource allocations and budget requests. Examples of such additional urban forest metrics for monitoring include, among others (note: metrics listed in bold text are described in detail, below):

- **Canopy cover (by land use or site-level)**
- **Relative Performance Index (RPI) and other tree performance metrics**
- Resident-initiated tree planting requests
- Storm response work orders
- Tree establishment success and post-planting growth rates
- **Tree Equity Score (TES)**
- Tree injury/removal permit applications
- Tree removals (by type: emergency, routine, development, private, etc.)
- Tree Tracker Tool tree planting self-reports
- Tree-related liability claims
- Tree-related social media engagement
- **Urban forest function/services**
- Urban forest inspection requests
- Urban forest product utilization
- Urban forest service requests requiring high-priority or significant response
- Whole-tree or tree part failures

- **Canopy cover – by land use:** In addition to a citywide target, canopy cover targets can be established according to land use (e.g., zoning) classification. Prior to establishing such targets in policy, the City will need to undertake an up-to-date analysis of existing canopy cover Potential Plantable Area (PPA) by land use. Establishing land use-specific canopy cover targets can provide significant benefits to the community by ensuring that opportunities to grow and protect the urban forest are optimized in closer proximity to community residents, where urban forest services are most important. However, determining locally appropriate canopy cover metrics for various zoning classifications may be resource-intensive and will require consultation and engagement with private property owners, including commercial landowners, institutions, the development community, and private residential homeowners, among others. Land use-based canopy cover targets must also

account for the willingness of these potential partners to contribute to growing the urban forest and to protect existing trees on their properties.

- **Canopy cover – site level:** Canopy cover targets can also be established on a site-level basis for individual land parcels, particularly through the development process (see box, "Best Practices – Land use and site-level canopy cover requirements" in Section 1.4.2 of the Background Review and Analysis report.) However, this approach requires considerable resources to identify appropriate site-specific canopy cover target levels, plan for their achievement over time, and monitor implementation.

- **Relative Performance Index (RPI) and other tree performance metrics:** Relative Performance Index (RPI) is an expression of the performance of a given tree species relative to the performance of all inventoried trees in the urban forest, represented by the following equation:

  RPI = (Percentage of trees in a single species in good condition) ÷ (Percentage of all trees in all species in good condition)

  An RPI greater than 1 indicates that trees of the subject species are, on average, in better condition than the overall urban forest population, while a score less than 1 indicates the inverse. RPI assessment of the urban forest inventory may inform tree species selection, and the Vibrant Cities Lab Community Assessment and Goal-Setting Tool established a range of performance targets based on tree RPI. Additional urban forest tree inventory data are required before RPI targets can be established for Brampton, and RPI is not currently considered a target of high priority or management utility.

  Other metrics of tree performance can also be derived from periodic updating and analysis of existing and recommended data sources (e.g., tree inventories) or additional data collection efforts (e.g., LiDAR, i-Tree Eco, ground-based surveys). Examples of detailed performance metrics include size variables (e.g., canopy width and height, live crown ratio, etc.) growth rate ratios, or leaf area/leaf area index (LAI), among others. Like the Relative Performance Index, baseline assessment and routine monitoring of these metrics is not currently considered a priority action for Brampton, but should be considered for implementation through the UFMP update process.

- **Tree Equity Score (TES):** American Forests, a United States-based non-profit conservation organization, recently published a tool and methodology for assessing a community's Tree Equity Score–the level of community access to urban forest services on a neighbourhood or parcel level. While this specific tool is not applicable for use in Canada, its underlying methodology can be applied to available Canadian urban forest and population data to replicate TES outputs and provide useful data for urban forest planning, target-setting, and impact analysis.

- **Urban forest function/services:** Because the urban forest is unevenly distributed across the city and community needs for urban forest services vary widely based upon existing conditions, establishing citywide targets for urban forest functions or the provision of urban

forest services is not feasible. Moreover, multiple other urban forest metrics and indicators of management performance function as proxies for urban forest function – a healthier, more expansive, and better-managed urban forest populated by larger trees will, by definition, provide more and wide-ranging services. However, urban forest performance targets can be established on a site- or project-specific basis, if specific urban forest functions are desired or targeted to be provided or increased. Existing tools, such as the Region of Peel Tree Planting Prioritization Tool (TPPT) and mapping, along with community and partner input, can also guide the identification, prioritization, and implementation of targeted urban forest functions and services, and inform the selection and siting of appropriate tree species to fulfill desired functions. Examples of urban forest function performance targets may include site shading (expressed as a percentage of shaded area or site-level canopy cover), stormwater retention (expressed through calculated stormwater retention metrics and yield curves), or carbon storage and/or sequestration, among many other quantifiable or qualitative targets. Such targets should be established on a site- or project-specific basis where appropriate.

5.1.3 Monitoring tools

Urban forest and urban forest management monitoring tools and methods may include, among others:

- **Benchmarking:** In the context of this UFMP, benchmarking involves evaluating the urban forest (physical asset) and its management against the goals, objectives, targets and actions established in the UFMP. Examples of urban forest benchmarking may include periodic re-assessment of urban forest canopy cover or tracking tree establishment rates, and comparing (benchmarking) these values against established targets. Brampton should periodically ‘check in’ on the overall status of UFMP actions relative to the implementation guidance outlined in the Implementation Plan component of the UFMP. This will allow managers to determine whether they are on track to achieve the goals and objectives supported by UFMP action items, and to assess whether changes in programs, policies or resources are required to achieve the UFMP vision

- **Situational awareness:** Urban forest managers should be vigilant and maintain continual awareness of situations and issues which may materially impact the urban forest. Examples may include development of large land parcels, changes in community values or resources, or the advent of new pests or diseases. Tools to maintain situational awareness are described throughout this section.

- **Urban forest inventories:** Detailed urban forest inventories, such as street and park tree attribute-based inventories or plot-based assessments, can reveal trends if data are kept up-to-date, accurate, and comparable over time. For example, an active and maintained tree inventory can be used to assess changes in tree condition, size class distribution, species diversity, and maintenance requirements. These findings can be benchmarked against management targets, and can be used to adjust management activities. Urban tree

inventories can also be open-sourced through web-hosted tree maps or other Public Participatory GIS (PPGIS) tools.

- **Studies and analyses:** A wide range of tools and technologies are available to support various urban forest analyses. Such tools include geospatial analysis (e.g., aerial photo interpretation to classify land cover, including urban tree canopy), plot-based surveys in permanent sampling plots (e.g., i-Tree Eco assessment), or LiDAR or hyperspectral imaging. To enhance the utility of these tools in urban forest monitoring, it is necessary to ensure that newly collected data are collected in formats and using methods that enable comparability with previously collected data, even if the newer methods are more accurate or otherwise improved.

- **Consultation:** The value of periodic stakeholder consultation as a monitoring tool should not be overlooked. Stakeholders, including community members, can provide valuable insight into the on-the-ground successes and shortcomings of urban forest management activities which may not be revealed through more technical and data-oriented monitoring measures, or through day-to-day municipal operations. As such, opportunities should be provided for stakeholder input on both an ongoing and periodic basis.

- **Performance indicators:** The Vibrant Cities Lab Community Assessment and Goal-Setting Tool is a useful adaptive management and urban forest monitoring tool. Brampton's status relative to performance indicators and targets should be reassessed on a periodic basis to track whether the urban forest and its management are trending in a favourable direction (i.e., from lower to higher-ranked indicator targets), and to identify if management focus, strategies or resources need to be adjusted.

5.2 Adaptive management

A comprehensive monitoring framework is essential to enable active adaptive management.

Active adaptive management is defined as:

"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 requires that a problem or issue be carefully assessed and understood before a strategy to solve it can be designed and implemented. The outcomes of the initial strategy are then monitored in a systematic manner, and any required adjustments are made based upon experience gained and new information collected. The adjusted approach is implemented and the evaluation cycle continues for as long as is necessary to accomplish the desired goals and/or to accommodate changing environmental, social or policy directions. This approach is directly applicable to urban forest management planning and implementation.

Adaptive management may result in adjustments to existing strategies or actions, such as changes to prioritization, resource requirements or other implementation guidance, or the development of entirely new goals, targets, and strategies.

Perhaps the most effective mechanism to facilitate this adaptive management process for urban forest management is to undertake regular and periodic Urban Forest Management Plan review. This process is built-in to the Brampton UFMP Implementation Plan and integrates the various monitoring approaches described above. Action items to support and implement urban forest and management monitoring, and to integrate monitoring findings into the adaptive management process, are primarily established under UFMP Strategic Goal 1 – Understand.

City of Brampton

Urban Forest Management Plan (2022-2032)

Implementation Plan

Final

Prepared by:

Urban Forest Innovations Inc.
Beacon Environmental Ltd.
A. Kennedy Consulting Ltd.

Contents

1 Introduction to the Implementation Plan

1.1 Implementation Plan structure

The Brampton UFMP Implementation Plan presents 36 recommended action items for implementation within the UFMP's ten-year planning horizon. Each action item is supported by detailed guidance which includes:

- **Priority category (Impact/Benefit, Effort/Cost):** Priority categorization (see Section 1.2) considers both the positive value or impact of an action and the effort and/or cost required for its successful implementation.
- **Lead(s) for implementation:** Identifies the organizational unit in the proposed expanded Urban Forestry section of Parks Maintenance and Forestry (see Action 2.1) or other City department, external agency, or other entity to be primarily responsible for implementation of the action. If more than one entity is identified, the action requires co-leadership.
- **Implementation partner(s):** Identifies internal (City) and/or external partners to be engaged in a supporting role in implementation of the action, or informed or consulted about its implementation.
- **Detailed implementation guidance:** Provides detailed guidance for implementation of the action.
- **Related OMTP actions:** Identifies actions established in the One Million Trees Program (OMTP) strategy (if applicable) which could support the implementation of the action by providing information, resources, enhanced processes, etc., or which would be supported by the implementation of the UFMP action.

1.2 Prioritizing actions

Actions are prioritized according to a four-quadrant matrix that considers both the positive impacts/benefits of an action and the effort and/or resources required for its successful implementation. Both impacts and costs are ranked qualitatively on a four-point scale, from 1 (Low) through 4 (Very High).

This approach categorizes actions into one of four possible groups, including:

1. **Top priorities and "Quick wins":** These actions represent high impact in return for relatively low effort or investment. Some of these actions can be considered "quick wins", as they can be implemented relatively quickly, build momentum to sustain progress towards achieving strategic goals and objectives, and build lasting support for urban forest management, and should be considered high priority initiatives. Others may take more time to implement, but can be achieved with relatively low complexity, effort, or resources.

2. **"Big moves":** These actions may require substantial changes to existing policies or practices—a shift from "business as usual", the allocation of considerable resources for additional staffing or contracted services, or coordinated involvement of existing staff from multiple divisions. In return for these sizeable efforts, "big move" actions will have significant and lasting positive impacts, and will place the City firmly on a path to realizing its vision for the urban forest and achieving the strategic goals and objectives articulated in the UFMP. Because of their positive impacts, "big moves" actions should be considered high-priority items. In some cases, however, their implementation may be protracted, or may need to be deferred until adequate resources are available, widespread organizational buy-in is secured, or prerequisite actions have been implemented.

3. **Moderate priorities:** These actions represent a relative balance between impact and effort, and should be pursued on a moderate priority basis. However, should opportunities arise to implement moderate priorities on an accelerated basis or in conjunction with higher-priority action items, they should be pursued to the fullest extent possible.

4. **Low priorities:** While important, these actions represent relatively low positive impact compared to the effort or resource expenditure required to implement them. It should be noted that no actions recommended in the City of Brampton Urban Forest Management Plan are classified as low priorities.

1.3 Implementation leads and partners

Generally considered the 'home' of urban forest management in Brampton, the Parks Maintenance and Forestry division of the Community Services Department is assigned as the lead division responsible for the implementation of most of the 36 actions recommended in this Urban Forest Management Plan. This assignment of lead responsibility to Parks Maintenance and Forestry recognizes the anticipated reduction in the near future of the considerable support for urban forest management and planning currently provided by the Environment and Development Engineering division, and envisions an expanded role and associated resources for Parks Maintenance and Forestry. It also anticipates ongoing interdepartmental support and collaboration facilitated by the Green City Working Group.

Parks Maintenance and Forestry will require the support of many other partners, including other City divisions, external groups and agencies, and members of the community, to successfully implement many of the recommendations outlined in the UFMP. Other partners may be less active in direct implementation support, but may need to be engaged in or consulted or informed about action implementation. Potential partners for action item implementation are outlined in Table 1, below and in the action items presented in Section 3.

Table 1: Potential implementation partners for the City of Brampton UFMP (based on City organizational chart presented in the 2022 Budget).

Brampton UFMP Action Implementation Partners	
City of Brampton	
Office of the Chief Administrative Officer (CAO)	*Planning, Building and Economic Development Department (PBED)*
Corporate Projects, Policy and Liaison	Building
Organizational Performance and Strategy	City Planning and Design
Community Services Department (CSD)	Development Services
Parks Maintenance and Forestry *(includes Parks Planning and Development)*	Economic Development
Corporate Support Services Department (CSS)	*Public Works and Engineering Department (PWE)*
Digital Innovation and IT	Building Design and Construction
Finance	Capital Works
Strategic Communications, Culture and Events	Environment and Development Engineering
Legislative Services Department (LS)	Road Maintenance, Operations and Fleet
Enforcement and By-law Services	*Green City Working Group* *(includes various internal divisions)*
Insurance and Risk Management	
Legal Services	
External partners	
Building Industry and Land Development Association (BILD)	Residents and community members
Conservation Authorities (CVC, TRCA)	School boards (Peel District / Dufferin-Peel Catholic)
First Nations	Other external partners (as identified)
Peel Region (incl. Peel Urban Forest Working Group)	

2 UFMP Implementation Plan

2.1 Summary of actions

2.1.1 Actions by strategic goal

Table 2: Summary of 36 Brampton Urban Forest Management Plan recommended actions, organized by strategic goal.

Goal	No.	Action	Page
1. Understand	1.1	Collect and maintain an inventory of City-owned trees and potential tree planting sites	9
	1.2	Collect an inventory of high-priority trees on private lands	10
	1.3	Undertake an urban forest canopy and structure study	11
	1.4	Undertake an urban forest climate change vulnerability assessment	12
	1.5	Monitor and report on progress towards urban forest targets	13
	1.6	Review and update the Urban Forest Management Plan every five years	14
2. Maintain	2.1	Update and expand the Urban Forestry section to support implementation of the UFMP	15
	2.2	Include urban forest data in the City's Corporate Asset Management Plan and systems	18
	2.3	Develop an urban forestry operations Levels of Service manual	19
	2.4	Develop a tree risk management policy	20
	2.5	Enhance tree risk management capabilities and practices	21
	2.6	Continue and enhance existing tree maintenance programs and practices	22
	2.7	Implement a young tree structural pruning program	23
	2.8	Develop an urban forest pest, disease, and invasive species strategy and priority response plans	24
	2.9	Enhance urban forest pest, disease, and invasive species management	26
3. Grow	3.1	Identify and prioritize tree establishment areas based on equity, services, and climate change adaptation	27
	3.2	Plant more trees in parks and open spaces where they will not conflict with formalized park uses	29
	3.3	Update and consolidate tree establishment policies and guidelines	30
	3.4	Undertake tree performance trials to diversify the urban forest and identify climate-ready trees	32
	3.5	Enhance all aspects of tree establishment for both City- and developer-planted trees	33
	3.6	Expand community involvement in tree planting and care on public lands	35

2.1.2 Actions by priority

2.1.3

Table 3: Summary of 36 Brampton Urban Forest Management Plan recommended actions, organized by priority in descending order.

