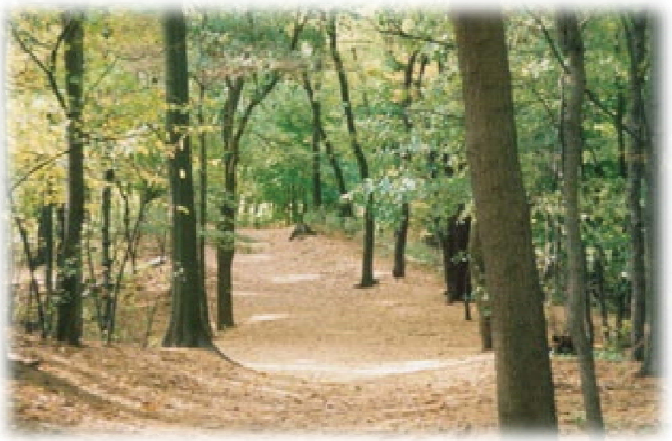


Management and Implementation ~ Community Engagement and Stewardship ~ Protection and Preservation

Replenishment and Enhancement ~ Tree Health and Risk Management

CITY OF BURLINGTON | **URBAN FOREST MANAGEMENT PLAN** | 2011-2030

JULY 2010

CITY OF Burlington

Table of Contents

OVERVIEW

Burlington residents enjoy a high quality of life in a vibrant, healthy and prosperous community. All of the city's trees, whether they are along streets or in parks, in yards or in woodlands, in the urban or in the rural areas, contribute significantly to the city's health and are considered part of the *urban forest*. The effective management of this diverse and valuable resource is the focus of this plan.

Burlington's urban forest includes trees of different species, ages and sizes. Some are large, old remnants of the area's natural forests; others are small, young saplings. Some have been planted; others have regenerated on their own. All of these trees form part of the city's *green infrastructure,* which sustains the community by filtering air pollution, providing shade, reducing energy use and bringing nature to the city.

Burlington's urban forest, as in many cities, is confronted with various challenges that threaten its health and sustainability. Primary pressures include changes in land use, urban intensification, conflicts with infrastructure, climate change, invasive pests, plants and diseases, and limited allocation of resources.

To maintain and enhance the urban forest under these conditions requires careful planning, effective management, adequate resource allocation and ongoing cooperation between the city, its residents and other local stakeholders.

In *Future Focus Seven*, the city's strategic plan, city Council committed to the development and implementation of an Urban Forest Management Plan (UFMP).

The purpose of this plan is to increase urban forest management effectiveness and efficiency, improve tree health and diversity, minimize risks to the public and maximize the benefits provided by a healthy and sustainable urban forest.

This plan identifies opportunities on both public and private lands, in urban and rural Burlington, and focuses on five key areas:

1. Management and Implementation
2. Community Engagement and Stewardship
3. Protection and Preservation
4. Replenishment and Enhancement
5. Tree Health and Risk Management

Recommendations for each of these areas have been developed based on a comprehensive review of Burlington's current practices, evaluation of leading examples from other jurisdictions and input from Council, city staff, various stakeholders and the community.

The recommendations have been assigned priorities within the plan's 20-year framework, considering actions likely to provide the most tangible benefits in the short and long-term. These priorities will need to be reviewed every five years and may be adjusted to reflect changes in existing conditions and/or resource availability.

URBAN FOREST BENEFITS

Urban forests provide a wide range of benefits to cities and the areas around them. These have been well documented in various studies and reports, and the latest research has begun ascribing economic value to some of these benefits.

Environmental Benefits

Trees in cities provide valuable environmental services, including these:

- filtering air pollution
- moderating the urban heat island effect
- providing energy savings by shading buildings in the summer and screening them from wind in the winter
- cleaning and reducing storm water runoff and
- removing atmospheric carbon.

Trees in built-up areas also provide habitat for urban-adapted wildlife and migratory birds, and they can provide temporary refuge for some types of wildlife moving between natural areas. Woodlands in both urban and rural areas provide habitat for a variety of species, including plant and animal *species at risk*.

Although there remains uncertainty about how different species and ecosystems are going to respond to the shifts predicted to be associated with climate change (i.e. shifts in temperature and precipitation and increased incidence of extreme weather events), it's generally agreed in the scientific community that the maintenance and restoration of treed areas is one of the easiest and least expensive means of reducing greenhouse-gas emissions and of cooling urban and rural environments.

VALUING THE URBAN FOREST

Each year, every street tree in Burlington provides over $67 in net benefits* by reducing building energy use, improving air quality, and storing carbon. This means that Burlington's 52,000 street trees combined provide an estimated $3.5 million annually for these environmental benefits alone. Since street trees account for only a small proportion of the canopy cover, the environmental value of Burlington's entire urban forest would be much greater.

*** Calculated using the United States Forest Service's *i-Tree Streets* computer model.**

Social/Economic Benefits

Trees and green spaces have been linked to improvements in these:

- physical and psychological well-being
- visual screening and noise reduction
- safety for pedestrians and other road users and
- property values.

Urban spaces with large, healthy trees feel more welcoming and safer than those without them. Stress levels have been found to be lower among people who enjoy even moderate exposure to trees and green areas, and research shows that trees facilitate positive social interaction.

PREAMBLE

The following vision, guiding principles and strategic objectives have been developed based on input from consultations with Council, city staff, representatives from a cross section of stakeholder groups and members of the community. These have also been developed with careful consideration for best practices and for Burlington's unique environmental and social context. The themes that run through these statements are intended to be realized through the implementation of the recommendations laid out in this plan.

VISION

The trees and woodlands of Burlington's urban forest will be maintained and enhanced for the long term, in recognition of the valued environmental, social and economic services they provide. The city will work with its partners and the community in the urban and rural areas to ensure that this essential resource is managed effectively to maximize tree cover and health, increase native biodiversity, minimize risks to public and property and contribute to the environmental sustainability and quality of life in Burlington.

GUIDING PRINCIPLES

The following seven principles are intended to guide the implementation of this plan over the long term.

i. The city's urban forest, a major component of its green infrastructure, is a valued and shared resource.

ii. The city, its residents and other local stakeholders must work together to improve and expand Burlington's urban forest.

iii. The right tree must be planted in the right place to reach its full potential.

iv. The city's urban forest must include a high diversity of *native* and non-*invasive species* to improve its resilience to various stressors, including climate change.

v. Tree protection and replenishment must be priority considerations during development and intensification.

vi. The city's trees must be maintained in a healthy and safe condition through ongoing risk management practices, a *Plant Health Care (PHC)* and *Integrated Pest Management (IPM)* approach.

vii. This plan must adopt an *adaptive management* approach that allows for changes in response to new information or new circumstances.

STRATEGIC GOALS

The following seven goals identify the key items that the City of Burlington is seeking to achieve through implementation of this plan.

1. **Increase awareness** among city staff, local landowners and residents alike about the benefits and services provided by the urban forest and how to care for it.

2. **Foster engagement and stewardship** in both the urban and the rural areas by providing resources, building partnerships and supporting educational and hands-on activities.

3. **Transition the city from a reactive to a proactive management paradigm** by implementing appropriate policies and management practices related to both the protection of existing trees and the planting of new trees, on public and private lands.

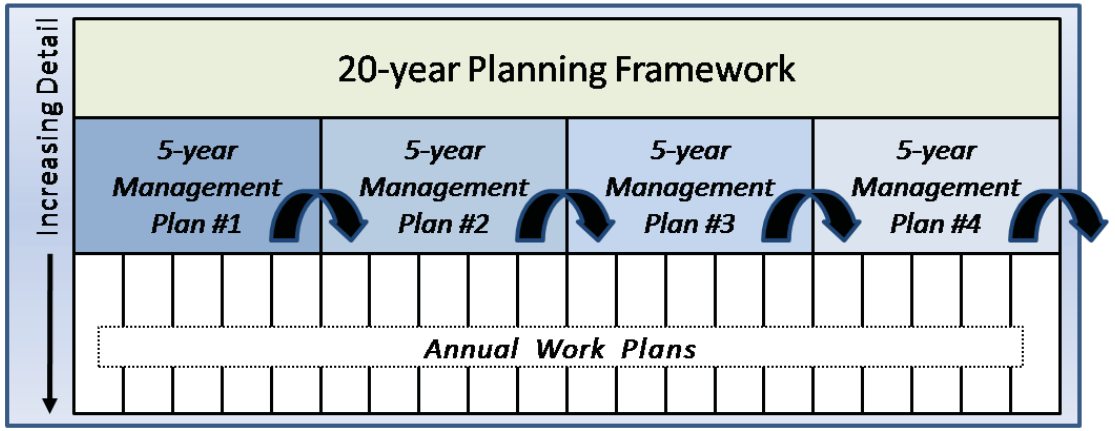
4. **Improve the resilience of trees and woodlands** to current and anticipated stressors by implementing policies and management practices that optimize *native species* diversity and tree growth potential.

5. **Minimize the risk presented by trees** in the urban forest to people and property on public lands by expanding and formalizing the city's current risk management practices.

6. **Monitor and review the status of the urban forest** using established criteria and indicators on a regular basis, and revise planning and practices as required to ensure ongoing progress towards realizing the vision.

7. **Ensure that the urban forest is recognized as a critical municipal asset** and infrastructure component through a long-term commitment to proactive management, adequate resource allocation and joint stewardship by city staff and the community.

PLAN FRAMEWORK



This plan spans 20 years because trees are a long-lived resource, and this span is considered a realistic timeline during which the guiding vision and strategic objectives can be realized. The recommendations in this plan will translate into immediate changes and inform day-to-day urban forest management policies and operations through four five-year management plans, as well as annual work plans developed by city staff.

This document lays out the long-term (i.e. 20 year) framework as well as the initial five-year management plan through the timing identified in the recommendations. Each subsequent five-year plan will confirm the priority actions and timing of outstanding recommendations, both from a policy and operational perspective, and identify resource requirements for that five-year period.

2011 – 2015: Five-Year Management Plan #1
2016 – 2020: Five-Year Management Plan #2
2020 – 2025: Five-Year Management Plan #3
2026 – 2030: Five-Year Management Plan #4

This framework allows for re-evaluation of practices and priorities at regular intervals, and it sets in motion policies and programs to transition Burlington from reactive to proactive management of its urban forest.

STATE OF BURLINGTON'S URBAN FOREST

Burlington's urban forest includes extensive wooded natural areas, as well as hundreds of thousands of trees along roads and in parks, yards and other open spaces. Current analysis estimates an average canopy cover of approximately 23%, comprising 17% in the urban area and 28% in the rural area.

The city's diverse topography includes the lower Queenston shale slopes, the Niagara Escarpment, the Peel Plain and the Iroquois Plain along the lakeshore. This landform diversity, as well as its location within Canada's relatively warm Carolinian Zone, is the basis for the city's ability to support a very high level of tree diversity.

The city's wooded natural areas cover more than 3,800 hectares, with most of those (approximately 3,150 hectares) being within the rural areas. Many of these wooded features are protected as designated Environmentally Sensitive Areas (ESAs), and some are also located within the provincial Greenbelt. In addition, Halton Region's by-law 121-05 regulates all woodlands of at least one hectare.

In addition to providing habitat for hundreds of species, including some *species at risk*, the ESAs also provide important ecological corridors and linkages.

Natural woodlands, or forested areas, account for approximately two thirds of the city's canopy cover, while more isolated trees along roads and in open spaces account for the remaining third. Upland deciduous forests are the dominant wooded natural area type in the city, with coniferous forests, treed swamps, plantations and thickets accounting for the remainder.

VALUING BURLINGTON'S STREET TREES

Number of street trees - 52,000
Street tree net benefits - $3.5 million*
Average net benefit - $67 per tree*
Street tree replacement value - $107 million*
Management costs - $2.1 million
Tree benefit/management cost ratio - 1.65:1

**** These are conservative estimates developed using the United States Forest Service i-Tree model, which accounts only for the annual cost savings of reducing building energy use, improving air quality and storing carbon associated with trees in urban settings.***

In 2010, the city completed an inventory of *street trees* in the urban area south of Dundas Street (Highway 5) and Highway 407. Analysis of this data reveals the following:

- The city has 52,000 street trees in its urban area, mostly in fair or good health.
- Most of the trees are young or middle-aged and are non-native (many were planted for desirable traits, such as showy flowers or tolerance for urban conditions).
- Nearly three-fifths of the city's street trees are non-native species.
- Nearly one-fifth of the city's street trees conflict with overhead utility wires or other infrastructure.
- The city's street trees are worth over $107 million in estimated *replacement value*.

