

City of Burlington, Vermont Urban Forestry Master Plan



Funded by: The United States Department of Agriculture Forest Service

Administered by: The Northern Vermont Resource Conservation and Development
Council
and the Vermont Department of Forests, Parks and Recreation



June 2002

Urban Forestry Master Plan



City of Burlington, Vermont
Mayor: Peter Clavelle

Department of Parks and Recreation
Director: Wayne Gross

Compiled by:

Lou Thompson
Grants Administrator/Consultant

Warren Spinner
Arborist/Project Manager

Bob Whalen
Superintendent of Parks, Planning and Development

Funded by:

The USDA Forest Service

Administered by:

Northern Vermont Resource Conservation & Development Council

Vermont Department of Forest, Parks & Recreation

CONTRIBUTORS

Board of Parks and Recreation Commissioners - David Porteous, Chair, Donna Foley, John Gallagher, Barbara Nolfi and Carolyn Hanson

David Bloniarz - USDA Forest Service

H. Dennis P. Ryan - University of Massachusetts

Steve Sinclair - Vermont Department of Forests, Parks and Recreation

Jill Mahon - University of Vermont Extension

Carl Whitke - Northern Vermont Resource Conservation and Development Council

David White and Jay Appleton - City of Burlington/Department of Planning and Zoning

Nikki Fuller - City of Burlington /Attorney's Office

John Underhill - volunteer proof editor

Andrew Noonan, Gene Aube and Bill Agnew - City of Burlington / Department of Parks and Recreation

Contents



EXECUTIVE SUMMARY.....	1
THE BURLINGTON URBAN FORESTRY MASTER PLAN	1
BURLINGTON’S URBAN FOREST IN THE YEAR 2010: A VISION FOR THE FUTURE	3
CHAPTER 1 - TREE INVENTORY.....	4
1.1 OBJECTIVES	4
1.2 SPECIES DIVERSITY	4
1.3 SPECIES SIZE	5
1.4 PLANTING SITES.....	5
1.5 TREE POPULATION	6
1.6 MONETARY STREET TREE VALUE.....	6
1.7 PARK AND CEMETERY TREES.....	6
1.8 MAPPING AND SOFTWARE.....	8
1.9 RECOMMENDATIONS	8
CHAPTER 2 - STREET TREE PLANTING PLAN - EXECUTIVE SUMMARY	9
SECTION 1 - VISION STATEMENT	9
SECTION 2 - INTRODUCTION TO THE URBAN FORESTRY MASTER PLAN.....	9
SECTION 3 - BENEFITS OF THE URBAN FOREST	9
SECTION 4 – INTRODUCTION TO THE STREET TREE PLANTING PLAN	9
SECTION 5 –BURLINGTON’S URBAN FOREST	10
SECTION 6 - INVENTORY OF BURLINGTON’S STREETS FOR TREE PLANTING	10
SECTION 7 -TYPICAL CONDITIONS OF THE BURLINGTON STREETScape	10
SECTION 8 - STREET TREES FOR BURLINGTON.....	10
SECTION 9 - STREET TREE PLANTING CLASSIFICATION	10
SECTION 10 - PRIORITIZING STREET TREE PLANTING	11
SECTION 11 - DESIGN AND PLANTING RECOMMENDATIONS	11
SECTION 12 - PROPERTY OWNERS’ MANUAL	11
CHAPTER 3 - OPERATIONS	12
3.1 CITY OF BURLINGTON	12
3.2 OTHER ORGANIZATIONS AND AGENCIES	14
3.3 BURLINGTON’S PUBLIC SCHOOLS AND PRIVATE CITIZENS	15
3.4 TREES AND GREENWAYS SECTION	15
3.5 EQUIPMENT INVENTORY	19
3.6 RECOMMENDATIONS	20
CHAPTER 4 - MAINTENANCE	21
4.1 MAINTENANCE ACTIVITIES	21
4.2 SCHEDULED MAINTENANCE.....	22
4.3 SERVICES	23
4.4 TREE PRUNING AND TRAINING	23
4.5 TREE REMOVAL	27
4.6 TREE PROTECTION AT CONSTRUCTION SITES	28
4.7 MITIGATION OF INSECTS AND DISEASE	29
4.8 WILDLIFE CONSIDERATIONS	30
4.9 WOOD WASTE UTILIZATION AND MANAGEMENT	31
4.10 FIVE YEAR PLAN.....	32
4.11 RECOMMENDATIONS.....	35