Priority category	No.	Action	Page
Top Priorities / Quick Wins	1.5	Monitor and report on progress towards urban forest targets	53
	1.6	Review and update the Urban Forest Management Plan every five years	54
	2.2	Include urban forest data in the City's Corporate Asset Management Plan and systems	53
	2.4	Develop a tree risk management policy	54
	2.7	Implement a young tree structural pruning program	53
	2.8	Develop an urban forest pest, disease, and invasive species strategy and priority response plans	54
	3.1	Identify and prioritize areas for tree establishment based on equity, function, and climate change adaptation considerations	53
	4.2	Update the Official Plan with policies specific to the urban forest	54
	4.3	Review and update tree by-laws every five years	53
	5.7	Expand the Residential Tree Program in partnership with others	54
	5.8	Enhance urban forest information sharing and cooperation across City departments	53
Big Moves	1.1	Collect and maintain an inventory of City-owned trees and potential tree planting sites	54
	1.3	Undertake an urban forest canopy and structure study	53
	2.1	Update and expand the City's Urban Forestry section to support the implementation of the UFMP	54
	2.5	Enhance tree risk management capabilities and practices	53
	2.6	Continue and enhance existing tree maintenance programs and practices	54
	2.9	Enhance urban forest pest, disease, and invasive species management	53
	3.3	Update and consolidate tree establishment policies and guidelines	54
	3.5	Enhance all aspects of tree establishment for both City- and developer-planted trees	53
	3.6	Expand community involvement in tree planting and care on public lands	54
	4.4	Increase the City's capacity to ensure that tree protection and planting plans are implemented properly on development sites	53
	5.1	Develop and implement an Urban Forest Awareness and Engagement Program	54

Priority category	No.	Action	Page
Moderate Priorities	1.2	Collect an inventory of high-priority trees on private lands	53
	1.4	Undertake an urban forest climate change vulnerability assessment	54
	2.3	Develop an urban forestry operations Levels of Service manual	53
	3.2	Plant more trees in parks and open spaces where they will not conflict with formalized park uses	54
	3.4	Undertake tree performance trials to diversify the urban forest and identify climate-ready trees	53
	4.1	Integrate urban forest values and objectives in all relevant City strategies, plans, and guidelines	54
	4.5	Develop and apply standards for City-owned woodland management	53
	5.2	Facilitate urban forest community-based science	54
	5.3	Enhance urban forest online and social media content	53
	5.4	Develop an urban forest products and foods utilization program	54
	5.5	Encourage and recognize urban forest stewardship	53
	5.6	Develop partnerships for tree establishment and urban forest stewardship on institutional and corporate lands	54
	5.9	Partner with institutions, agencies, and organizations in urban forest research	53
	5.10	Identify and pursue innovative urban forestry resourcing opportunities from external sources	54
Low Priorities	-	-	

2.1.4 UFMP action priority matrix

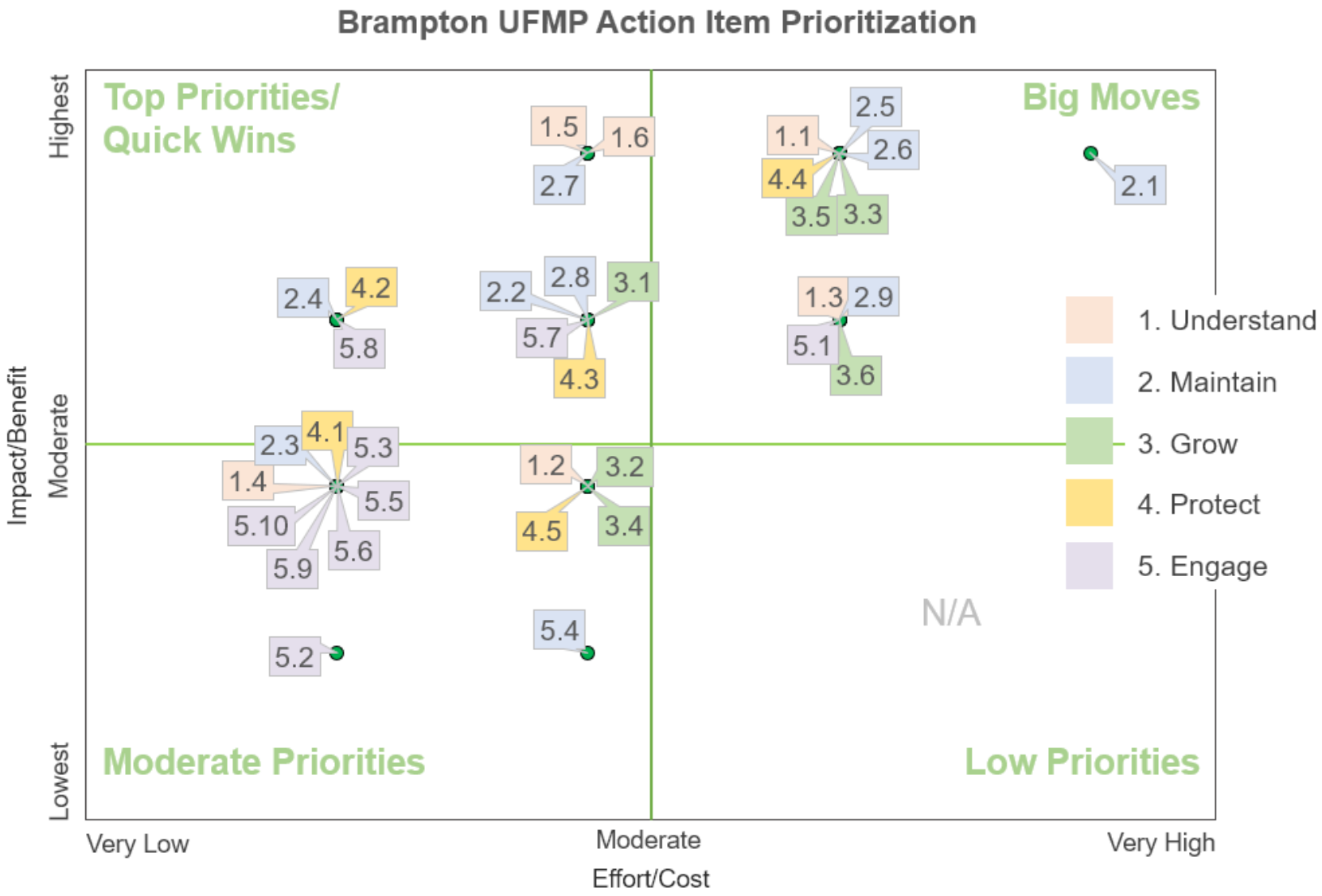


Figure 1: City of Brampton Urban Forest Management Plan (UFMP) action priority matrix, categorizing UFMP actions according to relative impact/benefit and effort/cost qualitatively ranked from Low to Very High.

2.2 Detailed action implementation guidance

2.2.1 Actions for strategic goal 1 – Understand

Action 1.1: Collect and maintain an inventory of City-owned trees and potential tree planting sites	
Priority category (Impact, Effort)	Big Moves (Very High, High)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	• Parks Planning and Development • Digital Innovation and IT (CSS) • Finance (CSS)

Guidance	**Collect**
	• Complete ongoing collection of street tree inventory on a high priority basis (completion fall 2023).
	• Collect inventory of trees in actively managed park areas (e.g., parking lots, mowed open areas, playgrounds, forest edges near active-use areas, etc.) and on City facility grounds.
	• Expand inventory to include potential tree planting sites in rights-of-way and actively-managed park areas.
	  ○ Classify sites according to established methodology (e.g., Rapid Urban Site Index or Brampton-specific attributes) to facilitate tree establishment planning.
	• Enhance management utility of inventory through collection of additional attributes including: tree risk ratings, maintenance recommendations and priority, pest/disease identification, and infrastructure conflicts, for all trees.
	  ○ This will necessitate modification to existing inventory database structure, but does not require re-collection of data for trees already inventoried.
	• Tender a contract to ensure timely completion of inventory data collection.
	
	Maintain
	• Establish processes to maintain up to date tree inventory data.
	  ○ Recommended detailed inventory update cycle of max. 7 years (street trees) and 10 years (other trees); shorter cycles are preferred.
	  ○ Update basic tree inventory attributes (dbh, condition) when trees are inspected or maintained in response to service requests or as part of routine maintenance cycle.
	  ○ Ensure that enhanced inventory attributes (see above) are collected for all trees with inventory updates.
	• Ensure trees planted through operations, capital projects, and development are integrated with the tree inventory in a timely manner and with full inventory attributes.
	  ○ Require capital projects and developers to submit ‘as-built’ tree inventory in format compatible with the tree inventory database (see Action 21) shortly after planting.

Related OMTP action(s)	*N/A*

Action 1.2: Collect an inventory of high-priority trees on private lands	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Moderate)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	Residents and community members
Guidance	• Trees to include priority species in the context of pest and disease management rapid response (e.g., American elm, red and other native oaks, black walnut). • To be conducted from public right-of-way without requiring access to private properties. • Include basic attributes (e.g., species, location, estimated dbh/size, condition). • Use inventory to guide outreach to tree owners in the event of advent of priority pest or disease in proximity to Brampton.
Related OMTP action(s)	*N/A*

Action 1.3: Undertake an urban forest canopy and structure study	
Priority category (Impact, Effort)	Big Moves (High, High)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	• Environment and Development Engineering (PWE) • Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • Residents and community members • Other: Academic institutions

Guidance	• Work in partnership with Peel Urban Forest Working Group (PUFWG) to undertake comprehensive urban forest study (geospatial and field-based) to update existing and inform new urban forest structure and function analyses.
	• Urban forest study results will inform the establishment of relevant urban forest targets and track progress towards the targets established in the UFMP.
	
	Geospatial analysis
	• Undertake high-quality geospatial assessment to map existing Urban Tree Cover (UTC), Potential Plantable Area (PPA) and Potential Plantable Spaces (PPS) across the city, and report at various spatial scales (e.g., land use, ward, neighbourhood, etc.)
	  ○ Requires current, 1 metre resolution leaf-on aerial imagery, preferably collected in year of study commencement. LiDAR data significantly increases quality of the analysis.
	  ○ Determine maximum PPA/PCC (%, ha) by identifying existing urban forest canopy, non-forest vegetation suitable for planting, vegetated areas unsuitable for planting (e.g., active sports fields, agricultural lands, etc.), and other non-vegetated, non-plantable land uses.
	
	Field-based urban forest study
	• Use i-Tree Eco data collection and analysis tools and protocols.
	• Collect a minimum of 200 (preferably 400) 0.1-acre (404 m^2) plots in accordance with i-Tree Eco field data collection methodology.
	  ○ Pre-stratify plot locations by simplified land use category or in accordance with current i-Tree guidance.
	  ○ Field data collection will require access to private properties.
	  ○ Minimum of 2 data collectors required for sampling a plot.
	  ○ Where possible (and with validation of study design by USDA or other experts), collect data in previously-sampled plots to establish a network of permanent sample plots to track change in urban forest structure/function over time.
	• Private property owners should be contacted well in advance of data collection via return post and requested to sign-off on allowing access to property by data collectors.

Related OMTP action(s)	*N/A*

Action 1.4: Undertake an urban forest climate change vulnerability assessment	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	• Academic institutions • Conservation Authorities (CVC, TRCA) • Peel Climate Change Partnership
Guidance	• When completed, use tree inventories and other urban forest assessment data and available climate data and models to conduct climate change vulnerability assessment (CCVA) to assess exposure, sensitivity and adaptive capacity of Brampton's urban forest to projected climate change effects. • Assess tree and treed natural areas vulnerabilities to various bioclimatic variables, such as temperature and growing season change, drought tolerance/moisture use, ice storm vulnerability, air pollution, humidity, etc., including potential climate change influence upon of significant urban forest pests, diseases, and invasive species population and distribution. • Identify areas susceptible to increased heat island effects. • CCVA should identify and prioritize adaptive strategies based upon identified vulnerabilities and adaptive capacities. • Seek and identify opportunities for partnership on CCVA methodology with TRCA, Peel Region, educational institutions, and other partners. • Refer to Town of Ajax Vulnerability Assessment for Natural Capita project (2018), and Ordóñez and Duinker (2015), as examples.
Related OMTP action(s)	*N/A*

Action 1.5: Monitor and report on progress towards urban forest targets	
Priority category (Impact, Effort)	Top Priorities (Very High, Moderate)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	• Environment and Development Engineering (PWE) • Multiple external partners (see guidance, below)

Guidance	• Undertake monitoring of recommended metrics using tools and methods described in Section 5.1.3 of UFMP Strategic Framework.
	  ○ Urban tree canopy (UTC) – citywide (see Action 3)
	  ○ Tree health and condition
	  ○ Tree diversity (species, genus, family)
	  ○ Age/size class
	  ○ Tree establishment
	  ○ Community engagement
	• For tree establishment monitoring:
	  ○ Pursue OMTP Action 4.1.2 to develop protocol and process to track (and validate) number, location, size, type, species, and other attributes of trees planted through City operations, tree removal compensation, planning applications (e.g., subdivision, Site Plan), capital projects, naturalization, community events, and private land planting.
	  ○ Encourage Conservation Authorities, development community, school boards, public, and others to use of existing Tree Tracker tool.
	  ○ Require developer submission of 'as-built' tree inventory data (subject to inspection and verification).
	  ○ Ensure all new City plantings are added to tree inventory.
	  ○ Regularly benchmark against 50,000 trees/year OMTP commitment.
	• As additional urban forest data become available through recommended studies and enhanced practices, assess feasibility of expanded monitoring efforts based on list of additional urban forest metrics, or others as appropriate.
	• In conjunction with UFMP review and update (see Action 6), review status of criteria-based performance indicators (Vibrant Cities Lab tool) relative to UFMP-established target levels.
	• Develop annual 'State of the Urban Forest' reports for Council, internal, and public use. Report on preceding year's urban forest management initiatives and actions, key monitoring metrics, observed and forecast trends, and near-term management priorities and resource requirements.

Related OMTP action(s)	Actions 3.1, 3.4, 4.1.2

Action 1.6: Review and update the Urban Forest Management Plan every five years	
Priority category (Impact, Effort)	Top Priorities (Very High, Moderate)
Lead(s)	Urban Forestry section – multiple units
Partner(s)	N/A

Guidance	• Every five years, undertake UFMP review and updating, including:
	  ○ Completion or compilation of any recent and relevant urban forest assessments or studies (e.g., inventory, i-Tree, etc.)
	  ○ Compilation and analysis of monitoring findings.
	  ○ Undertaking scoped internal, external, and public consultations to assess changes to existing, or emerging, threats/challenges, values, needs, priorities, opportunities, perceptions, and changes to existing urban forest management approaches and policies.
	  ○ Re-assessment of criteria-based performance indicators relative to UFMP-established target levels.
	  ○ Establishment of new performance targets, if appropriate.
	  ○ Assessment of changes to policies, regulations, legislation, practices, and programs relevant to the urban forest.
	  ○ Assessment of successes, shortcomings, and barriers to implementation of UFMP actions, and tracking of progress towards action implementation or completion.
	  ○ If necessary, re-prioritization of existing UFMP actions and development of new actions.
	  ○ Development of updated UFMP report and delivery of a UFMP review report to Council.

Related OMTP action(s)	Action 4.5

2.2.2 Actions for strategic goal 2 – Maintain

Action 2.1: Update and expand the Urban Forestry section to support implementation of the UFMP	
Priority category (Impact, Effort)	Big Moves (Very High, Very High)
Lead(s)	Parks Maintenance and Forestry – Urban Forestry section
Partner(s)	• Environment and Development Engineering (PWE) • Organizational Performance and Strategy (CAO)

Guidance	• Build capacity and consolidate all urban forestry maintenance operations and planning and strategic initiatives under a dedicated Urban Forestry Division, separate from Parks Maintenance, under the Community Services Department.
	• Optimal divisional organizational chart is shown in Figure 2, below.
	• Recommended work units and groups are described below.
	
	Urban Forestry – Operations
	• Responsible for the implementation of urban forest maintenance operations, including tree inspection, pruning, removal, planting and post-planting maintenance (operations-based), pest and disease management (Integrated Pest Management/IPM), urban forest monitoring and data analysis, and contract administration for contracted maintenance operations.
	• Work groups include Urban Forest Maintenance and Urban Forest Health.
	• In Urban Forest Maintenance, work units include:
	  ○ Tree inspection: Staff responsible for tree service request initial inspection, tree risk assessment, and work order development and prioritization.
	  ○ Maintenance operations: Staff arborists for implementation of non-contracted tree maintenance operations (tree pruning and removal, etc.)
	  ○ Contract administration: Staff responsible for the administration of tree maintenance and tree establishment contracts, including contract writing and oversight (field inspection).
	• In Urban Forest Health, work units include:
	  ○ Integrated Pest Management (IPM): Staff responsible for urban forest pest, disease, and invasive species (flora and fauna) management, including monitoring, inspection, and treatment/control, and management of IPM contracts on an as-needed basis.
	  ○ Monitoring and Analysis: Staff responsible for tree inventory management, monitoring UFMP-recommended and other urban forestry metrics, development of mapping and other supporting materials for other work units, and ‘State of the Urban Forest’ reporting (see Action 5).
	Urban Forestry – Planning
	• Responsible for the review and enforcement of tree-related components of planning and permit applications (in coordination with other City divisions) tree by-law permit application review, strategic initiatives, and community and partner engagement.

	• Work groups include Tree Protection and Plan Review, Strategic Initiatives, and Outreach and Engagement.
	• In Tree Protection and Plan Review, work units include:
	  ○ Plan and Permit Review: Staff responsible for review of tree-related components of *Planning Act, Building Code Act*, zoning by-law, and other relevant applications in coordination with other City divisions; and for review of tree by-law permit applications.
	  ○ Compliance Inspection and Enforcement: Staff responsible for undertaking site inspection to ensure compliance with approved plans and permits, and to enforce relevant legislation and regulations, including tree by-laws.
	• In Strategic Initiatives, work units include:
	  ○ OMTP/UFMP: Staff responsible for ensuring the ongoing implementation of the One Million Trees Program and the Urban Forest Management Plan, including direct implementation and coordination with other work units, as required.
	  ○ Natural Areas Management: Staff responsible for the inspection of natural areas, review and implementation oversight of approved Woodlot Management Plans, scoped management, maintenance of the Brampton Natural Areas Inventory (BNAI) and related coordination with CVC/TRCA, and natural areas management contract administration.
	  ○ Capital Projects and Landscape Architecture: Staff responsible for design, planning and review of tree-related components of City capital projects, associated site inspection and implementation support, plan and permit review support (as required,) and review/updating of tree-related components of City guidelines, standards, specifications, strategies, etc.
	• The Outreach and Engagement work unit coordinates all outreach to and engagement with external urban forestry partners and the community, in conjunction with other Urban Forestry work units if necessary to support specific projects or initiatives.
	