This analysis does not include the thousands of trees on public lands in the city's parks and rural communities, including those along rural roads, which have not yet been inventoried.

URBAN FOREST SUSTAINABILITY: CHALLENGES AND SOLUTIONS

Burlington's downtown has been named an urban growth centre in the province's *Growth Plan for the Greater Golden Horseshoe (2006)*. The city's current population of 175,000 is expected to grow to approximately 200,000 by the year 2031.

New residents bring diversity, ideas and new opportunities. They also bring more demand for housing and more pressure on the city's urban municipal services, including roads, sewers, parks and natural areas. These pressures, combined with the already present and emerging threats of tree pests, and environmental stresses anticipated with climate change, will require careful planning, active management, ongoing monitoring and creative problem solving to maintain the urban forest as a healthy and growing entity.

Currently, the biggest threat to the urban forest is the Emerald Ash Borer, which has the potential to decimate the city's ash trees.

At the site-specific level, particularly in urban and urbanizing areas, the biggest pressure on trees is the competition for space both above and below ground.

Below-ground root habitat in built-up areas is typically characterized by inadequate soil volumes, quality and drainage. Roots must share space with underground utilities, and soils can become too compacted to support the fine roots that provide water, oxygen and nutrients. Above ground, trunks, branches and foliage compete for growing space with people, buildings, utility wires and cars. As a result, conditions are typically insufficient to promote tree longevity and health, and trees are unable to reach their *genetic potential*, meaning they ultimately provide fewer benefits and cost more to maintain and replace.

Other conflicts occasionally occur when branch failures, tree roots and uprooted trees damage property and infrastructure and sometimes pose risks to human safety.

Solutions, as recommended in this plan, include the following:

- Identifying adequate space for trees early in the planning and development approval process
- improving above-ground and below-ground site conditions for trees, especially in built-up areas
- protecting trees determined to be significant in the community
- planting a diversity of native and non-invasive tree species, and
- regular, proactive tree care.

Urban trees with adequate growing space and subject to regular maintenance will be more resilient to environmental extremes and to the rigours of urban life and will, therefore, be better able to adapt to future challenges. They will also pose less risk of failure, need to be replaced less frequently and provide exponentially more benefits as they mature.

PLAN DEVELOPMENT

Key Considerations

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

1. The City of Burlington contains a defined urban area that will become increasingly built-up over the next few decades, as well as a rural area whose significant natural spaces are already reasonably well protected by both the Niagara Escarpment and Greenbelt legislation and policies.

2. A number of innovative policies and practices are already in place or under development in the city.

3. Although the city is responsible for thousands of trees on its streets and in its parks and open spaces, most of Burlington's trees are on private land.

4. There will be many challenges involved in protecting and maintaining the city's current tree cover under the existing and anticipated conditions.

5. Resources for urban forest management will likely be a limiting factor for the immediate future.

Key Directions

This plan recognizes each of these key considerations these ways:

1. It recognizes the distinct land-use and policy contexts in Burlington's urban and rural areas and includes a number of specific recommendations targeted to address opportunities unique to each of those areas.

2. It builds on and integrates existing policies and practices that support the vision and strategic goals.

3. It includes strategies for tree protection and replenishment on public and private lands.

4. It includes a recommendation to utilize a suite of criteria and indicators for monitoring the state of Burlington's urban forest, rather than simply setting a target for canopy cover.

5. It provides specific recommendations intended to optimize the cost/benefit ratio of urban forest management.

Other city-wide plans (e.g., Parks and Recreation Master Plan) were also considered during development of this plan.

Consultations

Internal consultations with Council and city staff and external consultations with the community and a cross-section of local stakeholder groups have been a cornerstone in the development of this plan.

These are the top priorities that came out of these consultations:

- the need to draw on best practices from elsewhere in Ontario and beyond
- the importance of early and ongoing education and engagement with a wide range of stakeholders and
- the need to address management of treed resources in all of Burlington (i.e. urban and rural areas, public and private lands).

This plan's recommendations reflect these and other priorities.

THE URBAN FOREST MANAGEMENT PLAN (UFMP)

1 MANAGEMENT AND IMPLEMENTATION

1.1 KEY ISSUES

The management and administration of the urban forest is the shared responsibility of a number of various stakeholders. The majority of the urban forest is under the ownership of residents and other local landowners. However, the city is directly responsible for trees along roads (in both the urban and rural areas) and in parks and open spaces, while the Region owns some woodlands in the city's rural area. Halton Region and the Ministry of Transportation both maintain major road *rights-of-way* throughout Burlington, many of which are lined with trees or present opportunities for tree plantings. Burlington Hydro and Hydro One are responsible for clearing any vegetation that might interfere with transmission lines in the urban and rural areas respectively. Conservation Halton and the Royal Botanical Gardens also own and manage some large wooded areas.

Burlington's municipal departments, the agencies mentioned above, private contractors and citizens are all directly involved in decision-making, funding and management processes that affect the health, structure and function of the urban forest. Communication, coordination and common direction among these parties are critical to realizing urban forest sustainability and implementing good management programs and practices.

It is also important that the status and progress of this plan, and the state of the urban forest, be monitored to ensure that the city is able to realize its vision for a sustainable urban forest.

1.2 CURRENT PRACTICES IN BURLINGTON

Service Delivery

Burlington's urban forest is managed by four municipal departments: Roads and Parks Maintenance, Parks and Recreation, Engineering, and Planning and Building. The city's forestry staff is currently within Roads and Parks Maintenance. Halton Region and Conservation Halton also manage a number of woodlots under their respective ownerships.

Roads and Parks Maintenance conducts operations, such as street and park tree pruning, inspection and planting. This includes maintenance of trees along regional roads. The staff conducts approximately 40% of these maintenance activities directly, and contractors carry out the remaining 60%. City forestry staff also review Tree Saving Plans as part of the site plan application process. They are also responsible for maintaining the current level of service for trees on city lands and for implementing urban forestry operating policies.

The Parks and Recreation Department is responsible for planning Burlington's public facilities, parks and open spaces and undertakes a variety of environmental initiatives, including tree planting and naturalization. All new parks have designated naturalization areas as well as individual tree plantings although some older parks in the city cannot accommodate these initiatives.

The Engineering Department oversees and undertakes a range of capital projects, including road and drainage improvements and subdivision and site servicing. These projects typically include tree plantings, which the department contracts out through tenders.

1.2 Current Practices in Burlington (cont'd)

Service Delivery (cont'd)

The Planning and Building department makes decisions that affect street and park trees and that impact trees on private lands, by regulating land uses, developing and implementing policies and by-laws and carrying out building and site inspections.

Halton Region, through its tree by-law, currently regulates tree removal activities in private woodlands of at least one hectare and in *greenlands* in the city, while Conservation Halton regulates activities in floodplains, valleys and wetlands and along the shoreline irrespective of land ownership.

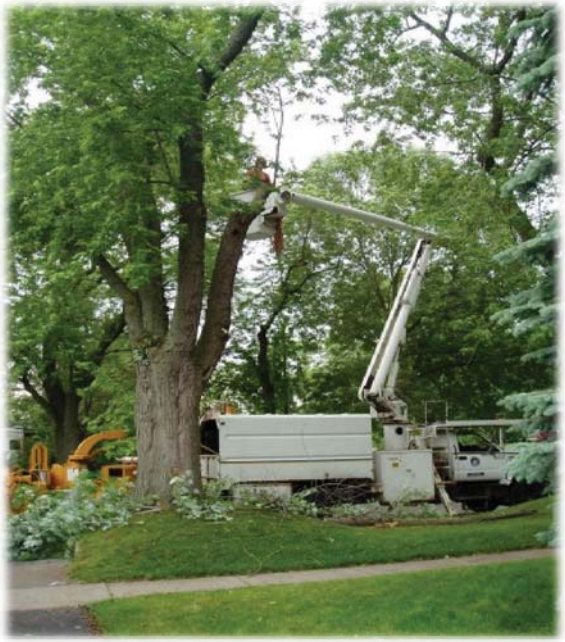
The activities of each city department, the Region and Conservation Halton have a profound effect upon individual trees and wooded areas within the city, as they often oversee, direct or comment on decisions about tree preservation, removal and replacement, as well as enhancement or restoration.

Utility and Road Right-of-Way Maintenance

Utility *right-of-way* and corridor maintenance is conducted with the primary objective of providing adequate clearance between trees and hydroelectric wires to prevent hazards and service disruptions, particularly during storms. Utility pruning is generally conducted on a more frequent basis than *grid pruning* and, often out of necessity, with lesser regard for tree health or proper structure. Burlington Hydro currently prunes trees along the urban utility rights-of-way on a three-year cycle, while Hydro One (which focuses on large transmission lines and the rural areas) uses a six-year cycle.

A key issue concerning utility pruning in Burlington is a lack of co-ordination between municipal and utility pruning activities. Clearer communication and delineation of responsibilities are needed to ensure that overlapping pruning cycles do not lead to inefficiencies. A review of tree planting standards is also needed to ensure that trees planted near utility lines are selected and located to minimize future conflicts as the trees mature and that good arboricultural practices, including proper pruning and hazard tree removal, are implemented.

Halton Region and the Ministry of Transportation maintain roadways and utilities in their rights-of-way. There is currently limited co-ordination between these agencies and the city regarding tree protection and replacement along these corridors.



1.2 Current Practices in Burlington (cont'd)

Tree Asset Management

Trees on city lands, like roads and sewers, are municipal assets, but unlike most other infrastructure they appreciate in value over time. A co-ordinated asset management system, including a baseline assessment, is necessary for successful maintenance of this resource. The Roads and Parks Maintenance department currently uses the Avantis Enterprise Asset Management System to manage many aspects of municipal infrastructure maintenance.

Burlington completed a basic inventory of its street trees in 2010, primarily in the urban areas south of Highway 5. This inventory is not currently linked with the results of the cyclical tree inspections or individual tree work requirements nor tracked in the city's Avantis system. Therefore, as trees are maintained or removed, there is no process to update inventory information. There is also no inventory of Burlington's park trees, street trees in the rural areas, nor records of trees removed or planted as part of the Site Plan Approval process on private lands.

Woodlot and Creek Block Management

Burlington's woodlot management practices are currently limited to annual inspections along *formal trails* in city-owned woodlands for hazard and diseased trees. The city recognizes that there should be more extensive management of city-owned woodlots, as well as in wooded creek blocks and storm water management areas. Key needs likely include invasive species management, ecologically sensitive trails and planting of native trees, as well as shrubs and groundcovers. However, current staffing and resource levels do not support an expanded level of service for these areas.

Budget and Reserve Funding

The 2009 net operating budget for direct urban forestry maintenance was $1.2 million. Additional funding for urban forestry activities such as tree planting and protection are within the Engineering and Parks and Recreation budgets. The city also maintains a "Future Services – Trees" reserve fund to support tree planting. This fund, valued at nearly $200,000 in 2010, is supported by development charges and is directed to the establishment of new trees. The city is currently formalizing the process to draw on these funds.

The city recently redefined its Winter Control Reserve Fund as a Severe Weather Reserve to expand the scope to include catastrophic weather events, such as ice storms, which impact the urban forest. The city has also proactively budgeted $11 million to manage the recently confirmed Emerald Ash Borer infestation on its lands.

1.3 Consultation Input

Consultations to discuss urban forest management and administration issues were held jointly with a number of municipal staff, including engineers, planners, risk managers and urban forestry staff. One of the key considerations identified by staff was a need for ongoing urban forest management and sustainability to be recognized and placed in the greater context of planning, infrastructure management, growth and other community needs. It was agreed that realizing the vision of a sustainable urban forest will depend on long-term financial and community support, as well as improved communication and co-ordination between various municipal departments. The need for improved communication and co-ordination with Burlington Hydro, Hydro One, Halton Region and the Ministry of Transportation on tree protection, pruning, removal and replacement along utility and transportation corridors was also identified.

In terms of implementing and monitoring the Urban Forest Management Plan itself, several stakeholders emphasized the need for measurable criteria and indicators and the importance of tracking both the status of the plan itself and the state of the urban forest. Formalizing a working group for municipal departments, agencies and organizations involved in tree care in the city to communicate and co-ordinate activities and programs was identified as a need. The importance of keeping contractors informed and educated about the city's standards on an ongoing basis was also raised.