CHAPTER 5 - EDUCATION.....	39
5.1 VOLUNTEERS FOR TREES.....	39
5.2 COMMUNITY INVOLVEMENT.....	40
5.3 INFORMATION AND FEEDBACK.....	41
5.4 TRAINING	41
5.5 RECOMMENDATIONS	43
SUMMARY	44
CHAPTER 6 - FUNDING.....	45
6.1 CITY GOVERNMENT RESPONSIBILITIES.....	45
6.2 BURLINGTON'S TREE CARE BUDGET	46
6.3 CURRENT CONDITIONS	47
6.4 FUNDING A PROGRAM.....	47
6.5 FUNDING METHODS TO AVOID.....	48
6.6 RECOMMENDATIONS.....	49
CHAPTER 7 - EMERGENCY RESPONSE.....	51
7.1 THE FIRST 48 HOURS.....	52
7.2 THE FIRST 30 DAYS.....	54
CHAPTER 8 - TREE ORDINANCE.....	58
REFERENCES	59



Executive Summary

An urban forest provides great value in many different areas, such as increased resale values for residential properties, savings from decreased heating and cooling costs, reduction of air pollution, and control of erosion from storm water runoff. It has been estimated that a tree with a 50-year life span provides nearly \$60,000 of benefit over its lifetime.

Other benefits are less easily measured, but no less valuable. An urban forest provides beauty that inspires us, recreation that refreshes us, and contact with nature that lifts our spirits. The aesthetic and inspirational value of an urban forest is incalculable.

Burlington's urban forest is thriving but is increasingly at risk. While many areas of the urban forest are in good condition, it is as often by accident as by design. Those areas that receive knowledgeable care are healthy and productive. Other areas are not so fortunate. Development, invasive non-native species, and infrequent maintenance threaten portions of the urban forest. Without a comprehensive plan to guide the protection, maintenance and restoration of its urban forest, the City of Burlington risks degrading an enormously valuable resource, one that is a critical element of both the environment and the city's infrastructure.

Burlington, however, is extremely fortunate in having strong support for its urban forest. Consequently, there has been substantial progress in developing planting standards and conducting a comprehensive inventory of the street tree population. Burlington is now in a favorable position to properly manage its urban forest. The Burlington Urban Forestry Master Plan is the guidance mechanism that will assist the city in such an endeavor.

The City of Burlington's 5-year Strategic Plan is currently being developed. Each Department within the City is required to develop its portion of the 5-year Plan. The Trees and Greenways section of the Parks and Recreation Department based their component of the Strategic Plan on this Urban Forestry Master Plan.

The Burlington Urban Forestry Master Plan

The Burlington Urban Forestry Master Plan (UFMP) consists of two documents: The Main Urban Forestry Master Plan Document and a Street Tree Planting Plan.

The UFMP was prepared by the staff of the Burlington Parks and Recreation Department and a private consulting firm was hired to assist in producing the Street Tree Planting Plan. Principal funding for the project came from the USDA Forest Service through the 1998 Ice Storm Recovery Program, which was administered by the Northern Vermont Resource Conservation and Development Council and the Vermont Department of Forest, Parks and Recreation. All of the grants secured had matching requirements for funds and the Burlington Parks and Recreation Department was responsible for having provided that match.

Purpose of the UFMP

The UFMP provides a comprehensive and multi-objective management plan for Burlington's urban forest, consistent with various industry goals and standards. The UFMP recommends methods to manage and care for urban trees and related vegetation on all land within the city limits, both individually and as part of the urban ecosystem. The UFMP addresses how the urban forest improves air and water quality, promotes energy efficiency, enhances noise control, improves urban livability and aesthetics, fosters the mental and physical health and well-being of its citizens, and promotes and improves wildlife habitat.

Goals of the UFMP

- Develop an integrated, coordinated approach to the management of the urban forest, which has the support of all concerned organizations, city departments, the business community and citizens, through enhanced communication and volunteerism.
- Ensure that the protection and management of the urban forest are citywide priorities. The urban forest is an essential part of the City's infrastructure.
- Secure stable funding and management resources to maintain and enhance the urban forest.
- Maximize and expand the urban tree canopy and produce a multi-aged and diverse forest.
- Assure that the urban forest is sustainable.
- Carry out the plan using education as the primary means of implementation, incentives as the next, and regulations as the last resort.
- Develop a plan that is socially equitable, providing benefits to all the citizens of the city.
- Develop a plan that is adaptable and responsive to change, providing benchmarks and schedules for implementation.
- Provide various approaches to implementation, involving all aspects of the community in creative alliances and partnerships.