	Administration
	• To provide clerical and administrative support to Urban Forestry division, including facilitating liaison with other City divisions.
	
	Resourcing for urban forest management
	• Until September 2022, continue to use Density Bonusing to secure green space or park development infrastructure, including trees and tree growing environments, wherever possible.
	• Ensure that urban forest infrastructure (e.g., trees and tree growing environments) are included in forthcoming Community Benefits Charges strategy and by-law to the fullest extent possible.
	• Undertake comprehensive analysis of the Tree Canopy Account (Reserve Fund #18) and forecast future growth and available resources. Direct resources to support UFMP actions where possible, ensuring that City standard reserve fund management practices are implemented.
	• Once established, operate Tree Protection and Plan Review work unit (and others, where feasible) on a cost recovery model, including recovering fees of plan review, site inspection, etc. wherever possible.

Related OMTP action(s)	*N/A*

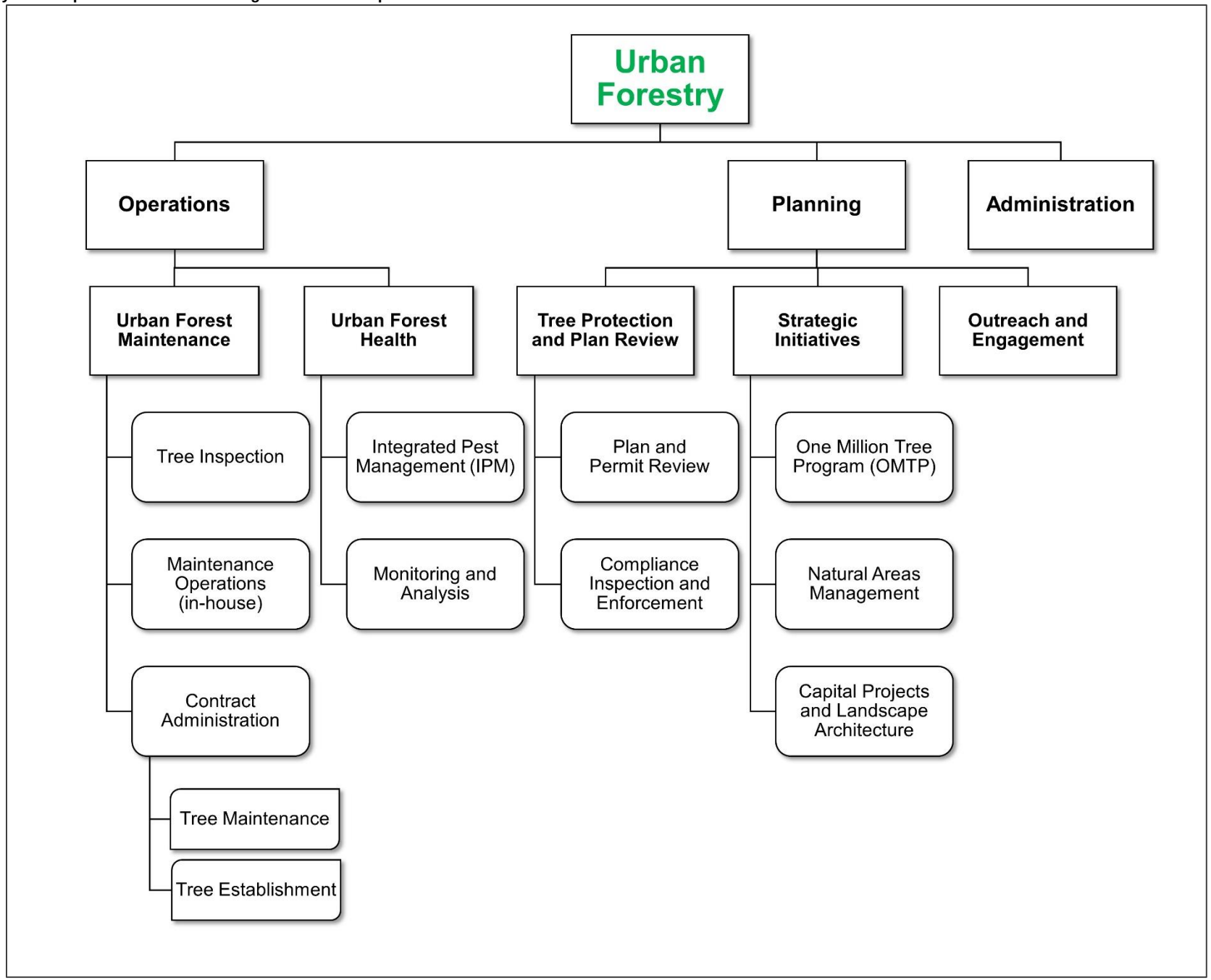


Figure 2: Recommended organizational chart for the proposed Urban Forestry section within the City of Brampton Community Services Department.

Action 2.2: Include urban forest data in the City's Corporate Asset Management Plan and systems	
Priority category (Impact, Effort)	Top Priorities (High, Moderate)
Lead(s)	Urban Forestry section – Monitoring and Analysis unit
Partner(s)	• Digital Innovation and IT (CSS) • Finance (CSS)
Guidance	**Asset management systems** • Expedite existing efforts to integrate tree inventory, including new data and ongoing updates, into Cityworks enterprise asset management and computerised maintenance management (EAM/CMM) systems. • Ensure basic tree data (e.g., location, size, tree protection zone radius) are accessible to other City divisions to facilitate service delivery (e.g., capital project planning). • Integrate existing Service Request and Work Order management with tree inventory data within EAM/CMM systems. • Ensure ability for service request entry, work order generation, near real-time (in-field and/or in-office) inventory updating. • Ensure information technology hardware compatibility and interoperability with asset management system and broader City IT framework. • Investigate feasibility of integrating inventoried trees, their prescribed Tree Protection Zone dimensions, and other related elements (e.g., soil cells, irrigation, etc.) with the OneCall utility information system to facilitate project planning and reduce injury. **Asset management plan** • Integrate urban forest assets with City asset management plans (AMP) in accordance with O.Reg. 588/17, which requires that non-core assets be included in AMPs by July 1, 2023. • Integrate measurable UFMP targets into AMP as key performance indicators. • When completed, analyse tree inventories and urban forest assessments (see Actions 1 through 3) to determine urban forest replacement/asset value and functional/service values to conduct an urban forest management benefit/cost ratio analysis to demonstrate positive value of sustained and enhanced urban forest management. • Periodically re-evaluate benefits/cost analysis, and report on 'state of the infrastructure' (urban forest assets); at minimum in alignment with asset management plan review/update cycles.
Related OMTP action(s)	*N/A*

Action 2.3: Develop an urban forestry operations Levels of Service manual	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Maintenance Operations unit
Partner(s)	N/A

Guidance	• Define Levels of Service (LoS) for common urban forest maintenance operations in a division policy or operations manual.
	• Operations to be considered may include, among others:
	  ○ Tree inspection/service request management
	  ○ Block/cyclical pruning (street and park trees)
	  ○ Request-based pruning
	  ○ Tree removal and stump grinding/treatment
	  ○ Request-based and routine (re-)planting
	  ○ Post-planting maintenance (monitoring, stake management, watering, mulching, weeding, etc.)
	  ○ Fertilization
	  ○ Integrated Pest Management (IPM)
	• Approved LoS of Service should be published on City urban forestry webpage to promote public awareness about expected service levels.
	• Refer to Brampton Corporate Asset Management Plan Section 4. Desired Levels of Service and Brampton Road and Traffic Levels of Service web portal for guidance on establishing and communicating LoS.

Related OMTP action(s)	*N/A*

Action 2.4: Develop a tree risk management policy	
Priority category (Impact, Effort)	Top Priorities (High, Low)
Lead(s)	Urban Forestry section – Maintenance Operations and Tree Inspection units
Partner(s)	Insurance and Risk Management (LS)
Guidance	• Develop Tree Risk Management Policy to frame the scope of tree risk management by outlining responsibilities, goals, and a standard of care statement; set thresholds for acceptable and unacceptable levels of risk for segments of the tree population; establish minimum training and qualifications of tree risk assessors and managers (in-house and contractors); set frequency of assessments for trees of different categories; review acceptable management options to mitigate risk in varying situations; establish record-keeping protocols for risk assessments and management actions; establish evidence retention protocols in the event of tree failure (with adverse consequences); identify funding and partnerships; and set program performance assessment and monitoring protocols. • Policy should formalize existing tree risk management programs and procedures, with appropriate revisions. • Should require application of current industry standards and best practices, including ANSI A300 Part 9 standard/ISA Best Management Practices (as revised) to tree risk assessment and management activities by staff and contractors. • Should explore options beyond tree removal to mitigate risk while retaining mature trees wherever feasible. • Coordinate with Integrated Risk Management section to develop policy and review liability implications of different approaches.
Related OMTP action(s)	*N/A*

Action 2.5: Enhance tree risk management capabilities and practices	
Priority category (Impact, Effort)	Big Moves (Very High, High)
Lead(s)	Urban Forestry section – Tree Inspection unit
Partner(s)	N/A
Guidance	**Capabilities** • Support PMF arboricultural staff and supervisors in obtaining tree risk assessment training and industry qualification (i.e., ISA Tree Risk Assessment Qualification/TRAQ). • Require that all tree inventory contractors, and all tree maintenance contract crew supervisors, maintain valid ISA Tree Risk Assessment Qualification (TRAQ) or functional equivalent and are competent in tree risk assessment methodology used in Brampton tree inventory (see Action 1). **Practices** • Undertake annual (Level 1 – Limited Visual) 'windshield survey' of street tree and actively-managed park tree population, and trees within tip-out distance of sanctioned higher-use trails in natural areas, to identify highest-priority observable tree risk issues, with appropriate protocols for follow-up (Level 2 – Basic) inspection and action. • Develop tree risk assessment priority zones based upon tree inventory characteristics (e.g., largest/oldest trees; higher density of species with known higher risk potential based on structural characteristics, high occupancy rates or target value, etc.). • Undertake periodic visual (Level 2 – Basic) tree risk assessment of larger and older trees at a higher frequency than under current inventory/inspection cycle (interval to be determined on as-needed basis for individual trees). • Undertake Level 3 – Advanced assessments as required/informed by Level 2 assessments and tree inventory, and for high-value trees or complex tree risk assessment cases. • Establish record-keeping of tree failures and consequences to develop a Brampton-specific tree risk profile to guide future risk assessment and mitigation. • Integrate risk assessments with tree inventory and assess risk of every inventoried tree as inventory data are updated (see Action 1). • Implement conservation-based tree risk mitigation measures, including cabling, bracing, crown reduction, where feasible. • ANSI A300 (Part 9-2017): Tree, Shrub and Other Woody Plants Management – Standard Practices (Tree Risk Assessment a. Tree Structure Assessment) and the International Society of Arboriculture (ISA) Tree Risk Assessment Best Management Practices, Second Edition (2017) are the current industry standards for tree risk assessment.
Related OMTP action(s)	*N/A*

Action 2.6: Continue and enhance existing tree maintenance programs and practices	
Priority category (Impact, Effort)	Big Moves (Very High, High)
Lead(s)	Urban Forestry section – Maintenance Operations and Contract Administration - Tree Maintenance units
Partner(s)	N/A

Guidance	• Ensure ongoing and fully resourced implementation of existing urban forestry maintenance operations, including service request response and proactive cyclical pruning of street and actively-maintained park trees.
	• Upon completion of street and park tree inventories (see Action 1):
	  ○ Conduct a maintenance cost analysis for full implementation of 5-year street tree pruning cycle and 7-year park tree pruning cycle, and transition operations to these enhanced service levels over time.
	  ○ Assess feasibility of implementing varying inspection and/or pruning cycles for trees based on location, species, or size.
	• Undertake a comprehensive review and revision of Landscape Specification No. 02232 – Tree Pruning and tree pruning contract specifications to ensure conformity ANSI A300 (Part 1) – 2017 Pruning standard and associated International Society of Arboriculture Best Management Practices (BMPs). Streamline/align specifications such that a single technical specification document governs pruning of all City-owned trees under all applicable scenarios (i.e., operations and capital projects).
	• Conduct periodic performance and value-for-money audits of tree maintenance contractors, including field-verification of tree maintenance performance, safe work practice, and other contract requirements. Require contractor digital and GIS work logging, and strengthen overall contract monitoring processes.
	• Increase monitoring of newly planted tree survival and performance (see Actions 5 and 21).
	• Monitor number, type, priority, and origin (internal or external) of tree inspection/service requests and observe trends over time to inform management.

Related OMTP action(s)	*N/A*

Action 2.7: Implement a young tree structural pruning program	
Priority category (Impact, Effort)	Top Priorities (Very High, Moderate)
Lead(s)	Urban Forestry section – Maintenance Operations unit
Partner(s)	N/A

Guidance	• For all City-managed caliper trees, implement a “3-in-10” young tree structural pruning (YTSP) program, whereby young trees are inspected and, if necessary, structurally pruned a minimum of 3 times within 10 years after planting.
	  ○ Focus on development of strong central leaders, good branch spacing, branch-to-trunk diameter ratios, and prevention of co-dominant unions and included bark.
	• For naturalization plantings (“whips”), conduct monitoring and commence YTSP once target trees (such as large-growing deciduous plantings) have reached an average height of at least 2.5 m.
	  ○ YTSP for naturalization plantings is important but can be less intensive than for street trees in terms of frequency and pruning dose.
	• Integrate YTSP with tree inventory and asset management system to track program performance and develop annual work lists.
	• Ensure that YTSP crews (in-house and contractors) obtain or demonstrate specialized training for young tree pruning to ensure development of good long-term tree structure, as young tree pruning tools and methods differ from mature trees.

Related OMTP action(s)	*N/A*

Action 2.8: Develop an urban forest pest, disease, and invasive species strategy and priority response plans	
Priority category (Impact, Effort)	Top Priorities (High, Moderate)
Lead(s)	Urban Forestry section – Integrated Pest Management (IPM) unit
Partner(s)	• Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • Others: agencies and organizations with invasive species focus or mandate (see list below)

Guidance	**Strategy**
	• This citywide strategy should:
	  ○ Identify and prioritize known and potential urban forest pests, diseases, and invasive plant species threats to Brampton.
	  ○ Delineate known and suspected populations of priority species in Brampton's urban forest.
	  ○ Apply an Integrated Pest Management (IPM) approach to delimit thresholds for acceptable infestation levels and define appropriate management responses for priority species prevention and control.
	  ○ Explore education and collaboration opportunities, such as regional invasive species working groups.
	  ○ Determine required resources for enhanced pest, disease, and invasive species management.
	  ○ Identify priority sites and pilot/trial projects for assessment and refinement of invasive species management techniques.
	  ○ Be developed with community and stakeholder consultation to determine priorities and to raise awareness.
	• Management priorities will likely include, among others:
	  ○ Asian longhorned beetle
	  ○ Oak wilt
	  ○ Dutch elm disease
	  ○ Hemlock woolly adelgid
	  ○ Spongy moth (formerly LDD moth)
	  ○ Multiple invasive and noxious plant species
	• Priority species for management should be determined upon completion and analysis of street, park, and priority private tree inventories, and current status of pests, diseases, and invasive species in geographical relation to Brampton.
	• Identify legislative/regulatory changes to protect the urban forest, such as strengthening City's ability to compel removal of infected/infested private trees.
	• Engage external and community partners for strategy development and implementation, including CVC and TRCA, Peel Region, and others.
	• Refer to Mississauga Invasive Species Management Plan (ISMP) and Red Deer, AB Integrated Pest Management manual as exemplary documents.
	• Build upon/align with pest and invasive species management strategies developed by CVC and TRCA.

	Rapid response plans
	• Develop rapid response plans for, at minimum:
	  ○ Asian longhorned beetle
	  ○ Oak wilt
	  ○ Hemlock woolly adelgid
	  ○ Spotted lanternfly
	• Plans should be enacted when priority species are suspected or known to be in proximity to or established in Brampton.
	• Plans should provide guidance for, at minimum:
	  ○ Understanding pest/disease lifecycle and infestation dynamics
	  ○ Infestation delimitation surveying
	  ○ Ongoing population monitoring
	  ○ Redeployment of existing resources (personnel, equipment)
	  ○ Engagement with and reporting to relevant agencies and partners (e.g., Canadian Food Inspection Agency; Ministry of Northern Development, Mines, Natural Resources and Forestry; Invasive Species Centre, TRCA, CVC, neighbouring municipalities, Peel Region, etc.)
	  ○ Integrated Pest Management (IPM)-based response options
	  ○ Public outreach (including to property owners with identified susceptible priority tree species identified in the private tree inventory (see Action 2).