1.4 Best Practices

Service Delivery

Many larger municipalities in southern Ontario apply a joint service delivery model to urban forest management. Under this system, urban forest management is carried out by a combination of municipal staff and private contractors. The key variables are the distribution of workload between contractors and staff and the type of work conducted by each. In most examples, municipal staff and contractors share the tasks of routine maintenance such as pruning, while utility line clearing, tree removal and stumping are often contracted out. Planting is often conducted by contractors as part of capital projects, with additional infill planting undertaken by the municipality or contractors by tender.

The main strength of the joint service delivery model is efficiency and cost effectiveness. However, this model can result in some lower quality work by contractors, especially if appropriate standards are not specified and if work is not adequately supervised. Maintaining co-ordination between municipal staff and contractors and clearly defining minimum quality standards as well as ensuring they are implemented are key to successful joint service delivery.

1.4 BEST PRACTICES (CONT'D)

Utility and Road Right-of-Way Maintenance

In some cities, utility providers have contracted municipal forestry departments to conduct pruning in utility corridors and along streets. These municipalities, in turn, then sub-contract part of this work, facilitating co-ordination of inspection and pruning cycles and ensuring that trees are pruned according to standards acceptable to the municipality. Other places bring municipal forestry staff together with utility companies to co-ordinate standards, practices and public awareness campaigns.

Another practice for effective utility right-of-way and corridor management is long-term vegetation community conversion. This means gradual replacement of mature, large growing tree species under utility lines with smaller stature trees and shrubs. Such programs naturally maintain line clearance and reduce potential risk from improperly pruned trees.

Tree Asset Management and Monitoring

There are two general types of urban forest inventories: sample plot-based and complete.

Several municipalities in southern Ontario have completed sample plot-based inventories that collect urban forest data from randomly located sample plots on both private and public property, known as Urban Forest Effect (or UFORE) studies. This data can be analyzed (using the *i-Tree* Eco model) in conjunction with hourly meteorological and air pollution information, to quantify urban forest structure, environmental benefits and value to the community.

Model outputs can be used to support effective resource management decisions, developing policy and setting management priorities. In Ontario, UFORE studies have been undertaken by London, Toronto, Brampton, Oakville and Ajax, among others.

Individual tree inventories are generally restricted to street or park trees, which are the main focus of municipal urban forest management. These inventories range from collection of basic species, size and location information, to complete asset-management systems with detailed condition assessments and prioritized work recommendations. A wide array of computer-based inventory management systems is available, from simple spreadsheet programs to sophisticated Geographic Information Systems.

Some cities have made their tree inventory databases and maps available online. A few cities also allow residents to add information about their own backyard trees, enabling a better understanding of urban forest composition and structure. Making inventory information readily accessible also promotes greater awareness of urban forestry issues and promotes stewardship.

Monitoring the status of the urban forest can be done, to some extent, through the UFORE approach. However, a more comprehensive set of criteria and indicators could allow for evaluation of a given municipality's treed resources, management approach and community engagement. This is considered most appropriate for Burlington.

1.4 Best Practices (cont'd)

Woodlot and Creek Block Management

Woodlands and other natural areas such as wooded creek blocks in urban settings require active management if they are to continue to provide some level of ecological function and maximize their potential value in terms of environmental services.

Municipal woodlot and creek block management plans in urban areas typically focus on maintaining a careful balance between access and protection of ecological sensitivities. This can be achieved through measures such as careful trail design, closure of informal trails through highly sensitive areas, educational signs, and clear markers of permitted uses.

Other typical elements include invasive species management, native plant restoration, engagement of local groups and residents and ongoing monitoring of management activities. In creek blocks, tree planting can help stabilize slopes, and Conservation Halton has policies that support reforestation creek blocks and a vision of having them all reforested.

Budget and Reserve Funding

Municipal forestry budgets vary widely among similarly sized municipalities in Ontario and largely depend on the local service delivery models, tax base and urban forest structure. Some municipalities maintain tree planting reserve funds for future tree planting and are able to draw on these resources to address emergency situations such as Emerald Ash Borer infestations. The creation of a tree planting reserve fund was recommended in Peterborough's urban forest strategy, and the City of Toronto has committed to investigating a funding strategy for its proposed Extreme Weather Reserve Fund, which may be used to fund tree replacement after severe weather events such as ice or wind storms.

While every municipal urban forestry program could likely benefit from more funding, the required funding ultimately depends on the nature and extent of the treed resources, the level of service that is required and expected and to what extent the municipality is committed to having a proactive and progressive urban forest management program.

1.5 Opportunities for Improvement

Service Delivery

The current service delivery model applied to urban forest management in Burlington is similar to that of many municipalities, and the service works well. There are, however, opportunities for improvement. The four municipal departments most involved in urban forest management (i.e. Roads and Parks Maintenance, Parks and Recreation, Engineering, and Planning and Building) must co-ordinate their activities on a more regular and formalized basis. Each department must recognize its unique role in shaping the urban forest and making decisions that affect existing and future trees. There is also a need for better and more regular co-ordination with the Region, Conservation Halton, the Ministry of Transportation, Hydro One, Burlington Hydro and other utilities on tree matters.

A multi-departmental Urban Forest Working Group that includes members from these departments and organizations should be established. This group will ensure that all parties work towards common standards and practices and understand the challenges and opportunities for sustainable urban forest management in Burlington.

This group should oversee and monitor the implementation of the Urban Forest Management Plan using standardized performance-based criteria and indicators. They should also ensure that implementation of existing plans and development of new plans for the city are consistent with the direction and objectives in this plan.

Utility and Road Right-of-Way Maintenance

Co-ordinating tree protection, pruning and planting standards between the city and utility companies (particularly Burlington Hydro and Hydro One) will promote good urban forestry practices for utility right-of-way maintenance. This will ensure that trees are planted in appropriate locations to prevent future conflicts with utilities and will reduce future maintenance costs and reduce risk.

There are also opportunities for the city to have more input to tree preservation and plantings along transportation corridors under the Region or Ministry of Transportation's (MTO) jurisdictions. One way to foster better communication would be to include representatives from the utility companies, the Region and possibly MTO in the Urban Forest Working Group and to share information about the planned maintenance locations, practices and concerns for a given time period.

The City of Burlington, Burlington Hydro and Hydro One should also co-ordinate promotional efforts to improve public awareness about the scope and role of their activities in relation to Burlington's urban forest.

Tree Asset Management and Monitoring

The city's Avantis asset management system is a powerful tool to improve the efficiency and effectiveness of a wide range of maintenance operations. This system can be readily harnessed to help the city transition from reactive tree maintenance to proactive urban forest management by integrating inventory data and inspection results into a computerized work order system.

Burlington now has a complete street tree inventory for areas south of Dundas Street. Trees north of Dundas, in rural settlements and in municipal parks, need to be added to the inventory. The inventory must be recognized as a "living" component of the city's asset management and should be continually updated as trees are inspected during the regular grid inspection and pruning cycle. Additional information including crown width, geographic co-ordinates, condition data and prioritized work requirements should also be collected and integrated into the existing inventory.

The city should also, in addition to monitoring the status of the recommendation in this plan, adopt a customized version of the criteria and indicators for strategic urban forest management to track the three key components to effective urban forest management: the status of the treed resources, the management approach and the level of community and stakeholder engagement. These criteria include measures such as canopy cover, species distribution, agency co-operation, tree inventory and tree risk management.

Woodlot Management

To better manage its woodlots, creek blocks and other natural areas, the city requires an assessment and plan of these areas that identifies key management issues, prioritizes work requirements and provides a template for ongoing management. Options and strategies for invasive species management should be investigated thoroughly as part of this work, and a balance between effectively managing storm water flow (in the case of creek blocks), maintaining ecological integrity and promoting urban forest sustainability must be achieved.

Opportunities for co-operation with the Royal Botanical Gardens and Conservation Halton should also be explored in developing woodlot management strategies, which will help promote the achievement of common objectives.

Procedures for improved coordination between departments should be implemented to ensure the best management of the urban forest. These are the key elements of such co-ordination:

- Ensuring all tree protection and replacement plans are reviewed by a certified and *qualified arborist* and that implementation is overseen by an arborist or comparably trained city staff.
- Building better relationships with Burlington Hydro, the Region, Conservation Halton and the Royal Botanical Gardens regarding tree protection and replacement.
- Ensuring that staff documents all proactive and reactive management appropriately.

MANAGEMENT AND IMPLEMENTATION 1.6 RECOMMENDATIONS	Priority	Resource Implications	Target Timing
Tree Asset Management			
1. Develop appropriate work order management processes to track work requests and work performed on individual inventoried trees within the city's asset management system.	High	Low (One-time)	2011
2. Expand the existing tree inventory on city lands by adding data about park trees and street trees north of Highway 5 and by increasing the list of parameters collected for each tree to allow for proactive management.	High	High (One-time)	2010 (Underway)
3. Start to document and track trees planted, protected and removed as part of the Site Plan Approval process.	Low	Low (Ongoing)	2015
4. Develop a city-wide Woodlot Management Plan, in partnership with the Royal Botanical Gardens and Conservation Halton, to provide direction for assessment and management of the city's woodlots, including wooded creek blocks, using an ecologically based approach.	High	High (One-time)	2012
5. Review opportunities with Burlington Hydro to co-ordinate pruning activities to minimize duplication and maximize efficiencies and ensure pruning and planting standards are appropriate.	Med	Low (One-time)	2013

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

MANAGEMENT AND IMPLEMENTATION 1.6 RECOMMENDATIONS (CONT'D)	Priority	Resource Implications	Target Timing
Urban Forest Management Plan Management and Implementation			
6. Undertake a State of the Urban Forest analysis every five years using the established suite of criteria and indicators.	Med	High (Periodic)	2015, 2020, 2025
7. Utilize a standard suite of criteria and indicators to evaluate the state of the city's urban forest and track the progress of this plan. Criteria will include measures of the forest itself, such as canopy cover, as well as measures of the city's management approach and success in building partnerships with the various stakeholders.	Med	Med (One-time)	2014
8. Establish an Urban Forestry Working Group including city departments and representatives from the Region, Conservation Halton, the Royal Botanical Gardens, Burlington Hydro, Hydro One, the Ministry of Transportation and other utilities to better co-ordinate tree protection and replenishment.	High	Low (Ongoing)	2011

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

WHY HAVE NO CANOPY COVER TARGETS BEEN SET?

Canopy cover is a relatively simple, one-dimensional indicator of the extent of the urban forest. However, it does not provide information about other aspects of the urban forest such as tree height, species diversity or age class. Setting overly ambitious canopy cover targets can unduly focus urban forest management on tree planting at the expense of other equally important strategic initiatives. Consequently, the recommendation of this plan is to track canopy cover as one of a comprehensive suite of criteria and indicators whereby "optimal" canopy cover is the maximum potential cover in the city.

2 COMMUNITY ENGAGEMENT AND STEWARDSHIP

2.1 KEY ISSUES

Similar to the situation in many other southern Ontario municipalities, Burlington's urban forest grows predominantly on private property. Consequently, residents and other stakeholders who own or manage land in the city have the greatest significant ability to influence the health and development of the urban forest. Making sure these people are educated about and engaged in tree care is key to ensuring that Burlington's urban forest is protected and replenished.

While most people appreciate trees, many do not understand the tangible benefits that a healthy urban forest brings to a community. In addition, many who are interested in caring for their trees lack the information or resources to do so. The city is in a position to provide some of this support and to develop partnerships with groups committed to providing stewardship.

2.2 CURRENT PRACTICES IN BURLINGTON

The city has for many years recognized the important role the community and local organizations have to play in caring for the urban forest. The city also recognizes the importance of providing information to the community on why they should care for their trees and how best to do so.

The city's website has a dedicated "urban forestry" page, as well as a page dedicated to providing information about this plan. The urban forestry page includes information about insect pests that occur or are anticipated to occur in the city, Burlington's Honour Roll of Trees and Arbor Day.

The city's Roads and Parks Maintenance Department helps organize and participates in an annual Arbor Day tree-planting event at a local school (a different ward is selected each year), as well as annual IKEA and Tree Canada Foundation supported tree plantings. Restoration events, including tree plantings, have also been undertaken with local organizations such as the local Field and Stream Rescue Team and the Bay Area Restoration Council.

The city has a Sustainable Development Committee that is a multi-sectoral citizens' committee that acts as an advisory body to City Council. Every few years this group completes a State of the Environment Report, which includes information about the city's wooded natural areas, and the group is committed to increasing awareness of local environmental issues.