Related OMTP action(s)	*N/A*

Action 2.9: Enhance urban forest pest, disease, and invasive species management	
Priority category (Impact, Effort)	Big Moves (High, High)
Lead(s)	Urban Forestry section – Integrated Pest Management (IPM) unit
Partner(s)	• Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG)

Guidance	• Seek capital funding request to support an expanded urban forest pest, disease, and invasive species management program under an Urban Forest Health - Integrated Pest Management work unit (see Action 7).
	• Maintain continuing education for all urban forest maintenance field staff regarding priority urban forest threats, including identification, reporting, monitoring, and management.
	• Upon completion, analyze tree inventory to determine priority tree species 'hot spots' (e.g., high oak populations) and distribute targeted mailings in the event of confirmed presence of priority host-specific threats (e.g., oak wilt, HWA, etc.)
	• Enhance online educational materials related to urban forest pests, diseases, and invasive species.
	  ○ Simplify navigation to tree pest and disease online educational materials on Brampton's trees online portal. Include direct link on portal front page.
	  ○ Expand existing online educational content to include oak wilt, hemlock woolly adelgid, and priority invasive plant species. Include links to external sources including the Invasive Species Centre, Ontario Invasive Plant Council 'Grow Me Instead' guide, EDDMaps Ontario, and CVC and TRCA invasive species resources.
	• Engage the community and other partners in limited invasive species management, such as 'weed pulls' (see Actions 22 and 27)
	• Continue existing partnerships with CVC and TRCA (e.g., Brampton Natural Areas Inventory - BNAI) to collect and maintain up-to-date invasive species population inventory data on public lands, where available.
	• Maintain ongoing collaboration through PUFWG Invasive Subcommittee, including on early detection monitoring and reporting.
	• Develop roster of private natural area ownership in Brampton and reach out to landowners to form information and best practices-sharing partnerships for invasive species management.

Related OMTP action(s)	*N/A*

2.2.3 Actions for strategic goal 3 – Grow

Action 3.1: Identify and prioritize areas for tree establishment based on equity, function, and climate change adaptation considerations	
Priority category (Impact, Effort)	Top Priorities (High, Moderate)
Lead(s)	Urban Forestry section – One Million Trees Program (OMTP) unit
Partner(s)	• Environment and Development Engineering (PWE) • Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • School boards (Peel District / Dufferin-Peel Catholic) • Community members, including representatives of climate vulnerable groups/populations • Others: Association for Canadian Educational Resources (ACER), Peel Climate Change Partnership

Guidance	• Collaborate with Peel Urban Forest Working Group (PUFWG) to update the existing Tree Planting Prioritization Tool (TPPT) with current underlying spatial and tabular data necessary to inform prioritization outputs.
	• Encourage Peel Region to undertake a Region-wide urban forest equity assessment using a 'made-for-Peel' methodology comparable to the American Forests Tree Equity Score tool (not available for use in Canada).
	• Deploy TPPT to identify and prioritize areas for tree establishment through City operations, naturalization, and community-involved tree planting programs and events.
	  ○ Develop an updated tree planting priority mapping for Brampton to inform all City-led tree establishment efforts.
	  ○ City Green Working Team to collaborate on areas prioritization and development of tree planting initiatives that target identified priority areas.
	
	Area prioritization
	• In general, prioritize tree establishment in areas where multiple identified needs overlap or converge (e.g., TPPT benefit #2 – Mitigating urban heat island effects *and* #7. Supporting improved physical health and emotional well-being).
	• Among the highest priorities to be supported by tree establishment include:
	  ○ Mitigating heat island effects (especially in areas with higher vulnerable populations, i.e., children and the elderly)
	  ○ Active transportation (e.g., cycling and walking)
	  ○ Air quality
	  ○ Environmental justice/equity and strengthening communities
	  ○ Water quality
	  ○ Ecosystem connectivity
	  ○ Economic value
	• In accordance with UFMP community survey input, and where feasible and in support of TPPT-identified priorities, focus plantings in parks and natural areas, along neighbourhood streets, and around community buildings and facilities.

	• Using updated urban tree canopy (UTC) cover and potential plantable area (PPA) data (see Action 3), identify areas of disproportionately low canopy and low household income to highlight underserved areas, and focus planting efforts to pursue urban forest distribution/access equity. If developed, use Regional urban forest equity analysis to further refine approaches (see guidance above). • Consider tree species physical and functional characteristics in relation to desired site- or area-specific functions to be supported by tree established (e.g., dense-canopied, wide-spreading trees in areas where shading to reduce heat island effects is required; moisture-tolerant species for stormwater mitigation sites). • Investigate/assess the suitability and performance of underutilized or novel tree species and cultivars, including Carolinian/southern species that may be better adapted to climate change effects and cultivars developed for drought and heat tolerance.
Related OMTP action(s)	Actions 1.1.1, 1.1.2, 2.1.7, 2.2.2, 2.3.1, 2.3.2, 2.3.3 and 3.7

Action 3.2: Plant more trees in parks and open spaces where they will not conflict with formalized park uses	
Priority category (Impact, Effort)	Moderate Priorities (M, M)
Lead(s)	Urban Forestry section – One Million Trees Program (OMTP) and Natural Areas Management units
Partner(s)	• Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • Multiple external implementation partners
Guidance	• Naturalization of park and open spaces should be prioritized in accordance with the City's Valleys and Parks Naturalization Program, and Natural Heritage Restoration Program (NHRP). • Additional naturalization may be undertaken where opportunities are identified in suitable locations (e.g., adjacent to riparian corridors and other components of the Natural Heritage System, in park lands suitable for passive activities, as buffers between different land uses, or between roadways and residential lands). • *Identify and prioritize planting opportunities on City facility grounds* (OMTP Action 2.8.1), taking a naturalization approach where appropriate. • Build on priorities identified in Action 3.1 to inform decision making. • Naturalization of park and open space lands will generally include a diversity of native and non-invasive trees and shrubs, but may also include untreed meadow or wetland communities. • A diversity of site-appropriate native non-invasive species should be used for such projects, including species anticipated to be tolerant of conditions in the context of climate change.
Related OMTP action(s)	Action 2.8.1

Action 3.3: Update and consolidate tree establishment policies and guidelines	
Priority category (Impact, Effort)	Big Moves (Very High, High)
Lead(s)	Urban Forestry section – Capital Projects and Landscape Architecture unit
Partner(s)	• Building Design and Construction (PWE) • Capital Works (PWE) • City Planning and Design (PBED) • Development Services (PBED) • Environment and Development Engineering (PWE) • Building Industry and Land Development Association (BILD) • Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG)
Guidance	• Undertake a comprehensive technical review of all tree establishment guidelines, standards, and specifications, including: o Landscape Development Guidelines (LDGs) o Site Plan Review User Guide o Development Design Guidelines o Subdivision Design Manual o Street Corridor Master Plan o Downtown Civic Design Guide o Sustainable Community Program guidelines o Brampton Complete Streets Guide (BCSG) o Parks Construction Standard Details o Landscape Specifications o Engineering & Design Standard Drawings o Brampton Standard Specifications (BSS) o Tree planting contract specifications o Tableland Tree Assessment Guidelines • Consolidate tree establishment guidance in a single overarching guidelines, standards, and specifications compendium document, to be applicable for all tree establishment scenarios on existing or future public lands in Brampton, including forestry operations, naturalization/stewardship, Site Plan or other planning applications, and capital projects. • Revise guidelines and practices to enhance urban forest diversity. o Remove focus on ‘dominant species’ in Landscape Design Guidelines; revise in favour of increased tree diversity and preferred native non-invasive species use (where feasible). o When completed, use street and park tree inventories and urban forest studies to plan for tree diversity at applicable scales (e.g., neighbourhood, ward, park). o In general, apply the ‘genus limit’ rule whereby no tree genus exceeds 10% to tree species selection for establishment through City programs and operations, and the development process. o Maintain flexibility to account for constraints such as neighbourhood character areas, existing species/genus overabundance, and other needs. • Develop consolidated tree species/cultivar selection matrix tool or static list, listing tree tolerances and preferences, physical and biological characteristics, and delineating appropriate planting

	scenarios and typologies, for use in all planting scenarios on public and private lands.
	• Enhance tree planting stock standards, including stringent specifications for tree stock root quality, root ball to caliper ratios, structural condition, and health.
	• Enhance standards for tree growing environment design elements (e.g., soil volume and quality, drainage, irrigation, etc.), such as:
	  ○ Mature tree size-correlated soil volumes for capital projects and new development.
	  ○ Guidelines for engineered growing environment solutions (e.g., soil cells, suspended pavements, etc.)
	  ○ Siting of utilities below sidewalks, or integrating utility duct banks below tree rooting environments, to maximise available soil volume for tree root growth.
	• Upon completion of review and consolidation, undertake cross-departmental and public outreach to increase awareness of updated guidelines and tree establishment best practices, and to ensure consistent application of guidelines to all applicable scenarios.
	• Refer to City of Kitchener “Development Manual – Urban Forest Appendix” as example of best practice for integrating soil volume requirements into a variety of development and design scenarios.

Related OMTP action(s)	Actions 1.2.2, 2.2., 2.6.6, 2.8.2

Action 3.4: Undertake tree performance trials to diversify the urban forest and identify climate-ready trees	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Moderate)
Lead(s)	Urban Forestry section – Tree Inspection unit
Partner(s)	• Conservation Authorities (CVC, TRCA) • Other: Academic institutions, Association for Canadian Educational Resources (ACER), local tree suppliers/growers

Guidance	• Undertake local tree species/cultivar suitability trials by obtaining and planting at least 40 caliper-sized trees per type.
	• Collaborate with local growers to select appropriate trial species/ cultivars. Trial at least 15 novel or underutilized types that:
	  ○ Are uncommon, underutilized, or unutilized in Brampton.
	  ○ Are large-growing and known to provide urban forest services and exhibit other desirable characteristics (e.g., species vigor, structural integrity, low allergenicity, aesthetic value, etc.)
	  ○ Are native to warmer (i.e., more southerly) Plant Hardiness Zones and climates, and are likely to be 'climate change ready' in Brampton.
	  ○ Favour selection of North American species.
	• Plant trial trees across different land types and microclimates on City-owned lands (e.g., parks, boulevards, facilities, lawn areas in right-of-way, etc.)
	• Ensure trees are inventoried, GIS-mapped, properly maintained (watered, pruned, mulched) throughout the trial period.
	• Undertake detailed assessment at least twice annually and record trial data for at least 5 years.
	• Measure/assess tree growth, health, condition, and maintenance needs.
	• Use trial findings to revise tree species/cultivar lists for City operations, capital projects, and other scenarios.
	• Seek in-kind support/partnership from local tree suppliers/growers and academic institutions, and integrate trials with capital projects, to reduce initial and monitoring costs.
	• Refer to *Climate ready street tree trials: A best practice guide* (Manea *et al.*, 2021).

Related OMTP action(s)	*N/A*

Action 3.5: Enhance all aspects of tree establishment for both City- and developer-planted trees	
Priority category (Impact, Effort)	Big Moves (Very High, Moderate)
Lead(s)	Urban Forestry section – Contract Administration - Tree Establishment, One Million Trees Program (OMTP), and Compliance Inspection and Enforcement units
Partner(s)	• Building (PBED) • Capital Works (PWE) • Development Services (PBED) • Environment and Development Engineering (PWE) • Building Industry and Land Development Association (BILD) and non-member builders and developers
Guidance	**Planting** • Increase rigor of City pre-planting inspection of contractor-supplied trees under operations planting contracts. • Assess feasibility of and implement in-nursery tree planting stock selection by City staff or third-party contractor to select high-quality trees for procurement. • Strengthen tree planting contract specifications regarding nursery stock quality, pre- and post-planting inspection, and rejection of substandard materials and installation. • Investigate the feasibility of establishing long-term tree growing contracts with regional tree nursery stock providers, focusing on locally sourced seed, locally grown stock, high-quality root production and root ball management, and structural development. • For new developments, establish clear sequencing requirements to ensure that trees are planted after substantial completion of all development and construction works (e.g., house building, road paving, curb/driveway installation, and sodding). • Ensure adequate erosion and sediment control (ESC) is implemented for all tree plantings to limit sediment migration to stormwater systems and waterbodies. **Maintenance** • For City plantings, require contractors to undertake and provide documented verification of post-planting maintenance (watering and mulching) within the warranty period to ensure that trees develop good root health prior to final acceptance. To ensure sustained funding for post-planting care, build-in to planting capital budget (refer to York Region). Ensure rigorous monitoring of contractor compliance (e.g., GPS tracking, work logs, in-field verification, spot inspections, etc.) • For developer-planted trees, require that developers undertake and document basic tree maintenance (watering and mulching) between preliminary and final inspections. Require that trees and tree growing environments are in good condition and conform to guidelines prior to transfer to City ownership. • Engage residents in tree watering (see Action 22) and monitoring. • Refer to Appendix 3 for optimal young tree maintenance schedule to guide implementation.

	Inspection and Acceptance
	• Increase rigor of City post-planting inspections of operations-planted trees to ensure implementation of tree planting best practices. Ensure that every operations-planted tree is inspected following planting by a qualified arborist.
	• For trees in new developments:
	  ○ Undertake City inspection of, or require third-party documentation of, comprehensive inspection of tree planting stock prior to and immediately following planting. Ensure that trees to be assumed by the City are comprehensively inspected at Final Inspection period by a qualified arborist (in-house or City contractor; not developer's contractor).
	  ○ Establish process whereby developers of new communities can exercise the option for City-led tree establishment in new communities. Developers to remit full-cost tree planting fee that accounts for tree procurement, delivery, installation, warranty, and two years of adequate maintenance (inspection, watering, mulching, weeding), thereby removing developer obligation to plant and maintain trees prior to City acceptance.
	• Shortly prior to assumption of trees in new communities, require developers to submit 'as-built' tree inventory data for all new trees, to be integrated with the municipal tree inventory and asset management systems.
	
	• Refer to Peel Urban Forest Best Practice Guide vol. 2: *Urban Forest Management Best Practices Guide for Peel*.

Related OMTP action(s)	*N/A*

Action 3.6: Expand community involvement in tree planting and care on public lands	
Priority category (Impact, Effort)	Big Moves (High, High)
Lead(s)	Urban Forestry section – Outreach and Engagement and One Million Trees Program (OMTP) units
Partner(s)	• Environment and Development Engineering (PWE) • Conservation Authorities (TRCA, CVC) • Peel Region (incl. PUFWG) • Others: Association for Canadian Educational Resources (ACER), EcoSource, Evergreen, LEAF, Tree Canada

Guidance	**Practices and protocols**
	• Ensure the process for engagement of volunteers is accessible, safe and in accordance with City procedures.
	• *Develop protocol for tree planting in existing parks wherein City staff plant caliper trees and community members complete infill planting with whips* (OMTP Action 2.1.5).
	
	Enhancing post-planting tree care and 'Adopt-a-Tree' program
	• Engage graphic designer to develop new, high-quality education/engagement materials to encourage residents to water trees, including:
	  ○ Door hangers to be supplied when trees planted
	  ○ Utility/tax bill mailing inserts
	  ○ Website/social media content
	  ○ Pamphlets for distribution at City facilities and events
	  ○ Transit vehicle and shelter/other public advertisements
	• Update documents entitled "*An Important Notice to New Home Purchasers from the City of Brampton*" and "*New Home Construction: A New Home Purchaser's Guide to the Construction of New Subdivisions and Homes in the City of Brampton*" to summarize tree protection requirements and basic young tree maintenance information, direct readers to City's "Trees" web portal for more information.
	• In addition to above materials, initiate face-to-face contact between planting crews (staff/contractor) and residents to review tree watering needs.
	• Use blue flagging tape on tree to publicly denote trees with resident watering commitment, thereby encouraging continued watering.
	• Provide weekly social media updates on tree watering needs (e.g., none in off-season, normal, extreme, etc.) based upon weather conditions, and provide clear guidance on tree watering volume/frequency requirements.
	• Encourage residents to properly mulch trees and avoid detrimental groundcovers (e.g., stone, synthetic/coloured mulch, grade change).
	• When materials are developed and program structure is established, roll-out a coordinated public tree watering campaign to encourage participation.
	• Through Urban Forest Engagement Coordinator, develop an 'Adopt-a-Tree' program to engage individuals, groups or businesses to formalize their commitment to water, weed and monitor City street, park, and facility trees.
	• Program options vary:

	○ Most basic program simply encourages residents to informally "adopt" a tree without any tracking, reporting or other program structure. ○ Optimal program allows participants to select a tree from a list or online map of available trees, make a public commitment to watering/tending by formally 'adopting' the tree, and report on activities (e.g., watering frequency). If reporting/activity frequency is insufficient, adopters can be prompted to action or disqualified from the program. ○ Consider 3-tier approach: Level 1 – participants commit to watering City tree fronting property; Level 2 – participants commit to watering, mulching and monitoring City tree fronting own property; Level 3 – participants commit to watering multiple City trees on street and/or park. ○ Other actions, including mulching, weeding and monitoring, should also be included. • For park tree adopters, ensure access to water source and mulch piles is available throughout the season. • Encourage reporting/tracking of tree work undertaken (e.g. mulch top-up, watering) and reporting of observed tree health issues. • Formal recognition of group or business tree adopters can encourage participation. **Woodlands** • Build on established community and commemorative planting events on public lands (e.g., Earth Day in April, National Tree Day and Brampton Tree Month in Sept., Tree Dedication Program). • Engage the community in planting opportunities on City facility grounds where suitable areas exist (per OMTP Action 2.8.1). • Continue to support community tree establishment events led by public sector partners (e.g., annual Scouts / Guides event led by TRCA in Valleybrook Park). • Work with partners (e.g., local schools) to engage the community in basic stewardship of local City-owned woodlands (e.g., garbage pick-up, invasive plant control "weed pulls", naturalization of degraded areas, community science). ○ Build on lessons learned from Massey Woodland pilot. ○ Consider identifying neighbourhood "Forest Ambassadors" to provide guided walks in local wooded natural areas. • Urban Forest Engagement Coordinator (see Action 5.1) required to lead this work.
Related OMTP action(s)	Actions 2.1.5, 2.8.1

2.2.4 Actions for strategic goal 4 – Protect

Action 4.1: Ensure that the urban forest is considered in all aspects of city planning	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	City Planning and Design (PBED)
Partner(s)	Urban Forestry section – Planning unit

Guidance	• As new City-wide strategies, plans and guidelines are developed, and as existing documents are updated, ensure that the UFMP vision, goals, objectives and targets, and relevant policies related to the urban forest, are considered and incorporated, as appropriate.
	  ○ Extent of integration will depend upon the nature and scope of the applicable document(s)
	• Opportunities include acknowledging and/or incorporating:
	  ○ Elements of the UFMP vision, guiding principles, goals, objectives, and targets
	  ○ Environmental, economic, and societal and health services provided by the urban forest
	  ○ Need for equitable access to urban forest services
	  ○ Ability of the urban forest to help communities adapt to climate change
	  ○ Support for sustained maintenance and monitoring of the urban forest
	  ○ The importance of improving urban forest resilience through enhanced structural and functional diversity
	  ○ The need for urban forest stewardship on private lands
	  ○ The value of interagency and community partnerships
	  ○ Support for pursuit of funding, research, and developing incentives for urban forest stewardship on private lands
	  ○ Investing in the urban forest as a priority, and
	  ○ Direction to incorporate the urban forest into municipal asset management planning.

Related OMTP action(s)	*N/A*

Action 4.2: Update the Official Plan with policies specific to the urban forest	
Priority category (Impact, Effort)	Top Priorities (High, Low)
Lead(s)	City Planning and Design (PBED)
Partner(s)	• Urban Forestry section – Planning unit • Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG)

Guidance	• As part of the ongoing Official Plan update process, ensure all urban forest-related and relevant land use planning policies are aligned with the current strategic and policy direction at the local, Regional (e.g., Peel Official Plan updates) and Provincial levels (e.g., the 2020 Provincial Policy Statement, 2017 Greenbelt Plan).
	• Develop and incorporate policies to recognize the value of and support sustaining and enhancing urban forest that are aligned with best practices and appropriate for the local context, including:
	  ○ Connections between sustaining the urban forest and supporting local climate change mitigation and adaptation
	  ○ Support for fully incorporating the urban forest, and other natural assets, into the City's asset management system.
	• Draw on planning and policy guidance from the Peel Urban Forest Best Practice Guide 1.
	• Ensure consistency with updated Regional Official Plan policy direction related to the urban forest.

Related OMTP action(s)	*N/A*

Action 4.3: Review and update tree by-laws every five years	
Priority category (Impact, Effort)	Top Priorities (High, Moderate)
Lead(s)	Urban Forestry section - Plan and Permit Review and Compliance Inspection and Enforcement units
Partner(s)	• Enforcement and By-law Services (LS) • Legal Services (LS)

Guidance	• Undertake regular (e.g., every five years) review of Brampton's tree by-laws to ensure alignment with current urban forestry strategic goals objectives and effective and efficient implementation.
	• Opportunities for updating the private Tree Preservation By-law (317-2012) and Woodlot Conservation By-law (316-2012) include:
	  ○ Streamlining by-law application and administration process (e.g., with on-line screening, application, and information submission tools)
	  ○ Requiring submission of more detailed and comprehensive information is provided by the applicant up front (e.g., Arborist Report, Woodland Assessment) thereby reducing the need for and facilitating site inspection
	  ○ Adding definitions and regulatory clauses related for boundary trees and heritage trees
	  ○ Considering reducing the minimum size of regulated trees below 30 cm dbh (for By-law 317-2012) and reducing/ removing other exemptions (e.g., distance to buildings)
	  ○ Considering increasing tree and/or woodland compensation requirements, and aligning compensation requirements for by-law permitted removals and development applications, and
	  ○ Adjusting permit fees to enable full cost recovery of permit application review, processing, and inspection/enforcement.
	• Opportunities for updating the City's Boulevard Maintenance and Highway Obstruction By-law (163-2013) (public trees) include:
	  ○ Adding definitions and/or clauses for "boundary trees" and defining "damage" and
	  ○ Increasing the tree compensation requirements.

Related OMTP action(s)	*N/A*

Action 4.4: Increase the City's capacity to ensure that tree protection and planting plans are implemented properly on development sites	
Priority category (Impact, Effort)	Big Moves (Very High, High)
Lead(s)	Urban Forestry section - Plan and Permit Review and Compliance Inspection and Enforcement units
Partner(s)	• Capital Works (PWE) • Enforcement and By-law Services (LS) • Road Maintenance, Operations and Fleet (PWE) • Building Industry and Land Development Association (BILD) and non-member builders and developers
Guidance	**Awareness** • Build awareness of City tree protection requirements by developing a tree protection brochure that summarizes all relevant aspects of the tree protection process and City policies and regulatory requirements in a user-friendly document. Distribute online and via social media, and via partners. • Work with Road Maintenance, Operations and Fleet to ensure that trees are adequately considered and protected during road maintenance and winter (snow clearing) operations. **Subdivision and Site Plans, and Capital Projects** • Ensure that City staff involved in development plan review and capital project design and planning are aware of applicable tree-related City policies, guidelines, and regulations. • Ensure that tree protection is the "preferred option/starting point" (instead of compensation) for all applications with potential impacts upon existing trees. • Ensure that qualified staff are engaged early in the design and planning process (including Peel Region projects) to review and advise on tree-related constraints and opportunities for plans and applications. • Incorporate tree and wooded areas protection into conditions of approval for subdivisions and site plans. **Building (and related) permits** • Incorporate a Tree Declaration Form as part of Building Permit and related permit (e.g., pool fence, curb cut) application process to facilitate screening for potential impacts to by-law regulated trees. ○ Forward applications with "positive" Tree Declarations to urban forestry plan review staff for expedited review and follow-up, if necessary, to ensure compliance with relevant tree protection requirements. • Establish full cost recovery for review of tree-related components of permit and other applications through appropriate permit fees and/or other mechanisms (e.g., service fees). **Compensation** • Ensure that applicable tree compensation measures are consistently obtained wherever required pursuant to Tableland Tree Assessment Guidelines.

	Securities • Implement the collection of securities as a tool to ensure full implementation of approved tree protection, planting, and compensation plans. **Compliance** • Establish a process to require third-party (i.e., arborist) inspection and reporting to City of tree protection plan implementation on development sites at key project milestones (e.g., tree protection fencing, excavation/grading, servicing, etc.) • Undertake both random and targeted site inspection to ensure compliance with approved tree protection plans, initially focusing efforts on sites with extensive tree protection and/or compensation requirements and higher-profile sites. **Enforcement** • Ensure staff in other relevant divisions (e.g., Building, Enforcement and By-law Services, Environment and Development Engineering, etc.) are notified of approved tree protection plans and tree-related permits to facilitate compliance inspection and enforcement. • Ensure that, at minimum, one urban forestry staff member (preferably in the proposed Tree Protection and Plan Review section, when established) is qualified as a Provincial Offences Officer to support by-law related education and outreach and enforcement of tree by-law infractions when needed. **Incentives** • Explore feasibility of providing partial reduction in landscaping requirements or compensation, or providing early release of securities, for demonstrated effective tree protection on development sites.
Related OMTP action(s)	*N/A*

Action 4.5: Develop and apply standards for City-owned woodland management	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Moderate)
Lead(s)	Urban Forestry section – Natural Areas Management units
Partner(s)	• Building Industry and Land Development Association (BILD) and non-member builders and developers • Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • Residents and community members

Guidance	• Where private woodlands are coming into City ownership through the planning process, require development proponents to:
	  ○ Develop a multi-year Woodland Management Plan, and
	  ○ Implement the initial management measures, where appropriate.
	• For all woodlands under City ownership establish minimum standards for site-specific Woodland Management Plans (see Massey Woodland Management Plan) that include:
	  ○ Tree risk management
	  ○ Signage related to access and permitted activities, and access control (if required)
	  ○ Trail siting and maintenance
	  ○ Pest, disease, and invasive species management, and
	  ○ Ecological function and biodiversity maintenance and enhancement (e.g., monitoring, invasive species control, habitat creation/ diversification).
	  ○ Where feasible, retain deadfall and snags for wildlife habitat and nutrient cycling benefits and functions.
	• Develop and maintain an inventory of all City-owned woodlands to inform asset planning, inventory/monitoring, maintenance, and management.
	• It may not be feasible to make all City-owned woodlands accessible to the public upon assumption; prioritize woodlands in areas of the City most lacking in greenspace access, maintenance, and management.
	• Work with the community and other partners (e.g., local schools) to encourage low-impact woodland use (e.g., adherence to formal trails, on-leash dog walking, litter and waste removal).
	• Work with partners, including local Conservation Authorities, to undertake targeted ecological restoration and monitor long-term ecological condition and use of City-owned woodlands.

Related OMTP action(s)	*N/A*

2.2.5 Actions for strategic goal 5 – Engage

Action 5.1: Develop and implement an Urban Forest Awareness and Engagement Program	
Priority category (Impact, Effort)	Big Moves (High, High)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Environment and Development Engineering (PWE) • Strategic Communications, Culture and Events (CSS) • Multiple external partners
Guidance	**General** • Staff one full-time Urban Forest Engagement Coordinator position. • Align with Brampton's One Million Trees Program guidance for comprehensive urban forest awareness and engagement strategy (OMTP Action 3.1.1) and Stormwater Education and Outreach Program. • Build on existing and well-received initiatives such as provision of classroom workshops by City staff, use of Elgin Woods Park as an outdoor education area, and the Park Hero Program. • Include multi-pronged strategies to increase awareness of both "carrot" (e.g., incentives, programs, events) and "stick" (e.g., tree by-laws, compensation requirements, standards) in place to sustain and enhance Brampton's urban forest. **Outreach and messaging tactics** • Promoting the environmental, economic, societal and health services of trees (including benefits related to mental and physical health, air quality, shade and cooling, stormwater, and carbon sequestration). • Increasing awareness of and participation in tree planting events (see OMTP Action 3.1.2). • Promoting native tree species and tree care/maintenance requirements (see OMTP Action 3.1.3). **Key initiatives** • Host annual green industry engagement webinars to help local arborists, environmental consultants, and development proponents understand the City's tree-related by-laws, policies, and guidelines. • Engage the community in the development of a Heritage Trees List, with criteria for inclusion to be developed by the Green City Working Group. ○ Establish and publicize a "Heritage Tree Hunt" for a defined time period to encourage engagement. • Other initiatives may include tree talks, tree tours, tree education (e.g., "Tree Tenders" program), etc. • Engage with local First Nations to identify shared goals related to the urban forest and mechanisms for successful collaboration. • Undertake a community "outreach blitz" in spring and fall to coordinate and promote tree activities, including building on the month of September being designated "Tree Month" in Brampton (see OMTP Action 3.6).
Related OMTP action(s)	Actions 3.1.1, 3.1.2, 3.1.3, 3.1.4, and 3.6

Action 5.2: Facilitate urban forest community-based science	
Priority category (Impact, Effort)	Moderate Priorities (Low, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Digital Innovation and IT (CSS) • Environment and Development Engineering (PWE) • Strategic Communications, Culture and Events (CSS) • Conservation Authorities (CVC, TRCA)

Guidance	• Include selected tree inventory data on Brampton's GeoHub Maps mapping and data portal.
	  ○ Data should include, at minimum, vector (point) locations with species and size (dbh) data.
	  ○ Mapping can be integrated with a service request function to allow users to submit requests tied to specific trees, with known locations, to facilitate response and management.
	• Explore opportunities, and establish program for, community-based long-term monitoring of naturalization planting areas and projects, such as submission of field data forms or photographic evidence.
	• Allow residents to upload basic urban forest data such as potential/available plantable sites, service requests, private tree inventory, potential heritage trees, or other tree-specific observations (e.g., pest/disease reporting) (would necessitate data screening, sample-based field verification, and moderation).
	• Promote public use of EDDMaps Ontario invasive species mapping tool and use reported data to inform invasive species planning and management (would necessitate field-based verification).
	• In general, use reported data for high-level planning; ground-truthing by trained staff or contractors is required for most data if used to inform tree maintenance operations.

Related OMTP action(s)	*N/A*

Action 5.3: Enhance urban forest online and social media content	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Digital Innovation and IT (CSS) • Strategic Communications, Culture and Events (CSS)

Guidance	**Website**
	• Maintain and build on existing "Trees" portal as the central website for urban forestry-related content.
	  ○ Update content on an as-needed basis to publicize upcoming events, update technical information, etc.
	  ○ Promote urban forest art submitted by the community as part of the UFMP process.
	  ○ Promote and celebrate full range of urban forestry initiatives and successes across the city.
	  ○ Promote the OMTP and the urban forest as central to community health and resiliency, and continually update the "Count My Tree" tree tracker with City and other plantings.
	  ○ Build on success of existing videos with new videos about selected timely and relevant urban forestry topics (e.g., resident monitoring and management of spongy moth (formerly LDD moth) infestations, invasive species management and alternatives, the OMTP and tree tracker tool, Brampton Tree Month, etc.)
	• Ensure all relevant web updates are integrated with social media content.
	
	Social media
	• Develop a coherent social media brand/image across major social media platforms (especially Facebook, Instagram, Twitter) with platform-specific (coordinated where appropriate) content and hashtags.
	• Work with Strategic Communications, Culture and Events division on development and dissemination of urban forestry social media content.
	  ○ Establish process for rapid review, approval, and posting of high-priority content.
	  ○ Track engagement (including "social listening", i.e., monitoring for social media mentions), and benchmark against other similar City social media content.
	• Develop "evergreen", "seasonal", and "responsive" content.
	  ○ Evergreen content can be posted at any time to maintain engagement and interest, and may include facts, tips (e.g., tree maintenance), photos, links to external sources, etc.
	  ○ Seasonal content may include seasonally-specific tree maintenance tips (e.g., watering/mulching, pruning, pest/disease monitoring and management, planting, salt use reduction in winter, etc.) or other periodic content (e.g., Brampton Tree Month, elm/oak pruning 'windows', etc.)

	○ Responsive content is developed in timely response to specific conditions or situations, and may require rapid development and posting (e.g., drought or emergency response, pest/disease management). • Develop and use video-based content when relevant and feasible, due to significantly higher engagement rates. • During growing season, provide weekly social media updates on young tree watering needs based upon weather conditions, and provide clear guidance on tree watering volume/frequency requirements. Refer to Kitchener social media for guidance. • Leverage and interact with existing local “green” network partners to share and amplify content.
Related OMTP action(s)	*N/A*

Action 5.4: Develop an urban forest products and foods utilization program	
Priority category (Impact, Effort)	Moderate Priorities (Low, Moderate)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Conservation Authorities (CVC, TRCA) • Peel Region (incl. PUFWG) • Residents and community members • School boards (Peel District / Dufferin-Peel Catholic) • Other: Partners in Project Green partnership

Guidance	• Investigate opportunities to coordinate the safe collection of food products from City and other publicly-owned fruit- and nut-bearing trees in parks, City facility grounds, and other public lands.
	• Publicize City's interest in, and explore opportunities for, establishing partnerships with local businesses and other groups with an interest in urban wood utilization and access to food products from urban trees.
	  ○ Upon completion of inventory, develop publicly available mapping of locations of City-owned fruit and nut trees and shrubs (e.g., *Amelanchier, Corylus, Juglans, Malus, Prunus,* etc.)
	  ○ Establish Terms of Reference/Memoranda of Understanding with interested groups concerning group/community maintenance and tending of food-bearing shrubs and monitoring (with reporting to City) of fruit- and nut-bearing City trees.
	  ○ Seek partner/NGO support to facilitate administration of urban forest products (wood) and foods utilization.
	• Identify suitable locations for, and preserve existing, 'urban forest orchards' (i.e., grouped plantings of a variety of fruit- and nut-bearing trees and shrubs), and increase diversity of food-bearing trees in these locations.
	• Identify sources of wood waste suitable for higher-value usage beyond existing programs (e.g., large mature trees nearing end-of-life, remnant ash trees).
	• Identify suitable locations for storage and transfer of wood to end-users as efficiently and cost-effectively as possible.
	• Develop a process for pre-registration of interested end-users of urban wood raw materials.
	• Continue participation in regional urban forest product working groups (e.g., Partners in Project Green) as opportunities arise.
	• Explore cooperation on urban forest products and foods program with CVC, TRCA, and local school boards.