2.2 Current Practices in Burlington (cont'd)

Some local groups and organizations in the city also undertake urban forestry related initiatives independently, such as these:

- Burlington Green, whose members undertake awareness raising, advocacy and action on a range of environmental issues, including preservation of trees and forested areas.
- Friends of Kerncliff Park, whose members undertake and monitor tree plantings in Kerncliff, as well as New City Park.
- The Bay Area Restoration Council.

Larger organizations involved in urban forestry planning and management within the city – the Royal Botanical Gardens, Conservation Halton and Halton Region (including the Halton-Peel Woodlands and Wildlife Stewardship Program) – engage in activities such as these:

- The Royal Botanical Gardens' multi-partner Cootes to Escarpment Park System Land Management Strategy.
- Conservation Halton's
  - Trees for Watershed Health
  - Managed Forest Tax Incentive Program planning service
  - support for tree planting on private lands.
- Halton-Peel Woodlands and Wildlife Stewardship Program's assistance to private (primarily rural) landowners with the management of their forest resources through funding for reforestation activities, forest management plan preparation, and advice and guidance on forest management, establishment and health issues.

2.3 Consultation Input

A common theme that came out of the consultations for this plan was the importance of early and ongoing engagement with residents, local community groups and other stakeholders who own or manage land in the city. Engagement with arboricultural contractors, who are currently responsible for about half of the city's urban forestry maintenance, was also identified as being of high importance.

In addition, a number of individuals and organizations came forward as potential volunteers and partners for urban forest stewardship activities.

Caring for Street Trees

During consultations, some residents asked if they are allowed to prune or water the trees on the city's boulevards. The city encourages residents to care for newly planted street trees and to continue to monitor the health of these trees. However, pruning and removal of any street trees should only be undertaken by a city staff trained arborist or a city-approved contractor.

2.4 Best Management Practices

A number of municipalities in southern Ontario, and elsewhere, offer a range of resources to foster engagement and support stewardship of their urban forests. Typically, larger cities with larger urban forestry departments offer the broadest range of information and services, but some mid-sized municipalities like Burlington are also finding creative ways to engage their communities. Some examples are cited below.

The Canadian Urban Forest Network's Compendium of Best Management Practices states: "Any urban forestry program has to integrate people as part of the program itself." It identifies maintaining an urban forestry section on the municipal website as a key component of municipal outreach, along with engagement through events such as field tours and open houses.

The City of Toronto maintains a comprehensive urban forestry website that includes information on the city's tree by-laws and policies, forest health care program (including fact sheets on common tree pests and sources of stress), operations in different wards and community volunteer event opportunities. Additional documents available for downloading include lists of native tree and shrub species, information on invasive plants and tree pests, and information on dealing with tree roots. The city also co-ordinates a number of community events annually, some with the Toronto Region Conservation Authority.

The Town of Richmond Hill also has a number of pages on various urban forestry topics on its website. In addition to information about the town's tree by-laws, the site provides pages on topics such as when the town's schedules pruning, how to deal with branches that touch hydro wires, when and how to water trees and how to prevent tree damage from powered grass trimmers and edgers.

The Town of Markham has a dedicated urban forestry page on its website that provides information on the town's Trees for Tomorrow Program, tree by-laws, boulevard tree care and invasive tree pests. The site also posts the town's Treescape Guidelines. Community stewardship initiatives co-ordinated by the town include workshops and a backyard tree planting program led by Local Enhancement and Appreciation of Forests (LEAF). The town also offers funding for local tree planting projects through its Trees for Tomorrow Fund.

The Town of Oakville's urban forest web page provides information about and links to a wide range of urban forestry initiatives. These include the town's tree by-laws and policies, tree protection guidelines and basic tree care information, major tree pest threats in the town, woodlot management approaches and the town's urban forest management plans and studies.

Halton Region also has a web page dedicated to its regional forests that includes information on current activities within the forests (e.g. trail improvements), maps, the Region's woodland by-law, the Region's forest management plan, and other topics such as invasive species and hunting regulations.

2.5 Opportunities for Improvement

The city should promote the value and sustainable management of the urban forest these ways:

- providing more information on the city's website
- providing pamphlets and posters about key topics in public spaces
- hosting or co-sponsoring public workshops, seminars, presentations, surveys, site walks and/or demonstrations
- developing and promoting urban forest stewardship awards and
- using the local media (e.g., newspapers, radio) and other local organizations to advertise stewardship events.

Urban forestry resources should include this information:

- the city's urban forest management practices (e.g. care of existing and planting of new street trees, links to city tree-related policies, standards, by-laws)
- key areas of interest or concern (e.g., invasive species identification and management, good tree care practices, lists of native species suitable for yards, tree risk management);
- opportunities for residents to support urban forest sustainability (e.g. watering new city trees in boulevards, planting and maintain trees on their property) and
- city-sponsored or endorsed events (past and upcoming) related to urban forestry.

The city should involve more residents and neighbourhood groups in the stewardship of trees on their lands by engaging in educational public workshops, seminars, presentations, visits to schools, site walks and demonstrations several times per year. Workshops could also be held for contractors working within the city (e.g. landscape architects, arborists, engineers) to inform them about city standards and practices related to tree protection and replacement. Opportunities for partnerships with various groups and organizations should also be explored.

In order to undertake expanded engagement effectively, dedicated resources are required to increase awareness, undertake outreach and coordinate stewardship activities. This would include organizing tree planting initiatives throughout the city, making presentations to various groups, including students, and providing technical support to residents and local groups on tree care issues.

Partnerships for both education and hands-on stewardship activities should be developed with a number of local area and national organizations. Key local organizations include Conservation Halton, the Ministry of Natural Resources, the Royal Botanical Gardens and the local school boards. The city also has a number of active community-based organizations such as Burlington Green, the Field and Stream Rescue Team, the Burlington Lions' Club and Friends of Kerncliff Park. Other broader organizations that could provide support include LEAF (Local Enhancement & Appreciation of Forests), Trees Ontario and the Nature Conservancy of Canada. This is not an exhaustive list, but a starting point.

COMMUNITY ENGAGEMENT AND STEWARDSHIP 2.6 RECOMMENDATIONS	Priority	Resource Implications	Target Timing
9. Develop and provide urban forestry related events, workshops and presentations designed to improve awareness and engagement among residents, community groups and other interested stakeholders such as contractors and consultants working within the city.	Med	Med (Ongoing)	2012
10. Expand and improve the urban forestry section on the city's website to offer more information and resources.	High	Low (One-time)	2011
11. Create an Urban Forest Community Coordinator function or role to support increased community engagement.	High	High (Ongoing)	2011
12. Develop and implement a program to acknowledge individuals, groups, builders, developers and corporations that undertake urban forest stewardship on their lands.	Low	Low (Ongoing)	2013
13. Expand opportunities for partnerships with local neighbourhood groups, school boards, agencies (e.g. Conservation Halton) and organizations to undertake urban forest stewardship activities.	Med	Med (Ongoing)	2012

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

3 PROTECTION AND PRESERVATION

3.1 KEY ISSUES

As Burlington grows, housing development and infrastructure renewal will place increasing pressures on the urban forest. Protecting existing trees, particularly larger specimens, prior to and during construction has been shown to be more effective in sustaining the provision of urban forest benefits than planting new trees. Works such as paving, sidewalk installation, excavation and road widening can adversely affect trees, and trees on private and public property are equally vulnerable. This type of work can lead to tree damage and mortality, which will result in losses in the overall canopy.

Early identification of wooded areas and trees to be protected is critical. This requires policies, guidelines and planning practices that recognize that trees, like other components of the urban infrastructure, need space and a suitable rooting environment. Early identification of trees and treed areas to be protected must then be followed by identification and implementation of effective protection measures.

3.2 CURRENT PRACTICES IN BURLINGTON

Trees on Public Property

By-law No. 19-1975 prohibits the removal or injury of trees located on public property, including parks, road rights-of-way and natural areas. The city has the authority to issue a fine for unauthorized public tree removal or injury. This by-law is currently being reviewed to ensure consistency with contemporary legislation and to reflect updated standards and practices.

The city also has tree protection and preservation specifications that apply to “trees not designated for removal for all works within the City of Burlington’s road right-of-way.” These specifications include minimum *tree protection zones* (TPZs) based on trunk diameter, requirements for protective hoarding and required procedures within TPZs, such as *root pruning* and *sensitive excavation*. The specification also enables the city to hold financial securities against tree damage for up to two years from the date of final inspection of the construction works. This is one of the few municipal specifications to recognize the importance of a tree’s *critical root zone* (CRZ) and is a progressive and comprehensive specification.

The Region and the Ministry of Transportation each have responsibility for planting and protecting the trees within regional and provincial rights-of-way. Protection of trees, where possible, during improvements to existing or creation of new transport corridors is typically considered through the Environmental Assessment process.

3.2 Current Practices in Burlington (cont'd)

Trees on Private Property

Halton Region's By-law 121-05 regulates woodlands of at least one hectare within the City of Burlington. It can also protect woodlands between half and one hectare if the local municipality delegates this authority to the Region. Burlington is currently in the process of delegating this responsibility to the Region. In addition, significant woodlands and other treed *key natural heritage features* in the rural areas are protected under the provincial Greenbelt legislation and regional *greenlands* are regulated by Halton Region's tree by-law.

The city's Official Plan includes a number of policies for protecting wooded natural heritage features, as well as a number of area-specific policies supporting protection of trees outside of recognized natural heritage features. The term "significant trees" is used but not defined.

Under By-law 116-1986, most types of development within the city are subject to the site plan approval process. As part of this process, applicants must submit a Tree Saving Plan (TSP), when applicable, along with other documents and drawings. The city's Site Plan Application Guidelines (2005) enable the city to retain securities against damage to trees and to require that applicants replace removed trees on an *aggregate-caliper* basis where possible on-site. TSPs are reviewed by a city arborist. Inspection of the implementation of tree protection measures specified in TSPs is currently limited.

Site plan approval is required for most *greenfield* developments as well as re-development in older residential areas and downtown where many of the city's mature trees in the urban area are found.

Boundary trees are protected under the provincial *Forestry Act*. The city has guidelines to address the protection of *boundary vegetation*, including boundary trees, during the development process in its Site Plan Application Guidelines (2005) and its Site Plan Requirements and Urban Design Guidelines for Low Density Residential Zones and North Aldershot (2009). These guidelines apply to all vegetation located within three metres of the subject property's boundaries and require either that the adjacent property owner be consulted regarding the proposed development and sign-off or that a certified arborist confirm in writing that the proposed development will not negatively impact the boundary vegetation. Boundary vegetation approved for removal is typically replaced with plans subject to review by a city arborist.

3.3 Consultation Input

A strong message that came out of consultations with city staff is the need for a comprehensive set of tree protection standards for use by all departments, including specifications for different land use contexts, as well as a need for more site inspections by trained staff.

In all consultations, the importance of balancing tree protection with the need for greater infill development and infrastructure renewal as the city's population grows, particularly in the urban area, was expressed. Many stakeholders were of the opinion that tree protection on private property must be more strongly supported by policies, standards and guidelines. Some expressed support for a private tree by-law; others were concerned that such a by-law would be unnecessarily restrictive. It was recognized that the city is improving its tree protection practices but that more innovative and comprehensive solutions are required to protect and preserve the urban forest.

3.4 Best Management Practices

Municipalities across North America are increasingly realizing the importance of tree protection as a key step to achieving urban forest sustainability. Best management practices involve the application of planning tools, at the jurisdiction-wide and at the site-specific level as well as the implementation of proactive management of existing resource on the ground.

Trees on Private Property

Over 50 municipalities in southern Ontario have implemented public or private tree by-laws under the authority of the *Municipal Act* (2001). The majority of these by-laws have been enacted by regional municipalities and focus on protection of woodlands. However, a number of lower-tier municipalities with tree protection by-laws also regulate the cutting of individual trees on private property.

Currently, 16 lower-tier municipalities in Ontario have tree by-laws focusing on the protection of individual trees on private property. These typically protect trees above a certain diameter, although there is significant variation in the size of trees protected and the exemptions provided by different municipalities. What each municipality regulates depends on what the jurisdiction considers to be a significant tree and where it perceives the greatest threats to tree protection. The resources required to implement and enforce these by-laws are also an important consideration. Although many of these by-laws are relatively new, reports to date recommend that private tree by-laws be accompanied by adequate resources to both educate land owners and enforce regulations when required.

3.4 Best Management Practices (cont'd)

Official Plan policies are another tool for creating a planning framework supportive of urban forest protection. While most municipalities in southern Ontario have policies addressing woodland protection, few municipalities have policies providing explicit support for the urban forest as a whole, including trees outside natural heritage systems.