Related OMTP action(s)	*N/A*

Action 5.5: Encourage and recognize urban forest stewardship	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Strategic Communications, Culture and Events (CSS) • Conservation Authorities (CVC, TRCA)
Guidance	**Recognition mechanisms** • *Develop a Brampton One Million Trees recognition program to celebrate community and staff leaders in Brampton* (OMTP Action 3.2), including the Grow Green Stewardship Award. • Celebrate neighbourhoods, individuals, businesses, and other partners involved in the Adopt-a-Tree Program (see Action 22) in corporate urban forest marketing. • Collaborate with CVC through SNAP, Greening Corporate Grounds, Sustainable Home Landscapes (Your Green Yard) and other programs to encourage and recognize urban forest stewardship. **Incentives to offer** • Provide landowners (including developers, builders, etc.) with formal and public recognition for notable contributions to urban forest stewardship. • Provide opportunities for recognition of significant contributions through the naming of parklands/open space, facilities/rooms, trails, and/or gardens. • Recognize developments meeting the “aspirational” urban forest targets established in the Sustainability Metrics and Sustainability Assessment Tool (SAT). • Promote the subsidies, “giveaways” and resources for tree establishment on residential lands (see Action 33) as well as institutional and corporate lands (see Action 32). **Incentives to explore** • Partial reduction in landscaping requirements (e.g., new tree planting) or compensation for effective preservation of existing trees on development sites. • Stormwater charge as a dedicated mechanism for funding stormwater management-related expenses and an associated stormwater credit for maintaining tree canopy or a certain percentage of a site in permeable surface condition suitable for tree establishment.
Related OMTP action(s)	Action 3.2

Action 5.6: Develop partnerships for tree establishment and urban forest stewardship on institutional and corporate lands	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Economic Development (PBED) • Environment and Development Engineering (PWE) • Conservation Authorities (TRCA, CVC) • Peel Region (incl. PUFWG) • School boards (Peel District / Dufferin-Peel Catholic) • Other: Association for Canadian Educational Resources (ACER), Brampton Board of Trade, Business Improvement Areas (BIAs) EcoSource, Evergreen, LEAF, Partners in Project Green, Tree Canada.

Guidance	**Schools**
	• Develop and share urban forest outreach materials tailored to different grades:
	  ○ *Continue to develop lesson plans on the importance of trees for teachers of Grades 1-12* (OMTP Action 3.5)
	• Partner with schools to increase tree cover on school grounds (OMTP Action 2.4):
	  ○ *Develop a list of priority schools sites to be planted in consultation with Peel District School Board (PDSB), Dufferin-Peel Catholic District School Board (DPCDSB), and Eco Schools* (OMTP Action 2.4.1).
	  ○ *Work with the Conservation Authorities school boards to facilitate School Tree Planting Days for students to plant trees on their school's property* (OMTP Action 2.4.2).
	  ○ *Collaborate with organizations such as LEAF, EcoSource, Evergreen, and ACER to develop and distribute education, awareness, and stewardship material to schools* (OMTP Action 2.4.3).
	
	Places of worship
	• Partner with places of worship to support tree planting on their properties (OMTP Action 2.5):
	  ○ *Develop a list of priority places of worship to be planted based on the identified priority neighbourhoods* (OMTP Action 2.5.1).
	  ○ *Collaborate with Conservation Authorities and places of worship to facilitate Tree Planting Days* (OMTP Action 2.5.2).
	  ○ *Continue to work with faith-based organizations to support tree planting efforts* (OMTP Action 2.5.3).
	  ○ *Foster partnerships with new faith-based organizations to support tree planting efforts* (OMTP Action 2.5.3).

	Institutional, commercial, and industrial sector lands
	• Work with Economic Development to access City's existing Commercial Realty Database and identify key contacts at local ICI sector members. Conduct appropriate outreach to explore opportunities for urban forest stewardship on corporate lands.
	• Explore partnership and support opportunities with CVC through Greening Corporate Grounds program.
	• *Encourage industrial and commercial property owners to plant trees and cultivate green spaces on their properties* (OMTP Action 2.7):
	  ○ *Support the Conservation Authorities' 'Greening Corporate Grounds' and 'Partners in Project Green' programs for tree planting on industrial properties, including greening parking lots* (OMTP Action 2.7.1).
	  ○ *Foster new partnerships with organizations, such as LEAF, to facilitate tree planting on commercial and industrial sites* (OMTP Action 2.7.2).
	  ○ *Work with Conservation Authorities to source tree species that would be more tolerant of industrial/commercial property conditions and resilient to climate change* (OMTP Action 2.7.3).

Related OMTP action(s)	Actions related to schools (2.4.1, 2.4.2, 2.4.3, 3.5), places of worship (2.5.1, 2.5.2, 2.5.3, 2.5.4), corporate lands (2.7.1, 2.7.2, 2.7.3)

Action 5.7: Expand the Residential Tree Program in partnership with others	
Priority category (Impact, Effort)	Top Priorities (High, Moderate)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Conservation Authorities (TRCA, CVC) • Peel Region (incl. PUFWG) • Others: Credit River Anglers' Association (CRAA), LEAF, Tree Canada, Tree for Me, TreeMobile, others

Guidance	• Continue to develop and expand the Residential Tree Program (OMTP Action 2.6.2), which launched in September 2021 with a 1,200-tree giveaway, by integrating promotion of this program within the broader Outreach and Engagement Program (see Action 28), and continue to provide this program as one of a suite of initiatives and services to expand the urban forest on residential lands (OMTP Action 2.6).
	• Explore partnership and support opportunities with CVC through Sustainable Home Landscapes (Your Green Yard) program.
	• *Encourage residents to undertake tree planting through incentives for planting on residential property* (OMTP Action 2.6):
	  ○ *Continue to promote private property tree planting efforts of partner organizations, such as TRCA's Healthy Yards program and CVC's Green Your Garden program* (OMTP Action 2.6.3).
	  ○ *Foster new partnerships with organizations such as LEAF, Tree for Me, and TreeMobile* (OMTP Action 2.6.4).
	  ○ *Work with home improvement retailers and garden centres willing to sponsor tree planting programs that provide subsidized tree resources to residents* (OMTP Action 2.6.5).
	  ○ *Develop a grant program to support community-led tree planting projects* (OMTP Action 2.6.7).
	• Continue to support local Sustainable Neighbourhood Action Plan (SNAP) efforts to expand tree cover on and near residences in SNAP neighbourhoods.
	• Promote and support species selection from a local list species adaptable to climate change and suitable for residential yards (see Action 19).

Related OMTP action(s)	Actions 2.6.2, 2.6.3, 2.6.4, 2.6.5, 2.6.7

Action 5.8: Enhance urban forest information sharing and cooperation across City departments	
Priority category (Impact, Effort)	Top Priorities (High, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit (via Green City Working Group)
Partner(s)	• Conservation Authorities (TRCA, CVC) • Peel Region (incl. PUFWG)

Guidance	• Continue to leverage existing Peel Urban Forest Working Group relationship for information sharing between local municipalities in Peel, and for outreach to municipal urban forest staff outside the Region.
	• Continue to use the Green City Working Group to facilitate:
	  ○ Interdepartmental information sharing related to high-level urban forest planning, management, and engagement initiatives, and
	  ○ City greening projects that support the Brampton One Million Trees Program and Brampton Eco Park Strategy (building on OMTP Action 3.7).
	• Provide opportunities for applied tree care learning and internal team building such as:
	  ○ *Host Staff Planting Days to plant trees on City facility grounds* (OMTP Action 3.1.6), and
	  ○ Supporting staff attendance at urban forest workshops and conferences, and hosting 'lunch-and-learns' to bring findings back to share with other staff.
	• Direct new Urban Forest Engagement Coordinator position (see Action 28) to collect, assess, and share data related to the status of outreach and stewardship efforts internally.
	• Ensure staff are aware of the Region's Greenlands Securement Program, which may facilitate bringing existing or potentially significant woodlands into public ownership.
	• Leverage the online resources and networking opportunities available through the Ontario Urban Forest Council (OUFC) and share internally.

Related OMTP action(s)	Action 3.7

Action 5.9: Partner with institutions, agencies, and organizations in urban forest research	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Conservation Authorities (TRCA, CVC) • Peel Region (incl. PUFWG) • School boards (Peel District / Dufferin-Peel Catholic) • Others: Academic institutions, Forests Ontario

Guidance	**General**
	• Proactively approach potential partners to express interest in supporting applied urban forest research with mutual benefit and management utility.
	• Support may include access to study sites, staff time, supervisory and technical oversight, or additional in-kind or other contributions.
	• It is not advised to rely on research partners to lead or undertake urban forest data collection with direct bearing on tree maintenance, tree risk management, or other urban forest operations (e.g., tree inventory).
	
	Areas of interest and partnership
	• Pest, disease, and invasive species management
	  ○ Support development of management plans and strategies
	  ○ Support pest, disease, and invasive species monitoring
	  ○ Pilot invasive species (flora) management methods and approaches in City-managed natural areas
	• Urban forest analysis
	  ○ GIS analysis of urban tree canopy (UTC), potential plantable area (PPA), and other geomatics
	  ○ Inventory analysis and reporting
	  ○ LiDAR and GIS analysis
	  ○ Support for urban forest study and other non-operational data collection and analysis
	  ○ UFMP monitoring metrics – data collection and analysis
	• Urban forest health and climate change adaptation/resilience
	  ○ Assessment of de-icing salt alternatives
	  ○ Stormwater management in urban forest context
	  ○ Tree performance trial establishment and monitoring (Action 20), building on Peel Urban Forest Best Practice Guide 4.
	  ○ Tree Relative Performance Index (RPI) assessment
	• Social dimensions of urban forest management
	  ○ Urban forest equity assessment
	  ○ Social and health outcomes of urban forest management
	
	• Other areas of research interest may be identified by partners and should be considered.

Related OMTP action(s)	*N/A*

Action 5.10: Identify and pursue innovative urban forestry resourcing opportunities from external sources	
Priority category (Impact, Effort)	Moderate Priorities (Moderate, Low)
Lead(s)	Urban Forestry section – Outreach and Engagement unit
Partner(s)	• Multiple external partners

Guidance	• Build on previous and/or ongoing resourcing/funding support.
	• Implement and promote a Brampton Million Trees Donation Program (per OMTP Action 3.3) to support tree establishment on public lands across the city.
	• Work to expand the Residential Tree Program (see Action 33) through partnerships (e.g., LEAF) and/or other sources of subsidized and/or free trees and/or planting services for residential properties (OMTP Action 2.6.1).
	• Explore potential funding and resource sharing opportunities from organizations focused on tree and environmental initiatives (e.g., Tree Canada, Forests Ontario, Evergreen, EcoSource, TD Friends of the Environment, Trillium Foundation).
	• Explore potential public sector funding and resource sharing opportunities, including sources that may not be exclusively aligned with the urban forest such as:
	  ○ Federal and Provincial funding and/or assistance for natural asset management planning and/or maintenance.
	  ○ Federal and Provincial funding for infrastructure (including green infrastructure) and/or climate change adaptation.
	• Engage with local First Nations to identify shared goals related to the urban forest and mechanisms for successful collaboration.
	• Work with Peel Region and other area municipalities to advocate for dedicated Provincial support for urban forest planning and management.

Related OMTP action(s)	Actions 2.6.1 and 3.3

2.3 Implementation resourcing

Except where noted in the detailed action implementation guidance (Section 3.2), UFMP action implementation will be the responsibility of the Urban Forestry section of the Parks Maintenance and Forestry division of the Community Services Department. UFMP action implementation will require considerable expansion of, and additional resources to support, the Urban Forestry section.

The proposed organizational structure of the Urban Forestry section, necessary to fully implement the UFMP, is outlined in detail in Action 2.1 and in Figure 2, above.

Table 4 and Figure 3, below, outline the proposed Urban Forestry section organizational units (i.e., divisions, business units, work units, and sub-units) primarily responsible for the implementation of specific UFMP actions, along with the assigned action items.

Table 5 presents the recommended actions, organized by strategic goal and including lead proposed organizational unit responsible for implementation.

Table 4: Proposed Urban Forestry section organizational units and associated UFMP actions. Action items are organized by priority category, including TP/QW: Top Priorities/Quick Wins, BM: Big Moves, and MP: Moderate Priorities. Responsibilities for each organizational unit are outlined in detail in Action 2.1. *(s)* denotes supporting role for division/department outside Community Services, Parks Maintenance and Forestry, Urban Forestry section. Action items distributed between two or more organizational units denote shared responsibility for implementation.

Section	Division	Business Unit	Work Unit	Action Items
Urban Forestry	**Operations**	Urban Forest Maintenance	Tree Inspection	TP/QW: 2.4 BM: 2.5 MP: 3.4
			Maintenance Operations	TP/QW: 2.4, 2.7 BM: 2.6 MP: 3.3
			Contract Administration	*(Tree Maintenance sub-unit)* BM: 2.6
				(Tree Establishment sub-unit) BM: 3.5
		Urban Forest Health	Integrated Pest Management (IPM)	TP/QW: 2.8 BM: 2.9
			Monitoring and Analysis	TP/QW: 1.5, 2.2 BM: 1.1, 1.3 MP:1.2, 1.4
	Planning TP/QW: 4.2*(s)* MP: 4.1*(s)*	Tree Protection and Plan Review	Plan and Permit Review	TP/QW: 4.3 BM: 4.4
			Compliance Inspection and Enforcement	TP/QW: 4.3 BM: 4.4
		Strategic Initiatives	One Million Trees Program (OMTP)	TP/QW: 3.1 BM: 3.6 MP: 3.2
			Natural Areas Management	MP: 3.2, 4.5
			Capital Projects and Landscape Architecture	BM: 3.3, 3.5
		Outreach and Engagement		TP/QW: 5.7, 5.8 BM: 3.6, 5.1 MP: 5.2 - 5.6, 5.9, 5.10
	Administration			

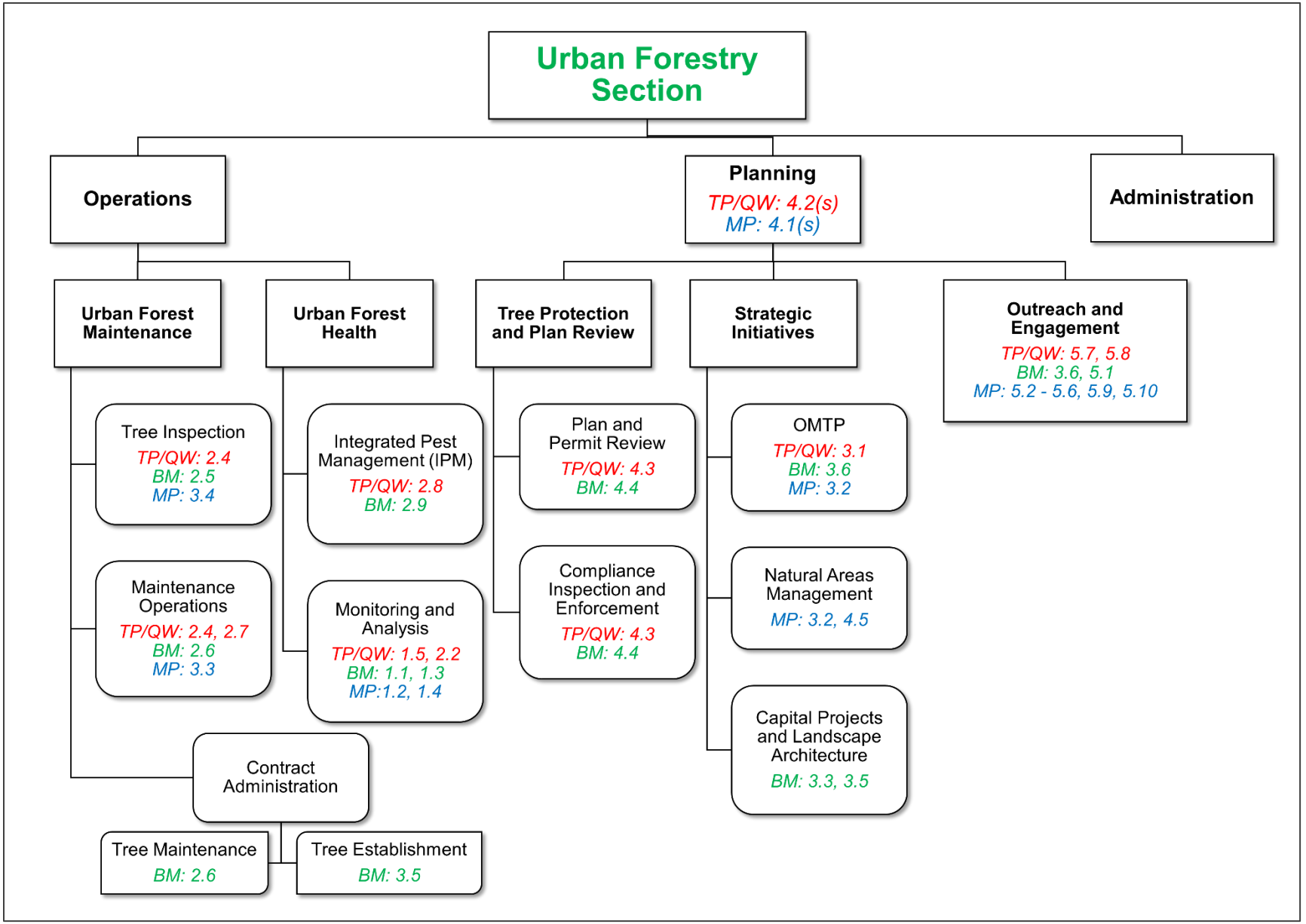


Figure 3: Recommended organizational chart for the Urban Forestry division within the City of Brampton Community Services Department, including UFMP action implementation lead responsibility assigned to individual organizational units.

Table 5: Brampton Urban Forest Management Plan recommended actions, organized by strategic goal and including lead proposed organizational unit responsible for implementation.

Goal	No.	Action	Org. Section
1. Understand	1.1	Collect and maintain an inventory of City-owned trees and potential tree planting sites	Monitoring and Analysis
	1.2	Collect an inventory of high-priority trees on private lands	Monitoring and Analysis
	1.3	Undertake an urban forest canopy and structure study	Monitoring and Analysis
	1.4	Undertake an urban forest climate change vulnerability assessment	Monitoring and Analysis
	1.5	Monitor and report on progress towards urban forest targets	Monitoring and Analysis
	1.6	Review and update the Urban Forest Management Plan every five years	Multiple (Operations and Planning)
2. Maintain	2.1	Update and expand the Urban Forestry section to support implementation of the UFMP	*N/A*
	2.2	Include urban forest data in the City's Corporate Asset Management Plan and systems	Monitoring and Analysis
	2.3	Develop an urban forestry operations Levels of Service manual	Maintenance Operations
	2.4	Develop a tree risk management policy	Maintenance Operations/ Tree Inspection
	2.5	Enhance tree risk management capabilities and practices	Tree Inspection
	2.6	Continue and enhance existing tree maintenance programs and practices	Maintenance Operations, Contract Admin. - Tree Maintenance
	2.7	Implement a young tree structural pruning program	Maintenance Operations
	2.8	Develop an urban forest pest, disease, and invasive species strategy and priority response plans	Integrated Pest Management (IPM)
	2.9	Enhance urban forest pest, disease, and invasive species management	Integrated Pest Management (IPM)
3. Grow	3.1	Identify and prioritize tree establishment areas based on equity, services, and climate change adaptation	One Million Trees Program (OMTP)
	3.2	Plant more trees in parks and open spaces where they will not conflict with formalized park uses	One Million Trees Program (OMTP), Natural Areas Management
	3.3	Update and consolidate tree establishment policies and guidelines	Capital Projects and Landscape Architecture
	3.4	Undertake tree performance trials to diversify the urban forest and identify climate-ready trees	Tree Inspection
	3.5	Enhance all aspects of tree establishment for both City- and developer-planted trees	Contract Admin. - Tree Establishment, One Million Trees Program (OMTP), Compliance Inspection and Enforcement
	3.6	Expand community involvement in tree planting and care on public lands	Outreach and Engagement, One Million Trees Program (OMTP)

Goal	No.	Action	Org. Section
4. Protect	4.1	Ensure that the urban forest is considered in all aspects of city planning	City Planning and Design (PBED) (w/ UF section Planning support)
	4.2	Update the Official Plan with policies specific to the urban forest	City Planning and Design (PBED) (w/ UF section Planning support)
	4.3	Review and update tree by-laws every five years	Plan and Permit Review, Compliance Inspection and Enforcement
	4.4	Increase the City's capacity to ensure that tree protection and planting plans are implemented properly on development sites	Plan and Permit Review, Compliance Inspection and Enforcement
	4.5	Develop and apply standards for City-owned woodland management	Natural Areas Management
5. Engage	5.1	Develop and implement an Urban Forest Awareness and Engagement Program	Outreach and Engagement
	5.2	Facilitate urban forest community-based science	Outreach and Engagement
	5.3	Enhance urban forest online and social media content	Outreach and Engagement
	5.4	Develop an urban forest products and foods utilization program	Outreach and Engagement
	5.5	Encourage and recognize urban forest stewardship	Outreach and Engagement
	5.6	Develop partnerships for tree establishment and urban forest stewardship on institutional and corporate lands	Outreach and Engagement
	5.7	Expand the Residential Tree Program in partnership with others	Outreach and Engagement
	5.8	Enhance urban forest information sharing and cooperation across City departments	Outreach and Engagement (w/ multiple units supporting)
	5.9	Partner with institutions, agencies, and organizations in urban forest research	Outreach and Engagement
	5.10	Identify and pursue innovative urban forestry resourcing opportunities from external sources	Outreach and Engagement

2.4 Funding urban forest management

As in communities across Canada, urban forest management in Brampton is predominantly funded through the City's operating and capital budgets, which in turn are supported by taxes and levies, user fees and service charges, reserve funds and investments, development charges, and Federal and Provincial contributions and transfers. These traditional sources will likely remain the primary funding sources for urban forest management in Brampton throughout the UFMP planning horizon and beyond. However, these same sources fund many other municipal services and initiatives, limiting resource availability for urban forest management. Moreover, some funding sources, such as development charges or many grant programs, can only be directed towards the construction of new (and traditionally "gray") infrastructure and cannot be used to support monitoring or maintenance. This further limits resource availability for urban forest management.

While municipalities in Ontario do not have access to some funding tools available to jurisdictions in other provinces, such as community revitalization levies or local improvement or special taxes, other innovative and non-traditional resource opportunities to support urban forest management may be available to Brampton and its partners, and should be explored. Examples of potential sources are described below.

2.4.1 Community Benefits Charges (CBC)

The Provincial *COVID-19 Economic Recovery Act, 2020* amended Section 37 of the *Planning Act* to permit municipalities to impose community benefits charges (CBC) "against land to pay for the capital costs of facilities, services, and matters required because of development…" as of September 18, 2022. Community benefits charges must be specified in an associated by-law, which in turn must be informed by a community benefits charge strategy that identifies the facilities, services and matters that will be funded with community benefits charges. To date, it is unclear to what extent community benefits charges may be used to support urban forest-related capital initiatives in Brampton. However, the relevant legislation does not prescribe eligible services or other matters, and the City should therefore ensure that urban forest infrastructure (e.g., trees and tree growing environments) are included in the community benefits charges strategy and by-law to the fullest extent possible.

2.4.2 Density Bonusing

Density bonusing is a planning tool that allows proposed development to exceed permitted height and/or density in return for "facilities, services or matters" or equivalent cash-in-lieu. Density bonusing can be used to support urban forest-related capital initiatives such as green space or park development. However, the utility of this planning tool to support urban forest-related benefits will be limited, as the density bonusing regime will be eliminated in favour of the community benefits charges framework in September 2022.

2.4.3 Grants

Various external grant funding opportunities may be available for municipalities and/or municipal partners to support urban forestry initiatives. Although the availability of grant opportunities changes regularly, several opportunities appear to be consistently available for eligible projects and recipients. These include the TD Friends of the Environment Foundation, Tree Canada Community Tree Grants, the Canadian Tree Fund (for tree research and education projects), the Environment Canada EcoAction Community Funding Program, the North American Partnership for Environmental Community Action (NAPECA), and WWF Go Wild School Grants, among others. In 2021, the Federal government began to allocate over $3 billion to support "nature-based climate solutions", which may include partnerships with local governments to support tree establishment in a climate change adaptation and mitigation context. In August 2021, Brampton was awarded $1.28 million in Federal funding to support tree planting.

Although many grant funding opportunities may not be directly available for municipal governments and may not support monitoring or maintenance of existing urban forest assets, the City can work collaboratively with grant recipients to prepare grant funding applications, support and jointly implement grant-funded initiatives, and achieve broader urban forestry objectives through such partnerships.

2.4.4 Urban forest reserve funds

Similar to several other municipalities (e.g., Burlington, ON; Newmarket, ON; Saanich, BC; Toronto, ON), Brampton has established an urban forestry discretionary reserve fund (Reserve Fund #18 – Tree Canopy Account). Brampton's urban forestry reserve, in place since 2018, is largely funded by tree removal compensation cash-in-lieu payments, and to date has been used to support the tree giveaway portion of the newly initiated (September 2021) Residential Tree Planting Program. The City's Tree Canopy Account can likely be used to support additional urban forest initiatives, including action items outlined in the UFMP Implementation Plan. The City should investigate further opportunities for growing the reserve fund in addition to tree compensation cash-in-lieu payments, such as directing a portion of community benefits charges or development charges to service-specific reserve funds, as prescribed pursuant to the *Development Charges Act, 1997.* Financial analysis and forecasting should also be undertaken for the Tree Canopy Account to project fund growth and resultant resource availability, and the fund should be operated in accordance with the City's standard reserve/reserve fund management practices (e.g., reporting, operating off interest/growth, etc.)

2.4.5 Cost recovery

Where feasible, it may be possible to operate elements of a municipal urban forest management program under a cost recovery model. Under such a framework, the full or partial cost incurred by the municipality to fulfill some types of externally generated service requests is charged back to the requestor as a fee, thereby reducing operating budget impacts. Cost recovery is typically reserved for service requests that primarily advance private interests, such as development application review, on-site oversight or compliance inspection, permit processing, or public tree removal to facilitate development. In situations where public trees are removed to facilitate private interests, cost recovery is intended to complement, and not replace, the compensation (tree replacement or cash-in-lieu) for the approved removal or injury of public trees.

The cost recovery model cannot be applied to routine urban forest maintenance operations such as public tree inspection or maintenance, even if service requests are generated externally.

2.4.6 Fundraising and philanthropy

Private citizens, groups, foundations, and corporations may have an interest in providing financial or in-kind support for urban forestry projects and initiatives, especially if such initiatives align with organizational mandates or values. Opportunities for obtaining such support should be explored, and the City's willingness to partner with interested parties should be publicized.

3 Conceptual renderings

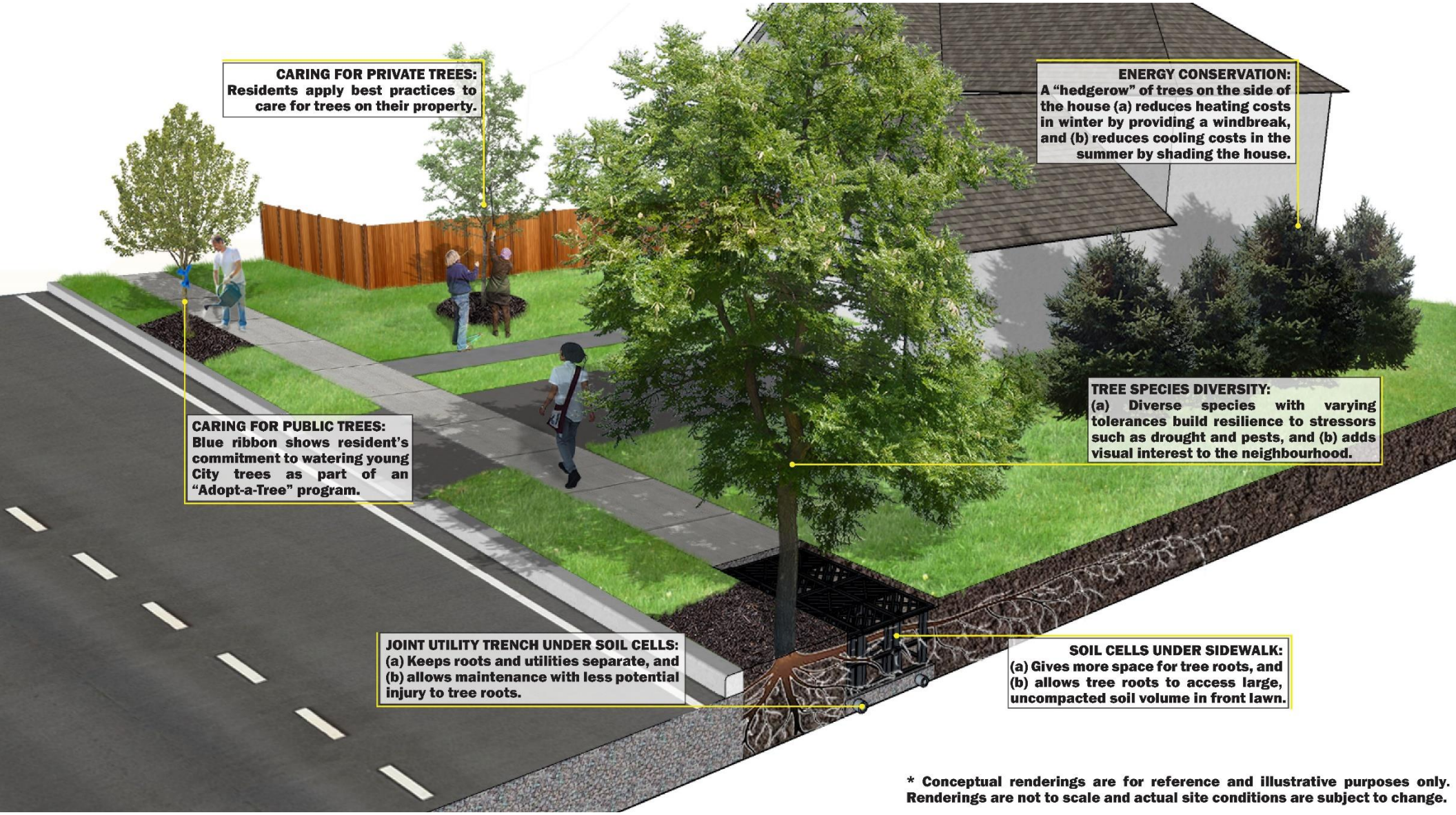
The City of Brampton Urban Forest Management Plan includes a series of four rendered illustrations that conceptually depict the implementation of a number of recommended actions or action item elements. The four conceptual drawings include:

1. **Residential streetscape:** The residential streetscape conceptual rendering depicts the implementation of engineered growing environment solutions including root break-out zones that allow the roots of trees situated in narrow boulevards to access the large volumes of uncompacted soil in adjacent yards, and joint utility trenches below sidewalks which prevent root/infrastructure conflicts and facilitate maintenance while minimizing the risk of root damage and tree injury. The concept also shows engaged residents applying best practices for tree care and maintenance, such as watering newly planted street trees and structurally pruning young trees on private property. The concept also depicts a diverse range of tree species, which promotes urban forest resilience, and trees planted in ways that maximize the services they provide to the community (such as shading and providing windbreaks to the adjacent house).