The *Planning Act* (in particular Section 41, site plan control) provides municipalities with the authority to identify trees for protection and require replacements on private lands subject to the development process. A number of municipalities in southern Ontario use this authority and require that all trees of at least 10 centimetres in diameter be assessed and inventoried and that detailed tree preservation plans be submitted as part of site plan application.

Boundary trees can become an issue when activities or development on one property have the potential to harm trees shared by the adjacent property owner. The *Forestry Act* (1990) makes it an offense to injure or destroy a boundary tree without the neighbour's formal consent. Research indicates that no municipalities currently have by-laws or policies to specifically address private boundary tree issues. However, a few municipalities manage boundary trees incidentally through their broader private tree by-laws (e.g. Mississauga, Orillia, Toronto and Markham), whereby a permit to impact such a tree will only be issued if the neighbour consents in writing. Research on this subject has also revealed that if neighbouring landowners cannot reach an agreement regarding boundary trees, they must solve the matter through a civil litigation process.

The definition of a "significant" tree varies considerably among municipalities. Thresholds for minimum tree diameters considered worth protecting through private tree by-laws range from 15 to 76 centimetres. Some municipalities consider all trees above a specified diameter to have some significance, while others exclude certain invasive species. Significance can also vary with land use context; for example, smaller woodlots may be considered more significant in an urban setting than a rural setting, for social and environmental reasons rather than ecological ones. Determining what trees are "significant" in Burlington will require consideration for the existing treed resources, the distinction between the city's urban and rural areas and consultation with the community.

Several municipalities also prescribe minimum standards for arborist reports to support tree protection on construction sites. Generally, these reports require tree inventories and tree-specific protection guidelines and must be written by a certified arborist or professional forester. The most comprehensive report guidelines require regularly documented site inspections by the project consulting arborist before, during and after construction in order to ensure that tree protection methods remain intact throughout the course of the works.

3.4 Best Management Practices (cont'd)

Trees on Public Property

On city lands, particularly in urban areas, tree protection often means protecting tree roots during development or construction. In rural areas, tree protection typically relates to woodlots, hedgerows and other forested areas. Protection of trees along roadway allowances is also an issue. In all areas, effective protection means preventing the tree and its roots from being damaged and implementing measures and specifications suited to different land uses (e.g. a park versus a parking lot).

One of North America's most progressive municipalities in terms of tree protection is the City of Palo Alto, California, where tree protection and habitat design best practices for a variety of land uses and projects are compiled in a "Tree Technical Manual." The manual supports the local Tree Protection Ordinance, which applies to both public and private lands, and is readily available to all residents.

The Region of York and the City of Nanaimo, British Columbia, have compiled similar manuals. The Town of Markham recently developed a "Treescape Manual" that addresses the challenges of urban forest tree protection and replenishment. Few other municipalities have synthesized tree-related standards, specifications and guidelines into one document. However, many have tree protection specifications for construction sites.

Some cities are increasingly turning to innovative technologies, such as directional boring, hydraulic and pneumatic soil excavation and "tree-first" design, to protect existing trees affected by construction and development. The critical barrier resides in the implementation of these practices, which are not well known and can be more costly than traditional approaches.

Trees and Construction

Construction activities that can seriously damage trees include root injury by trenching and excavation; soil compaction by heavy machinery or materials storage; trunk abrasion and branch injury from inadequate clearance and poor operation; defoliation from exhaust heat; and poisoning from spilled chemicals.

Construction-related damage can often be prevented by having trained arborists on site during construction to supervise activities and to work with staff and contractors on site.

3.5 Opportunities for Improvement

Trees on Private Property

The city's Official Plan should build on its current woodland and tree protection policies by adding general policies to recognize the many services provided by the urban forest, as well as contain the following:

- a definition of what constitutes a "significant tree" in the city (in either the Official Plan or supporting guidelines)
- policies that support tree protection and urban forest enhancement wherever possible
- policies supporting development of management plans for city-owned woodlots, as well as city or conservation authority-owned creek blocks, and
- policies that support monitoring the status of the urban forest and its associated canopy cover.

To comply with current best practices, the city's Site Plan Application Guidelines should be revised to require an inventory of all trees of at least 10 centimetres in diameter on site and to ensure opportunities for tree protection and replacement are considered.

Standards cannot be effective without compliance and enforcement. The city needs to ensure that specifications outlined in Tree Saving Plans and arborist reports are implemented, maintained and monitored after plans are submitted. There are several means to accomplish this: staff inspectors may be trained to better understand and evaluate tree protection requirements, additional resources may be allocated to enable more frequent inspections by planning and/or urban forestry staff, and standards to require regular arborist inspections may be included as part of site plan application guidelines and capital project requirements.

Currently, wooded areas in the city greater than one hectare are regulated by Halton Region's tree by-law (By-law 121-05). The city is in the process of extending this authority to woodlands between half and one hectare (i.e., the size of one to four football fields) by finalizing and approving a delegation by-law being developed to this effect. Once this by-law is approved, it will make Burlington consistent with adjacent municipalities and provide more comprehensive protection for privately owned woodlands across the city.

In addition, some type of a private tree by-law should be considered for individual significant trees. Currently, individual trees on private property are retained or removed at the landowner's discretion, except during the development process when landscaping and tree preservation plans are typically required as part of site plan approvals. The city should undertake a detailed study of options for protecting significant trees not in woodlands, and not part of the development process, on private lands in the city.

The recommended private tree by-law study should determine these:

- if protection of "significant" trees should be pursued solely through education and awareness or through education and legislation (i.e. designation of identified trees under the *Ontario Heritage Act, 1990* or a private tree by-law under the *Municipal Act, 2001*), and
- if a private tree by-law is to be pursued, it should
    - include a regulatory definition of "significant trees"
    - examine if the application area is to be the urban area alone or if it is to include the urban areas and rural settlement areas
    - consider including some reasonable permit exemptions and exceptions
    - identify the resources that will be required to educate residents and enforce the by-law
    - be exclusive of lands regulated by Halton's tree by-law and
    - consider input obtained through a broad-based consultative process.

Burlington already has a reasonable approach for managing boundary tree issues during the development process. Recommendations included in this plan further strengthen this approach. If a private tree by-law is developed, a procedure for dealing with boundary trees should be included to regulate their potential damage or destruction outside the site plan approval process.

Trees on Public Property

The City of Burlington is in the process of completing a review and update of its Public Tree Protection By-law 19-1975, which focuses on protection of all trees on city-owned lands. Key aspects of the by-law that require updating include making the by-law consistent with current tree protection provisions under the *Municipal Act* (2001) clearly defining boundary trees and implementing a standardized approach for tree replacement.

Development of a co-ordinated and comprehensive series of city-wide specifications for tree preservation and habitat would be a useful tool for city staff as well as for contractors and even residents. Such specifications should build on the standards already adopted by the city and could also be applied to developments on private lands.

In order to be effective, these standards must be consistently implemented. This will require regular site inspections by trained inspectors and qualified arborists to supervise the work of contractors, both those working for the city and for third parties within rights-of-way. Inspection reports should become a condition of site plan approval and be required for all capital projects that may affect trees.

There is also an opportunity for better coordination of tree protection (and replacement) when roadwork is undertaken by Halton Region or the Ministry of Transportation in the city.

PROTECTION AND PRESERVATION 3.6 RECOMMENDATIONS	Priority	Resource Implications	Target Timing
City Policies and Guidelines			
14. Amend the city's Official Plan: • to specifically acknowledge the benefits provided by urban trees and green infrastructure • to include specific policies supporting the development of management plans for city-owned woodlots and other wooded natural areas including creek blocks and • to include policies supporting the ongoing management and monitoring of the urban forest.	High	Low (One-time)	2011
15. Develop a policy-based definition of "significant trees" to guide tree protection during the planning process and to include in the Official Plan and the Site Plan Application guidelines.	High	Low (One-time)	2011
16. Amend Site Plan Application Guidelines and guidelines for larger scale developments: • to include wording from the *Planning Act* (1990) that supports tree preservation as a condition of Site Plan approval • to include an objective of maintaining and expanding the city's tree canopy • to require that all trees of at least 10 centimeters in diameter be assessed and documented • to require securities for trees to be protected, and retain securities until an arborist report is provided at least two years after completion of construction confirming tree health and • to require a qualified arborist to conduct site inspections to ensure tree protection measures are implemented and all work proceeds as approved.	High	Low (One-time)	2011
17. Strengthen the city's current guidelines for addressing boundary vegetation and boundary trees during the development process by incorporating the legal justification provided through the *Forestry Act* (1990).	High	Low (One-time)	2011
18. Develop policies that allow for engineering guidelines to be adjusted, in consultation with staff and others as required, in order to retain existing grades in support of tree preservation.	Med	Low (One-time)	2012

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

PROTECTION AND PRESERVATION 3.6 RECOMMENDATIONS (CONT'D)	Priority	Resource Implications	Target Timing
Tree Protection By-laws			
19. Complete the delegation of woodlands between 0.5 and one hectare to the Region (which already regulates all woodlands in the city of at least one hectare) under its tree by-law.	High	Low (One-time)	Underway (2010)
20. Complete the review and update of the city's Public Tree Protection By-law 19-1975 for protection of trees on city-owned lands.	Med	Low (One-time)	2011
21. Complete a detailed study to evaluate the effectiveness of private tree by-laws in other communities, the appropriateness of a by-law for Burlington and potential resource implications.	Med	High (One-time)	2016
Site Inspection and Staffing			
22. Require an arborist review all city capital projects with tree impacts and perform regular and documented site inspections.	High	Med (Ongoing)	Underway (2010)
23. Increase resources for city inspection and oversight of tree protection requirements on all project types, and provide training for city staff inspectors.	High	High (Ongoing)	2012
24. Introduce the arboriculture/landscape architecture skill set into the existing Planning department complement as soon as a recruitment opportunity arises.	Med	Low (One-time)	2012

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

4 Replenishment and Enhancement

4.1 Key Issues

Tree establishment to replenish leaf area and canopy cover lost through tree mortality and removal is a critical aspect of sustainable urban forest management. As new and infill development take place, urban infrastructure is built and maintained and aging trees are removed, the outcome of new tree establishment will determine the structure and function of the future urban forest.

The challenge of ensuring that newly planted trees reach their maximum genetic potential can be overcome by creating adequate space for trees through innovative site design, identifying areas in need of increased tree establishment and applying new techniques and technologies to provide optimal growing conditions in otherwise stressful environments. Tree establishment decisions must also consider species diversity and distribution, stocking targets, development needs and budgetary constraints.

The implementation of a range of sustainable practices will ensure that existing and newly planted trees contribute to urban canopy cover. Knowledge of differing requirements for different tree species, risk management and greater use of a diversity of native tree species where appropriate to improve the overall resilience of the urban forest are also key considerations.

4.2 Current Practices in Burlington

Policies and Guidelines

The North Aldershot planning area in the city is on the Escarpment and includes a number of significant natural areas. The Official Plan includes a requirement for North Aldershot that encourages "all development to preserve existing significant trees, wooded areas and hedgerows, and plant additional trees in accordance with good forestry management practices." The Official Plan also encourages establishment of native species and discourages planting of invasive non-native species in North Aldershot and in public areas on the waterfront.

The city's Site Plan Application Guidelines (2005) require the replacement of trees removed through the development process, if they serve a "deemed purpose" and also require replacement for preserved or transplanted trees that do not survive.

Replacement standards used by the city are one to one by the aggregate-caliper formula. This method is considered simple and fair and has been effectively utilized by the city for over two decades.

4.2 Current Practices in Burlington (cont'd)

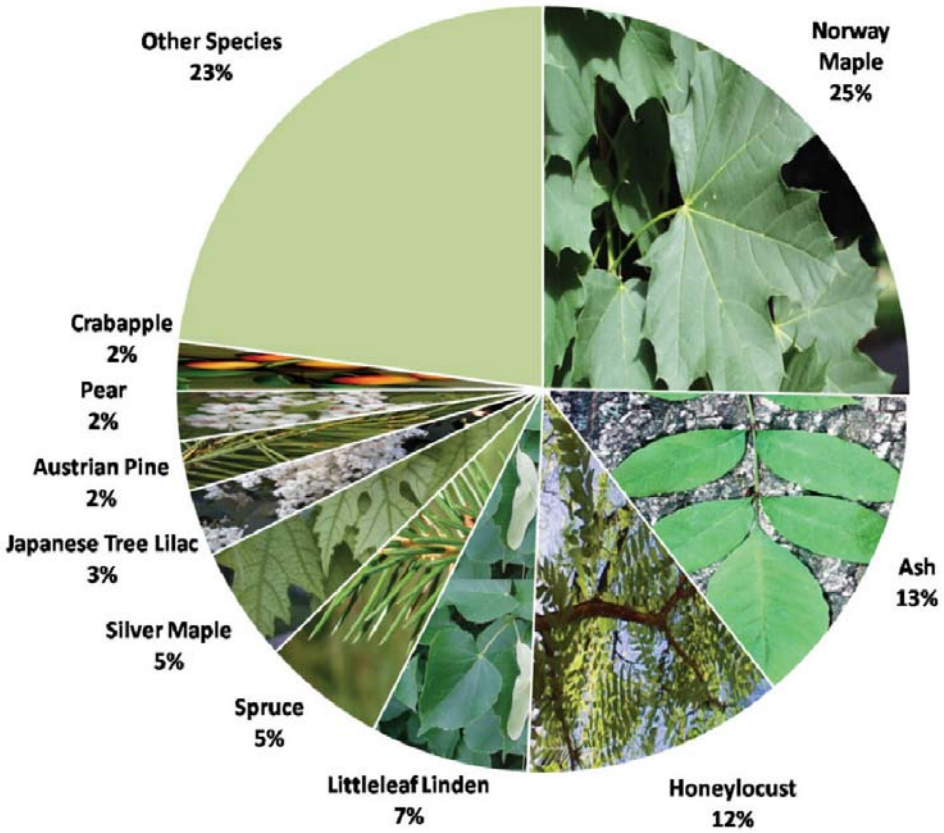
Species Selection

Selecting the appropriate species of trees for planting in urban areas can be challenging. Urban conditions differ greatly from those in natural areas, so some of the most common and hardy forest species, such as sugar maple, fare poorly on municipal streets.

Historically, urban areas in Burlington were planted with a small selection of predominantly non-native tree species, the most notable of which was Norway maple. Readily planted in the 1960s in the wake of the Dutch Elm disease epidemic, this non-native and invasive tree now accounts for 25% of the city's street trees. Approximately three-fifths (63%) of Burlington's street trees are introduced or exotic species. While many, such as Linden or London plane, are well-suited to urban conditions and present few problems for urban forest management, others present significant threats when they seed into natural areas. Too much of even a native species can be risky, as intensive use of ash the last 30 years has resulted in 13% of the city's street trees being vulnerable to the Emerald Ash Borer.

The city is committed to establishing a more diverse future urban forest and to working with contractors and developers to ensure a diverse range of native and non-native, non-invasive tree species get into the ground. The city no longer permits the planting of Norway maple or ash on city streets or in new developments and has made significant progress since 1979 when 36% of the street trees were Norway maples, 22% were ash, and 21% were honey locust. However, it will take time to achieve optimal levels of diversity.

Street Tree Species Diversity in Burlington (2009)



The sustainability and health of the future urban forest will rely on the selection and planting of a diversity of tree species, planted in appropriate locations and maintained until they are well established. While the use of native species is preferable, some non-invasive non-native trees are also suitable under difficult growing conditions.

4.2 Current Practices in Burlington (cont'd)

Tree Planting

Burlington plants approximately 1000 trees annually as replacements, through capital projects and in response to resident requests for street trees. Trees are typically planted in boulevard settings, but are also planted in parks. The city does not actively plant trees in naturalized areas, except as part of annual Arbor Day celebrations, and during annual plantings in cooperation with local stakeholders. Volunteer-based programs typically do not include plantings on road rights-of-way. Planting is conducted by three departments: Roads and Parks Maintenance, Engineering, and Parks and Recreation.

In new communities, trees are planted during development in accordance with the city's planning policies, typically with prior review by city forestry staff. During construction or maintenance of infrastructure, tree planting is typically included in the contract tendering process. For these projects, inspection of trees is the responsibility of the Engineering Department, but is not always conducted by someone with arboricultural expertise.

For local regional and provincial roadway projects, the city has an opportunity to comment on tree replacement.

4.2 Current Practices in Burlington (cont'd)

Tree Habitat

The city's street tree inventory identified over 700 vacant plantable spaces along city streets. Many of these vacant spaces, as well as those already occupied by trees, are found in boulevards or other locations where soil quality, soil volume, drainage, proximity to utility services, or other critical factors do not support the growth of future large-stature trees.

Almost 20% of Burlington's street trees are currently in some degree of conflict with overhead utility wires. This requires a practice of gradual replacement with smaller stature vegetation to avoid ongoing maintenance requirements and possible service disruptions. At the same time, consideration must be given to the impact on the streetscape to ensure a balance is found between the concerns with utility wire conflicts and the creation of a streetscape that is attractive and provides shade protection for pedestrians.

Engineering specifications currently require 1.73 cubic metres of soil volume for trees planted in pits along sidewalks and roadways. In parking lots, the minimum required planting bed width is 2.5 metres, with no minimum required soil depth or volume. In new developments, topsoil volumes are often inadequate to promote good root growth. Such limited rooting volumes will not sustain the large-stature, mature trees that provide so much value in the form of shade, storm water attenuation and air quality improvement.

The roots of trees planted along sidewalks and in boulevards must compete with the road sub-base, designed to support the weight of traffic and compacted to between 95% and 100% *Standard Proctor Density*. Street trees are also often subjected to physical damage, drought and high salt levels. These factors contribute to increased overall stress, inadequate access to air and nutrients, stunted growth and premature tree mortality.

Urban design guidelines in Burlington are beginning to include innovations such as group plantings of street trees, as opposed to more formally spaced linear plantings. The continuation and wider application of this practice may promote tree longevity. These guidelines are not currently extended to parking lots, however, and trees in lots are generally required to be planted at regular linear spacing between parking and traffic areas.

The intensity and extent of city tree establishment in Burlington is subject to available funding through the responsible departments, particularly Roads and Parks Maintenance. At a minimum, every tree removed for health or risk management reasons by the city is replaced. Limited additional planting occurs when resources permit. Tree establishment through Engineering Department projects is typically part of the tender process. Trees are typically installed through a contract with a two-year warranty. However, there is no dedicated annual budget for tree planting through Engineering, nor through Parks and Recreation projects.

4.3 Consultation Input

Consultations with staff from the three departments responsible for tree establishment revealed that there are shared concerns for the quality of trees being planted, as well as for the suitability of the environments where they are planted. An absence of procedures and a lack of available resources to inspect planting stock means that sub-standard trees, such as those with poor form, *girdling roots* or diseases, are sometimes planted as part of construction or development projects. It was also recognized that more could be done to improve growing environments through investigating innovative approaches to better integrate trees into the urban *hardscape* and that establishing a balance between the needs of trees and requirements for reliable, serviceable and cost-effective infrastructure is crucial. Stakeholders and residents also expressed concern about the city planting trees in poor locations where they stay small and need to be replaced every five to seven years.

City staff also raised their concern about the lack of up-to-date and co-ordinated planting specifications. For example, specifications used to tender infrastructure projects that include tree establishment differ from guidelines used by the Parks and Recreation Department. Municipal site plan application guidelines provide yet another series of planting specifications. One set of comprehensive tree and vegetation management requirements and guidelines is needed, tailored to different project types and land uses.

4.4 Best Practices

Species Selection

Communities across North America are increasingly adopting practices to ensure that the right trees are established in the right places, thereby reducing future maintenance costs and promoting tree longevity. Several cities have developed lists of acceptable species for plantings in municipal rights-of-way, often divided by habitat type. These species lists are also accompanied with the minimum soil volumes allowable per tree, by habitat type. A comprehensive list of acceptable species, with a mix of native and non-invasive, non-native trees (if required because of difficult urban conditions), ensures that urban forest diversity is promoted through planting, especially in new communities and as part of infrastructure projects.

In its strategic plan, the City of Peterborough committed to undertaking an innovative step to achieving long-term urban forest sustainability through species suitability trials. The Town of Oakville has made the same commitment. Some cities, such as Ithaca, New York, have also experimented with planting far less-costly bare-root nursery stock, with generally favourable growth results. Bare-root planting requires greater skill and knowledge than planting ball-and-burlap or containerized trees, but can be more successful if properly implemented.

4.4 Best Practices(cont'd)

Species Selection (cont'd)

Species selection should be based on a wide range of considerations. For example, research has shown that selecting the proper trees and placing them appropriately can significantly reduce energy usage for heating and cooling buildings. Planting small statured trees under utility wires can also reduce the need for costly corrective pruning.

Planting a diversity of native and non-invasive tree species is perhaps the most important consideration since doing so builds in resiliency to stressors such as insect infestations.

Trees Native to Burlington

Sugar maple, red maple, red oak, basswood, white pine and eastern hemlock are a few of the native woodland trees found in Burlington. Less common Carolinian tree species that occur naturally in the city include flowering dogwood, black oak, chinquapin oak and sassafras.

Tree Habitat

Research shows that healthy trees generally require between 75 centimetres and 120 centimetres of soil depth to achieve optimum growth, depending on soil quality and drainage. Minimum recommended soil volumes to grow a 40 centimetre diameter tree in areas which receive adequate rainfall (e.g. at least 750 millimetres per year) is around 30 cubic metres. Larger trees require proportionately more soil, and requirements can vary with species and soil conditions.

Soil quality is also critical, although rarely specified. Cities across North America and Europe are beginning to adopt techniques and technologies to provide enhanced rooting environments, while maintaining the ability to provide municipal services such as sidewalks and utilities. The objective of implementing any *enhanced rooting environment technology* is to provide the greatest amount of good quality soil suited to the tree species planted and the local drainage regime. Inadequate soil volume, quality, drainage and density are the chief limiting factors for tree growth in urban areas.

The two most common enhanced rooting environment techniques in use in other jurisdictions are engineered soils and soil cells. Engineered soils mix crushed gravel and mineral soil to form a supporting latticework that maintains essential *macropores*. Soil cells are containers constructed of modular plastic and steel cells designed to support loads without compacting the soil within them. While costly, both techniques have been extensively tested, with consistently positive results. Canadian cities including Winnipeg, Toronto, Whistler and Kelowna have experimented with soil cells in some parts of their cities.

Tree placement is another critical habitat consideration. Common design sensibilities still tend to favour regularly spaced, linear plantings, especially along roads and sidewalks. While mature roadside trees provide a graceful canopy, roadside boulevards rarely provide optimal growth conditions. For example, plantings in boulevards invariably perform worse than those in neighbouring front yards.

4.4 Best Practices(cont'd)

Tree Habitat (cont'd)

The tight spacing of many typical plantings leaves little room for full canopy development. In fact, research and experience suggest that tree establishment budgets can be optimized by planting fewer trees and reallocating funds to provide enhanced rooting environments. The established trees will grow faster, provide more benefits, require less maintenance and live significantly longer than a greater number of trees planted in poorer conditions.

4.5 Opportunities for Improvement

Policies and Guidelines

City Official Plan policies and Site Plan Application Guidelines should both be revised to include policies that require tree replacement, at least for all significant trees removed as part of development. Replacement should be calculated according to the city's current aggregate-caliper method, or an alternative standard applied equally to all projects. Policies should specifically support the integration of trees in open spaces and parking areas.

On public lands, the following targets should be adopted:

- No species should make up more than 10% of the inventory
- No *genus* should account for more than 20% and
- No *family* should make up more than 30% on any given street, park or new neighbourhood.

Planting a diversity of native trees should also be part of woodlot and creek block naturalization projects. Lists of suitable species for these types of projects are available through Conservation Halton.

Why Are Native Trees Important?

Native trees are adapted to a range of local conditions and provide habitat for a diversity of local wildlife. Although many native trees will not thrive in hardscape environments (e.g., boulevards), they can thrive without much additional care (e.g., watering, fertilization) once they are established (e.g., after their first five years) in parks, creek blocks and other open space settings. These trees will provide many benefits for people as well as habitat for local wildlife.

4.5 Opportunities for Improvement (cont'd)

Tree Planting

Currently, the city does not regularly inspect the quality of nursery stock prior to its establishment, relying instead upon the contractor to provide suitable trees and plant them correctly. This may occasionally result in poor quality tree planting. Enacting procedures to inspect a representative sample of planting stock prior to establishment will help ensure that site-appropriate and healthy trees are planted the first time around. This may require some additional resource allocation but would represent an important investment in the future of Burlington's urban forest. Beyond the expiry of the typical two-year warranty period, young trees still require care and maintenance. Typically, they require watering, mulching and important structural pruning to ensure they become well established.