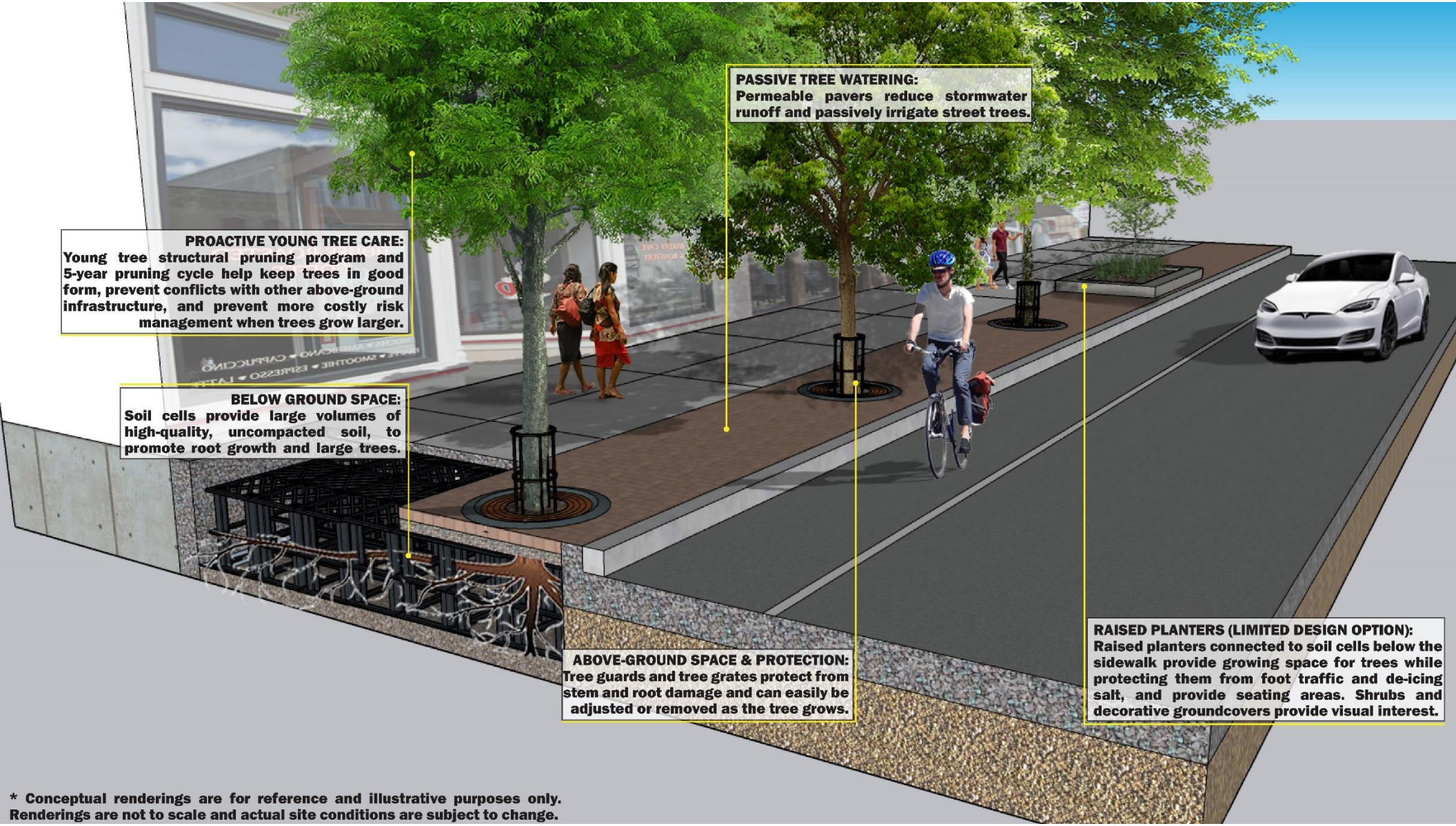
2. **Urban streetscape:** The urban streetscape conceptual rendering depicts a downtown "Main Street" scenario. Trees are planted in engineered rooting environments constructed of structural soil cells, that allow tree roots to access large volumes of uncompacted soils while supporting an urbanized "hardscape" above-ground. Trees are protected using removable tree guards and easily maintainable tree grates that can be expanded as the trees grow, to prevent girdling. A diverse range of tree species is planted and maintained according to best practices, such as a 5-year tree pruning cycle, to provide clearance to pedestrians, vehicles, and commercial signage, while providing a dense leafy canopy that contributes to a comfortable, welcoming, and pedestrian-friendly environment. Design options such as permeable pavers or raised-edge planters, which can be implemented where appropriate and feasible, promote tree health by protecting them against de-icing salt contamination and providing passive irrigation through stormwater infiltration.

3. **Parking lot:** The parking lot conceptual rendering depicts a municipal or commercial parking lot that meets multiple design objectives, including stormwater management, urban heat island mitigation, and promotion of biodiversity (among others). The bioswale captures and filters stormwater runoff while providing a large soil volume to support mature shade trees, and provides an opportunity to plant a diverse range of tree species, including novel and underutilized verities. Shading of parked cars and pavements cools the local microclimate while also reducing fuel evaporation from gas tanks, thereby protecting air quality.

4. **Park and woodland edge:** The parkland and woodland edge conceptual rendering illustrates a city park where an existing woodland has been retained and where the local community has been engaged in growing and caring for the urban forest. Trees removed through urban forestry operations have been repurposes as play structures and park furniture, sequestering carbon and reducing waste, and trees are planted strategically to provide shade and cooling and improve air quality near the playground. Community members are actively engaged in caring for woodlands and natural areas through invasive species management, and safe harvesting of urban forest foods, such as berries, is encouraged. Naturalized forest edges encourage nature connection and provide habitat for a wide range of species, and community members are engaged in planting and caring for young trees throughout the park to sustain and expand the urban forest.



* Conceptual renderings are for reference and illustrative purposes only. Renderings are not to scale and actual site conditions are subject to change.



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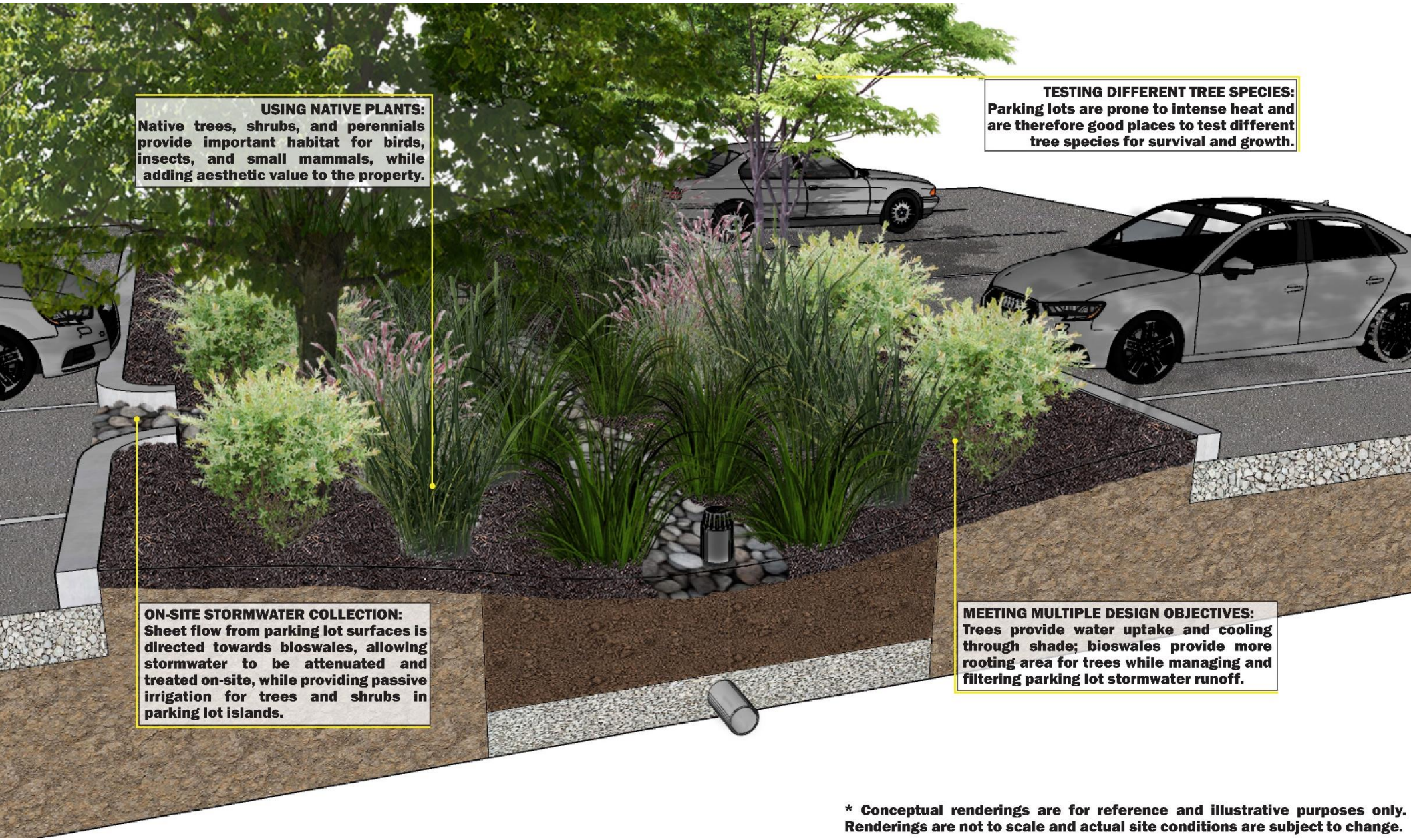

*** Conceptual renderings are for reference and illustrative purposes only. Renderings are not to scale and actual site conditions are subject to change.**


LOCAL WOOD RE-USE:
City trees, removed through urban forestry operations, are repurposed as durable park furniture. Salvaged wood is diverted from the waste stream and stores carbon.
FOREST FOOD:
Harvesting fruit from native plants, such as Serviceberries, for community consumption through local food banks, providing local and organic nutrition.
CARING FOR OUR FORESTS:
(a) Forest edges naturalized with diversity of small native trees and shrubs, and (b) community members engaged in invasive species 'weed pulls' - protecting forest health and improving ecological function.
COMMUNITY HEALTH BENEFITS:
Trees are strategically placed to provide natural shade for playground structures, providing cooling, improving air quality, and protecting people from harmful UV rays.
COMMUNITY TREE PLANTING:
Community partners establishing trees on park lands, helping to meet the goal of planting one million trees by 2040.
* Conceptual renderings are for reference and illustrative purposes only.
Renderings are not to scale and actual site conditions are subject to change.

City of Brampton

Urban Forest Management Plan (2022-2032)

References

Prepared by:

Urban Forest Innovations Inc.
Beacon Environmental Ltd.
A. Kennedy Consulting Ltd.

References

Ambrose, M.J. 2016. The 10-20-30 rule revisited: Is it a useful standard for urban forest diversity. Presentation at Partners in Community Forestry, Indianapolis, IN, November 16-17, 2016.

American Forests. 2017. Why We No Longer Recommend a 40 Percent Urban Tree Canopy Goal. Available online at: https://www.americanforests.org/blog/no-longer-recommend-40-percent-urban-tree-canopy-goal/. Last accessed December 16, 2021.

American National Standard Institute. 2017. ANSI A300 (Part 9)-2017: Tree, Shrub and Other Woody Plant Management – Standard Practices (Tree Risk Assessment a. Tree Failure).

Ball, J. 2015. American Nurseryman - Using a 5 percent rule for tree selection. 21 January 2015. Available online at https://www.amerinursery.com/american-nurseryman/the-5-percent-rule/. Last accessed December 16, 2021.

Berman, M.G., Jonides, J., and S. Kaplan. 2008. The cognitive benefits of interacting with nature. Psychological Science 19: 1207-1212.

Canadian Cancer Society. 2021. Spotlight on sun safety. Available online at https://cancer.ca/en/cancer-information/reduce-your-risk/be-sun-safe/spotlight-on-sun-safety. Last accessed December 16, 2021.

Canadian Nursery Landscape Association (CNLA). Undated. Canadian Nursery Stock Standard (Ninth Edition). 60 pp.

Clark, J.R., Matheny, N. P., Cross, G. and V. Wake. 1997. A model of Urban Forest Sustainability. Journal of Arboriculture 23, 1: 17-30.

Coutts, A. and R. Harris. 2012. A multi-scale assessment of urban heating in Melbourne during an extreme heat event and policy approaches for adaptation. Melbourne: School of Geography and Environmental Science, Monash University.

Donovan, G.H., and D.T. Butry. 2010. Trees in the city: valuing street trees in Portland, Oregon. Landscape and Urban Planning 94: 77–83.

Donovan, G.H., Burty, D.T., Michael, Y.L., Prestemon, J.P., Liebhold, A.M., Gatziolis, D. and M.Y. Yao. 2013. The relationship between trees and human health: Evidence from the spread of the Emerald Ash Borer. American Journal of Preventive Medicine 44: 139-145.

Faeth, S.H., Bang, C. and S. Saari. 2011. Urban biodiversity: patterns and mechanisms. Annals of the New York Academy of Sciences: 69-81.

Fernandez-Juricic, E. 2000. Avifaunal use of wooded streets in an urban landscape. Conservation Biology 14: 513-521.

Forest Commission of the United Kingdom. Undated. Noise abatement. Available online at: https://www.forestry.gov.uk/fr/infd-8aefl5. Last accessed December 16, 2021.

Gilman, E.F. and A. Bisson. 2007. University of Florida, Institute of Food and Agricultural Sciences. The urban forest hurricane recovery program. Factsheet. Chapter 12: Developing a preventive pruning program: Young trees. Publication ENH 1052. Available online at: https://hort.ifas.ufl.edu/woody/documents/ch_12_mw04.pdf. Last accessed December 16, 2021.

Green Infrastructure Ontario. 2015. Urban Forests: Call to Action. Available online at: http://greeninfrastructureontario.org/wp-content/uploads/2016/06/GIO_Urban_Forest_Call_to_Action_Sept15Print.pdf. Last accessed December 16, 2021.

Heisler, G. M. 1986. Energy savings with trees. Journal of Arboriculture 12: 113–125.

International Society of Arboriculture. 2017. Best Management Practices, Tree Risk Assessment, Second Edition. 16 pp.

Kenney, W. A. 2000. Leaf area density as an urban forestry planning and management tool. The Forestry Chronicle 76, 2: 235-239.

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

Kuo, F.E., Sullivan, W.C., Coley, R.L., and L. Brunson. 1998. Fertile ground for community: Inner-city neighborhood common spaces. American Journal of Community Psychology 26: 823-851.

Leff, M. I. 2016. The Sustainable Urban Forest: A Step-by-Step Approach. U.S. Forest Service and Davey Institute.

Lerman, S.B, Nislow, K.H., Nowak, D.J., DeStefano, S, King, D.I. and D.T. Jones-Farrand. 2014. Using urban forest assessment tools to model bird habitat potential. Landscape and Urban Planning 122: 29-40.

Manea, A., Staas, L., Plant, L., Ossola, A., Beaumont, L., Power, S., Johnson, T., Gallagher, R., Griffiths, G., & Leishman, M. 2021. *Climate ready street tree trials: A best practice guide*. Macquarie University. Available online at: https://doi.org/10.25949/v8n7-wt66. Last accessed April 13, 2022.

McPherson, E.G. and J. Muchnick. 2005. Effects of street tree shade on asphalt concrete pavement performance. Journal of Arboriculture 31: 303-310.

Miller, R.W., and Sylvester, W.A. 1981. An economic evaluation of the pruning cycle. Journal of Arboriculture 7, 4: 109-111.

Miller, R.W., Hauer, R.J., and Werner, L.P. 2015. Urban forestry: planning and managing urban greenspaces. Waveland press. 560 pp.

Naderi, J.R. 2003. Landscape design in clear zone: Effect of landscape variables on pedestrian health and driver safety. Transportation Research Record 1851, 1: 119-130.

Nordh, H., Hartig, T., Hagerhall, C. M., and G. Fry. 2009. Components of small urban parks that predict the possibility for restoration. Urban Forestry & Urban Greening 8: 225-235.

Region of Peel. 2017. An Assessment of Urban Tree Canopy Cover in Peel Region 2015. October 6, 2017. B.A. Blackwell and Associates Ltd. 75 pp.

Richards, N.A. 1983. Diversity and stability in a street tree population. Urban Ecology 7: 159–171.

Santamour, F.S. 1990. Trees for urban planting: Diversity, uniformity, and common sense. Metropolitan Tree Improvement Alliance Proc. 7: 57–65.

Scharenbroch, B.C., Carter, D., Bialecki, M., Fahey, R., Scheberl, L., Catania, M., Roman, L.A., Bassuk, N., Harper, R.W., Werner, L. and Siewert, A., 2017. A rapid urban site index for assessing the quality of street tree planting sites. Urban Forestry & Urban Greening 27: 279-286.

Sisinni, S.M., Zipperer, W.C., and Pleninger, A.G. 1995. Impacts from a major ice storm: street-tree damage in Rochester, New York. Journal of Arboriculture 21, 3: 156-167.

Slater, G. 2010. The cooling ability of urban parks. Master's thesis, University of Guelph. School of Environmental and Rural Design.

Sullivan, W.C., Kuo, F.E. and S. DePooter. 2004. The fruit of urban nature: Vital neighborhood spaces. Environment and Behavior 36: 678-700.

Taylor, A. F., Kuo, F.E. and W.C. Sullivan. 2001. Coping with ADD: The surprising connection to green play settings. Environment and Behavior 33: 54-77.

Toronto and Region Conservation Authority (TRCA). 2011. City of Brampton Urban Forest Study. Technical Report. June 2011. 124 pp.

Tree Canada. Undated. Canadian Urban Forest Network (CUFN) Compendium of Best Management Practices. Available online at: https://treecanada.ca/resources/canadian-urban-forest-compendium/. Last accessed December 16, 2021.

Ulrich, R.S. 1984. View through a window may influence recovery from surgery. Science 224: 420-421.

Ulrich, R.S., R.F. Simons, B.D. Losito, E. Fiorito, M.A. Miles, and M. Zelson. 1991. Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology 11: 201–230.

United States Environmental Protection Agency (EPA). 2016. Stormwater Trees: Technical Memorandum. EPA Contract No. EP-BPA-13-R5-0001. Available online at: https://www.epa.gov/sites/default/files/2016-11/documents/final_stormwater_trees_technical_memo_508.pdf. Last accessed: January 6, 2022.

Urban Tree Foundation. 2010. Tree Quality Cue Card. Available online at: http://www.urbantree.org/pdf/treequalityonsheet.pdf. Last accessed December 16, 2021.

Wolf, K.L. 2007. City Trees and Property Values. Arborist News 16, 4: 34-36.