The city does not have jurisdiction over trees planted on residents' property, and unfortunately some nurseries still promote non-native, invasive tree species for planting in these areas. Private lots often have much higher quality soil and greater rooting space than boulevards and are the ideal places to plant large-growing native trees. Increasing awareness and providing technical information to residents and environmental organizations that promote, support and undertake tree planting on private lands will contribute to increased canopy cover, species diversity and provision of urban forest benefits.

Although the city does not have jurisdiction over tree plantings on regional or provincial rights-of-way, it does have opportunities to comment on proposed tree replacements along these corridors and is responsible for maintaining trees on regional roads. The city should try to ensure that these plantings meet its objectives for diversity, density and quality.

Species Selection

Burlington's urban forest enhancement and replenishment program can become a key instrument in achieving urban forest sustainability and promoting species diversity across the city. For example, the inventory shows that some older neighbourhoods are heavily populated by large, old silver maples. These neighbourhoods should be targeted for increased infill planting with a diversity of native species before these large trees are removed to maintain some continuity in canopy coverage. The inventory also suggests that newer communities are heavily over-populated with Norway maple and ash trees; a wider range of species should be planted in these and newly developing communities.

4.5 Opportunities for Improvement (cont'd)

Tree Habitat

Implementing advanced rooting environment techniques and technologies increases the up-front cost of some projects, but cost savings can be realized by directing a larger share of funds for nursery stock towards lower-density, higher-quality plantings. Additional savings come from reduced costs of future tree maintenance, storm water management, energy use and even health care, as larger, healthier trees provide far more benefits than small trees, which require more frequent replacement.

In the downtown area, the city should investigate the feasibility of a range of enhanced rooting techniques, including, but not limited to, engineered soils and soil cells. This investigation should include several real-world feasibility and proof-of-concept studies, which would involve selecting appropriate locations, soil mixes and tree species.

The city should also promote native tree planting on the high-quality environments found in many front yards, some of which may fall at least partly into the municipal road allowance. Increasing public awareness about the importance of front-yard planting will play an important role in establishing more trees in high-quality habitat and promoting healthy urban forests.

Other opportunities for urban forest replenishment on lands not owned by the city include school grounds, conservation authority lands, industrial areas and business parks, institutional lands, golf courses and cemeteries.

All of these best practice considerations should be formalized and consolidated in city-wide Treescape Guidelines, including these:

- guidelines for tree habitat including adequate soil volumes, soil depths and basic soil quality requirements
- specifications for typical right-of-way cross-sections (arterial, collector, local, etc.), new subdivisions, parklands and open spaces that integrate appropriate tree rooting environments
- a list of recommended trees and shrubs that would indicate their suitability for different conditions and that would account for urban forest diversity targets and
- requirements for an arborist to review and supervise proper implementation of plans and to follow up both immediately and two years post-construction to assess survival.

REPLENISHMENT AND ENHANCEMENT 4.6 RECOMMENDATIONS	Priority	Resource Implications	Target Timing
City Policies and Guidelines			
25. Amend the city's Official Plan with these inclusions: • objectives that support replenishment and enhancement of the urban forest with a high diversity of predominantly native trees • specific policies supporting the replacement of trees removed through the development and/or infill process • the naturalization and reforestation of creek blocks and • the integration of trees in parks, open spaces and parking areas.	High	Low (One-time)	2011
26. Develop comprehensive city-wide Treescape Guidelines for tree protection and replacement with consideration for existing materials from various departments. Key areas to be addressed include minimum soil depths and volumes, recommended native and non-invasive species, specifications for different settings and requirements for inspections.	Med	Med (One-time)	2012
27. Amend the Site Plan Application Guidelines and guidelines for larger scale developments: • to include wording from the *Planning Act* (1990) that supports tree planting as a condition of Site Plan approval (where preservation is not feasible) • to change the term "trees serving a deemed purpose" to "significant trees" (once a definition for "significant trees" has been developed) and require their replacement and • to allocate a percentage of funds received for parkland dedications to tree planting and management in the city.	High	Low (One-time)	2011
28. Develop a standard methodology for tree valuation that would provide the basis for setting securities that reasonably reflect the value of private trees deemed to be protected or replaced through the development process.	High	Low (One-time)	2011

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

REPLENISHMENT AND ENHANCEMENT 4.6 RECOMMENDATIONS (CONT'D)	Priority	Resource Implications	Target Timing
Operations			
29. Increase resources and implement a formal program to plant in public spaces dominated by mature trees (so that regeneration is started before the mature trees must be removed).	Med	Med (Ongoing)	2013
30. Develop a program to identify and increase resources to plant more trees in city parks and vacant public locations in the urban areas not planned for development.	Med	High (Ongoing)	2013
31. Increase technical support for tree planting initiatives throughout the city, and engage residents, non-profit groups and other organizations to promote, support and undertake tree planting on private and public lands.	Low	Med (Ongoing)	2012
32. Increase inspection resources to ensure that new tree plantings are installed in accordance with standardized specifications and that they survive following installation.	Med	Med (Ongoing)	2012
33. Explore establishing long-term tree-growing contracts to ensure availability of high-quality native planting stock for city projects.	Low	Med (One-time)	2014

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

5 Tree Health Care and Risk Management

5.1 Key Issues

Trees in urban areas face many stresses, making them increasingly susceptible to pests and diseases. Stressed trees are also more prone to structural problems, which may be further compounded by long intervals between inspection and maintenance, as well as inadequate cultural practices. A co-ordinated approach to manage pests, diseases and invasive species, to maintain an optimal growing environment and to promote good tree form and structure is called Plant Health Care (PHC). PHC also recognizes the importance of other landscape plants such as shrubs and grasses and the positive or negative influence these plants may have on tree health.

Integrated Pest Management (IPM) is a similar concept, which aims to assess and control pest populations through a combination of early detection, cultural practices and pesticides, if required. A comprehensive PHC and IPM program, coupled with a detailed risk management strategy that includes regular inspections, cyclical maintenance pruning and an effective emergency response program, is critical in maintaining and promoting a healthy, safe and functional urban forest.

Improving tree health and safety will allow the urban forest to provide more benefits for Burlington's residents and also save taxpayer dollars as liability and insurance claims are reduced.

5.2 Current Practices in Burlington

The City of Burlington currently undertakes a variety of programs to ensure that the urban forest is maintained in a healthy and safe condition. These are described briefly in this section.

Inspection, Pruning and Risk Management

Many municipalities inspect and prune their trees in a scheduled manner. This practice is called "grid," "block" or "cyclical" maintenance. Burlington's street trees in the urban area are inspected and pruned on a seven-year cycle. Street trees are visually inspected for health, structure and risk and are pruned or removed, as required. When resources permit, neighbourhoods with a large number of older trees or trees that have had cabling systems installed to support weak limbs or *co-dominant* stems are visually inspected more frequently. This inspection data is not currently stored digitally or integrated with the street tree inventory.

Trees within falling distance of formal trails in parks and natural areas are inspected annually. Other park trees are generally inspected on a seven-year cycle. Pruning in parks is currently carried out on an as-needed basis.

Burlington Hydro inspects and prunes street trees on a three-year cycle, while Hydro One follows a six-year cycle with the key objective of eliminating conflicts with above-ground utility wires or transmission lines.

5.2 Current Practices in Burlington (cont'd)

Emergency Response

After-hours emergency requests for tree maintenance through a dedicated Emergency Services phone line and addressed by on-call Roads and Parks Maintenance staff. Working hours service requests are managed through the city's computerized work order system and are addressed on a priority basis.

Tree Health Care and Integrated Pest Management

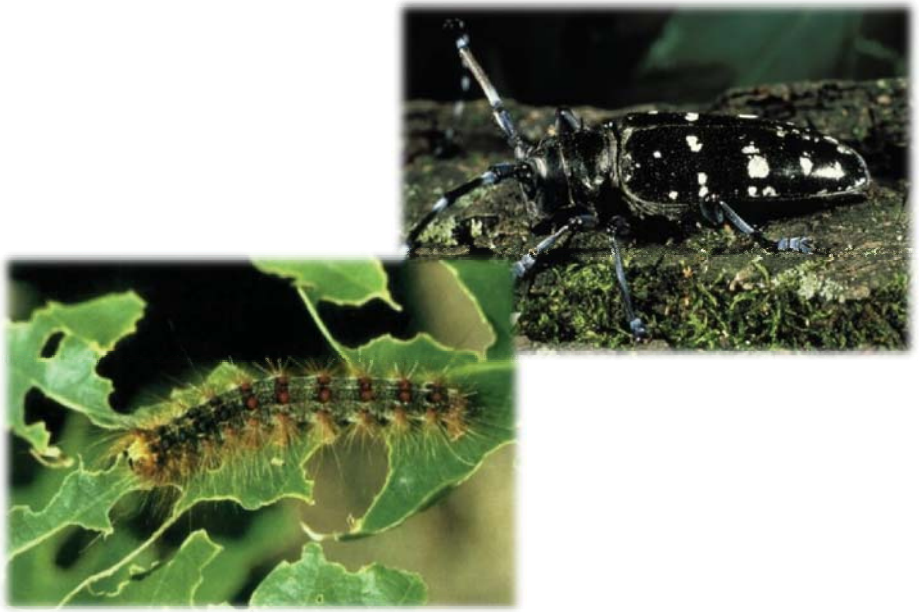
Burlington's approach to Plant Health Care currently includes limited watering and mulching of trees in high-stress environments. Tree maintenance is otherwise generally limited to pruning, although newly planted trees are watered and mulched after installation. There is also no co-ordinated program or plan to control invasive plant species in woodlots, parks and other natural areas.

In the past, the Roads and Parks Department has coordinated with residents to keep pest populations, specifically gypsy moth, under control through a number of IPM methods (e.g. egg mass scraping, installing sticky bands, using pheromones and aerial spraying). Burlington has also recently implemented an adaptive Emerald Ash Borer (EAB) management strategy to help manage this destructive beetle.

5.3 Consultation Input

Burlington's residents and other stakeholders recognize the importance of adequate growing spaces, effective pest management and tree species diversity in promoting urban forest sustainability. Many expressed concern for tree health and public safety, and wanted solutions to promote the health and longevity of the urban forest, while minimizing risks to people, property and infrastructure.

It was also noted that there is a need to manage invasive plant and pest species. A woodlot management strategy would help provide direction for sustaining the city's woodlots and creek blocks. Stakeholders asked that the inspection and pruning cycle, species and planting stock selection and data management protocols be reviewed and updated, as required.



5.3 Best Practices

Cyclical Inspection and Pruning

A sampling of municipalities across North America found that urban forest inspection and pruning intervals vary widely between municipalities, from short five-year cycles to a much longer 16-year cycles. A shorter cycle does not necessarily imply better management. Longer cycles can be supported by an urban forestry program dedicated to planting diverse, high-quality nursery stock in good habitat, resulting in fewer short-term maintenance requirements.

Another successful approach to cyclical pruning is to establish a different cycle depending on the age or species of the trees to be maintained. For example, most trees in Edmonton are pruned on a seven-year cycle, while elm trees are pruned on a four-year cycle. This targeted pruning enables earlier detection of Dutch Elm disease. Trees in Calgary are pruned on an eight-year cycle. Young trees, however, are inspected and maintained a minimum of three times in the first ten years. Maintenance during the "formative years" of a tree's life, which can be conducted from the ground at little cost, is the best possible investment in the future urban forest, and that early maintenance reduces future liability and management costs.

In a city like Burlington, which contains both a densely populated urban area and rural settlement areas, it is challenging to ensure that all street trees are maintained in a cyclical manner. Economic analyses demonstrate that scheduling tree maintenance by species, age class and location is ideal, but generally not feasible because of time and resource constraints.

A four- to five-year pruning cycle generally provides the optimum balance between operating costs and maintained tree value, but various municipalities successfully implement a wide range of different schedules and service delivery models.

Risk Management

The key to effective risk management is an operational policy that co-ordinates inspection, mitigation and proactive planning, in order to improve safety and reduce risk, uncertainty and liability. These are the key components of an effective risk management strategy:

- Policy statement, including scope and responsibilities
- Goals of the strategy
- Standard of care statement
- Determination of acceptable risk
- Minimum training and qualifications of risk assessors
- Frequency of assessment
- Management options
- Record-keeping protocols and
- Strategy funding, assessment and reporting.

European jurisdictions have among the most stringent risk management policies of those studied. For example, some districts mandate tree inspection frequencies between one and four years. Trees in close proximity to roadways, buildings or other intensively used areas are inspected on a more frequent basis, as are certain tree species known to be more prone to structural defects.

5.3 Best Practices (cont'd)

Emergency Response

Few municipalities have dedicated storm response protocols for the urban forest. However, innovations in hurricane-prone areas of the United States demonstrate the value of pre-storm planning to identify and mitigate potential hazards. Developing a directed emergency response plan within a broader risk management policy helps ensure that risks are mitigated as required and that the necessary resources are allocated to the planning through recovery stages of a significant storm event. The focus of post-storm inspections should be the retention of as many trees as possible because the most failure-prone component parts were likely to have failed during the storm.

Plant Health Care and Integrated Pest Management

Dedicated programs to identify and manage plant health issues, including pests, reduce urban forest stressors and consequently lead to lower tree mortality. Leading municipalities implement programs to control vegetation pests such as noxious weeds and invasive species in natural areas and also run programs to create and expand *mulch beds* shared by multiple trees. Others have begun tree hardiness trials to assess the suitability of diverse species and use watering bags for new trees. For example, Winnipeg's comprehensive IPM program applies non-pesticide approaches, such as sticky banding and monitoring, in combination with the targeted application of chemicals. In southern Ontario, several municipalities currently undertake annual gypsy moth and Emerald Ash Borer surveys.

5.4 Opportunities for Improvement

Cyclical Inspection and Pruning

Burlington's seven-year grid pruning cycle is comparable with those of many municipalities and ranks among the shorter cycles. There are, however, three opportunities to improve the pruning cycle, described below.

1. New developments and rural settlements are currently not included in the cycle. New urban and suburban communities should be integrated into the grid pruning cycle, and rural street trees should be regularly inspected and maintained on an as-needed basis.

2. Newly planted street and park trees should be pruned at least three times in the first ten years after planting.

3. The pruning and inspection cycle should be integrated into the city's asset management system, which can facilitate maintenance and progress tracking, decision-making and work order processing.

Emergency Response

Burlington does not currently operate a web-based tree service or inspection request system, nor is there a cohesive emergency response plan to deal with major storms. Implementing these measures may result in increased opportunities to mitigate risk and better co-ordinate emergency response activities, enabling a greater number of mature trees to be retained and reducing liability posed by potential tree failures.

5.4 Opportunities for Improvement (cont'd)

Plant Health Care and Integrated Pest Management

Burlington's current plant health care and pest control activities are implemented as part of daily urban forest management. However, there is no overarching policy to recognize the holistic and integrative approach of either Plant Health Care (PHC) or Integrated Pest Management (IPM). Formalizing these approaches through implementation of this plan will support the city's commitment to urban forest sustainability and environmental stewardship. It will also provide a basis for the expansion of services to include increased mulching and watering of trees, monitoring and control of invasive plant and insect species, and selection and establishment of suitable trees, shrubs and groundcovers in appropriate locations.

The city should undertake replicated and controlled trials to test these:

- the usability and success of bare root (as opposed to container or ball-and-burlap) stock
- the effectiveness of providing tree watering bags with newly planted trees on boulevards
- the suitability of different native tree species (including Carolinian species) for tolerance to urban conditions and
- the effectiveness and feasibility of enhanced rooting environment technologies for integrating trees in paved areas, such as parking lots and downtown sidewalks.

Risk Management

There are several opportunities to improve Burlington's risk management practices. A formal urban forest risk management policy should be developed to confirm successful inspection and pruning practices currently in place and further develop these programs to enhance risk management. A dedicated policy will set minimum standards for risk inspection and documentation, resulting in consistency of assessment and sustained resources for inspection over the long term. This should include the installation of signs at the entrances of city-owned woodland trails that direct users to stay on the trails and enter at their own risk.

TREE HEALTH CARE AND RISK MANAGEMENT 5.6 RECOMMENDATIONS	Priority	Resource Implications	Target Timing
34. Evaluate innovative and alternative planting techniques, approaches and products that support increased tree resilience and longevity.	Low	Med (Ongoing)	2012
35. Formalize the city's process for evaluating trees and identifying those requiring removal or risk mitigation.	High	Med (One-time)	2012
36. Develop a web-based tree service or inspection request system and an effective implementation strategy so that responses can be prioritized and documented in a consistent and effective manner.	Low	Med (One-time)	2015
37. Modify the city's Level of Service to ensure that newly planted trees are pruned within the first two years of planting and twice more within the first ten years of planting.	Med	High (Ongoing)	2014
38. Undertake a benefit/cost analysis of implementing a five-year pruning and inspection cycle Level of Service.	Low	Med (One-time)	2021-2025
39. Integrate rural communities into the city's seven-year grid inspection cycle.	High	Med (Ongoing)	2012
40. Formalize programs for and integrate the city's following current practices that are consistent with best practices into the Avantis Maintenance Management System: • the grid pruning and inspection cycle data (currently at seven years) • inspection of cabled trees (annual) • inspection of formal trails in city-owned woodlands (annual) and • inspection of mature trees (bi-annual).	High	Med (Ongoing)	2010

Resource Implications: Low = existing staff work plan and/or existing resources, Med = moderate impact to staff work plan and/or resources (~ $10,000), High = significant impact to staff work plan and/or resources (~ $50,000).

GLOSSARY

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

Aggregate-Caliper: A method for assessing tree removal compensation planting, whereby the combined caliper (diameter) of trees to be planted must meet or exceed the diameter of the tree removed.

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

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

Boundary Vegetation: All existing vegetation within three metres of a subject property, as defined in Burlington's Site Plan Application Guidelines, 2005.

Co-dominant: With respect to tree stems, where two or more of similar diameter are emerging from the same location on the trunk. Co-dominant unions are typically weak and face a higher risk of failure than normal unions. Commonly found on improperly maintained trees, and more common among certain tree species.

Critical Root Zone: In Burlington, an area beyond the Tree Protection Zone where works are permitted but may still damage important roots unless proper root-sensitive procedures are implemented.

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

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

Formal Trails: Pathways through parks and natural areas established and maintained by a municipality for the purpose of promoting recreation.

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

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

Girdling Roots: Tree roots that grow in a circling orientation, rather than spreading. Such roots, commonly found among certain species such as Norway maple, as well as in areas with poor-quality soils, may ultimately deprive a tree of water and nutrients by effectively choking off internal transport vessels.

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

GLOSSARY (CONT'D)

Greenlands: Areas in Halton Region that have been designated through the provincial Greenbelt Act (2005) as part of the 1.8 million acres of environmentally sensitive and agricultural land around the Greater Golden Horseshoe protected through the act. These lands include the Oak Ridges Moraine and the Niagara Escarpment.

Greenfield: A site to be used for development purposes, whose previous land use was predominantly agriculture but may also include natural areas.

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

Hardscape: A landscape, generally found in urban areas, where the predominant features are pavements, sidewalks, roads or other impermeable or semi-permeable concrete- or asphalt-based surfaces.

Integrated Pest Management (IPM): An integrated approach to managing pest populations that reduces or eliminates the use of pesticides. Key components of IPM may include setting thresholds, population monitoring, trapping, cultural practices (e.g. tree species selection), mechanical or biological controls and chemical pesticide application.

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

Key Natural Heritage Features: As per Section 3.2.4 of the provincial Greenbelt Plan (2005) include: significant habitat of endangered species, threatened species and special concern species, fish habitat, wetlands, Life Science Areas of Natural and Scientific Interest (ANSIs), significant valleylands, significant woodlands, significant wildlife habitat, sand barrens, savannahs and tallgrass prairies and alvars.

Macropores: Cavities that are larger than 50 nanometres that may occur in the soil and are created by agents such as plant roots, fungi or soil fauna. Macropores are important for tree growth as they increase the hydraulic conductivity of the soil, allowing water and air to infiltrate faster and deeper.

Mulch beds: Continuous expanses of wood chips or other mulch spread at the base of trees and tree groupings. Mulch beds promote tree health by regulating soil moisture and temperature, reducing competition from weeds and reducing soil compaction.

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

Plant Health Care (PHC): A holistic approach to improving the health and quality of landscape vegetation, especially trees, through a wide range of practices, including proper species selection and planting, mulching, watering, fertilization, protection, pruning and risk mitigation. Particular attention is paid to the rooting environment, as a majority of plant health issues originate as a result of below-ground stressors.

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

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

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

GLOSSARY (CONT'D)

Species at Risk: In Ontario, a "species at risk" is any naturally occurring plant or animal in danger of extinction or of disappearing from the province. Once classified as "at risk," they are added to the Species at Risk in Ontario (SARO) List. Such species can also be designated at the federal level.

Root Pruning: The selective and targeted removal of tree roots prior to construction to minimize the potential for damage associated with soil excavation. A key objective of root pruning is to minimize loss to significant structural and feeder roots, while preventing interference with necessary works, which may result in further root damage.

Sensitive Excavation: The implementation of excavation methods such as hydraulically or pneumatically assisted excavation to uncover roots prior to large-scale excavation, in order to enable effective root pruning.

Standard Proctor Density: The maximum dry density of a soil determined in accordance with Ontario Provincial Standards.

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

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

Urban Forest: Generally refers to all trees and associated woody vegetation (e.g. shrubs), within a given jurisdiction, typically one with a significant urbanized component or one that is entirely urbanized. This includes trees in natural areas as well as trees in more manicured settings such as parks, yards and boulevards. In the City of Burlington, the urban forest encompasses trees in both the urban and rural areas within the city but is called the "urban" forest because this is the convention that has developed.

ACKNOWLEDGEMENTS

This Urban Forest Management Plan is the product of a collaborative effort between the City's Project Management Team and the project study team.

PROJECT MANAGEMENT TEAM (City of Burlington)

Cathy Robertson, Director of Roads and Parks Maintenance (RPM)
Mark Covert, Manager of Program Development (RPM)
Rick Lipsitt, City Forester (RPM)

PROJECT STUDY TEAM

Philip van Wassenaer, Senior Urban Forest Consultant, Urban Forest Innovations Inc.
Margot Ursic, Planning Ecologist / Facilitator, Beacon Environmental
Alex Satel, Urban Forest Consultant, Urban Forest Innovations Inc.
Liz Howson, Senior Planner, Macauley Shiomi Howson
Jeremy Jackson, GIS Specialist and Certified Arborist
Dr. Andy Kenney, Professor of Urban Forestry, University of Toronto

LOCAL STAKEHOLDER ORGANIZATIONS

Burlington Green, Burlington Lions Club, Friends of Kerncliff Park, Royal Botanical Gardens, Conservation Halton, Halton Region, Burlington Historical Society, Region of Halton Police Services, Hydro One, Burlington Hydro, Field & Stream Rescue Team, Hamilton Halton Home Builders Association, Sustainable Development Committee (SDS), Halton Agricultural Advisory Committee, Halton District School Board, Halton Catholic District School Board and Burlington private schools.

Thanks are also extended to the following members of City Council, city staff and members of stakeholder organizations who participated in meetings and provided input to the development of this plan.

CITY COUNCIL

Mayor Cam Jackson
Ward 1 - Councillor Rick Craven
Ward 2 - Councillor Peter Thoem
Ward 3 - Councillor John Taylor
Ward 4 - Councillor Jack Dennison
Ward 5 - Councillor Rick Goldring
Ward 6 - Councillor Carol D'Amelio

CITY STAFF

Bruce Krushelnicki, Director, Planning & Building
Robert Jurk, Senior Project Leader, Engineering
Jamie Tellier, Coordinator Site Plans & Urban Design, Planning & Building
Robin Van de Lande, Senior Environmental Planner, Planning & Building
Brian McKelvey, Supervisor of Forestry, RPM
Jeff Thompson, Contract Administrator, Design & Construction, Engineering
Ingrid Vanderbrug, Landscape Architect, Parks & Recreation
Dave Wright, Insurance & Risk Management Officer, Finance
Sean O'Brady, Communications Advisor, Clerks Department
Lisa Shields, Assistant City Solicitor
Blake Hurley, Assistant City Solicitor

PHOTO CREDITS

All photos in this document were provided courtesy of the City of Burlington's Communications Department, Urban Forest Innovations Inc. and Beacon Environmental Ltd.

Management and Implementation ~ Community Engagement and Stewardship ~ Protection and Preservation

Replenishment and Enhancement ~ Tree Health and Risk Management

CITY OF BURLINGTON | **URBAN FOREST MANAGEMENT PLAN** | 2011-2030