The Audience

The UFMP is designed for the following audiences:

The General Public

The UFMP contains information available to the public about the urban forest: what it is, where it is and the benefits that it provides.

Private Property Owners and Neighborhood Groups

The UFMP provides general information about trees and related vegetation as well as specific information on street tree planting and landscaping requirements, and activities in sensitive use and natural areas. The UFMP also includes an Owner's Manual to assist in tree care.

Developers

The UFMP addresses requirements for tree preservation and landscaping, and provides information about the advantages of preplanning and using tree professionals.

City Departments and Related Agencies

The UFMP specifies the responsibilities of the various departments that manage different aspects of the urban forest, and the coordination among those departments that is necessary to improve the urban forest.

Key Recommendations

The UFMP makes the following general recommendations:

1. Inventory and assess the health and condition of the urban forest.
2. Continue to identify planting opportunities and needs; promote and coordinate planting among private property owners, non-profit organizations and the nursery industry.
3. Implement planting and design standards for all areas of the urban forest.
4. Promote maintenance practices that foster the health and safety of the urban forest.
5. Implement a public education program to promote the care, preservation and enhancement of the urban forest.
6. Promote incentive programs to encourage compliance with recommendations that improve the urban forest.
7. Seek adequate funding to effectively manage the urban forest and enforce regulations.

One element that is common to all of the above recommendations is the need to coordinate the many activities among the various City Departments and groups that affect the urban forest. It will take great commitment and cooperation among all of Burlington's citizens to make today's vision of the urban environment into tomorrow's reality, creating a thriving and sustainable urban forest. To this end, methods to recruit, train and utilize volunteers are described in the plan. This plan also proposes alternate funding possibilities as well as consolidation and improvement of existing services and resources. The result of the city's actions, or of its inactions, will be measured in the years to come. The city's goal is to have a healthy and sustainable urban forest that contributes to the economic and environmental vitality of the city.

Burlington's Urban Forest in the Year 2010: A Vision for the Future

Burlington's urban forest, a mosaic of planted landscapes and what remains of the native forest, is a reflection of the city's health, well being, and livability. It is an important part of Burlington's character, giving the City a special sense of place.

The urban forest canopy is cohesive, not fragmented, because development includes trees as part of the total vision for sustainable economic and natural environments. The air and water are cleaner because the trees and plants remove pollution from the air and reduce run-off. Open spaces and urban stream corridors define a sense of space in our communities while providing a quiet respite from hectic urban life. Neighborhoods with tree-lined streets offer shade and protect us from inclement weather. Shoppers frequent shaded business districts where trees help save energy, reduce noise, and soften the hard edges of structures and paved areas.

Coordinated management of the urban forest occurs because municipal departments, businesses, civic organizations and citizens have formed partnerships to make a place for trees in the City. Citizens recognize that trees are a vital part of the City's infrastructure and ecosystem and therefore provide adequate, stable funding to maintain and enhance the urban forest.

Chapter 1



Tree Inventory

Burlington's Trees and Greenways Section of the Parks and Recreation Department is responsible for maintaining trees in the city's parks, but trees within public rights-of way along streets are the largest component of the urban forest under the care of the city. A street tree inventory system was started in 1997. The initial inventory was completed in 1999 and finalized in 2001, consequently, data that was previously unknown had been gathered on approximately 10,000 trees. The inventory data is organized on the TreeKeeper 6.0¹ inventory software system. Additions to the inventory and updates to the work history records and service requests have become part of the regular maintenance of the inventory database.



1.1 OBJECTIVES²

The objectives of the inventory are:

1. To determine the composition of Burlington's urban forest (the number of each species)
2. To identify all trees by location, condition and species
3. To link inventoried trees to an address and code number
4. To determine the location and number of vacant planting sites
5. To determine maintenance needs of the urban forest, such as training/pruning, cable and bracing, fertilizing, diagnostics, line clearing and tree removal

1.2 SPECIES DIVERSITY

The figure of 10,015 trees is used to calculate the species composition percentages for the street tree population. The street tree population is represented by 95 species/cultivars. **Table 1A** identifies six species that comprise almost 32% of the total tree population. No one species accounts for more than 8% of the population. As of May 1, 2002, the City had 11,755 street tree planting sites. Of this number, 6,987 individual street trees have been inventoried with 4,768 potential planting sites remaining.

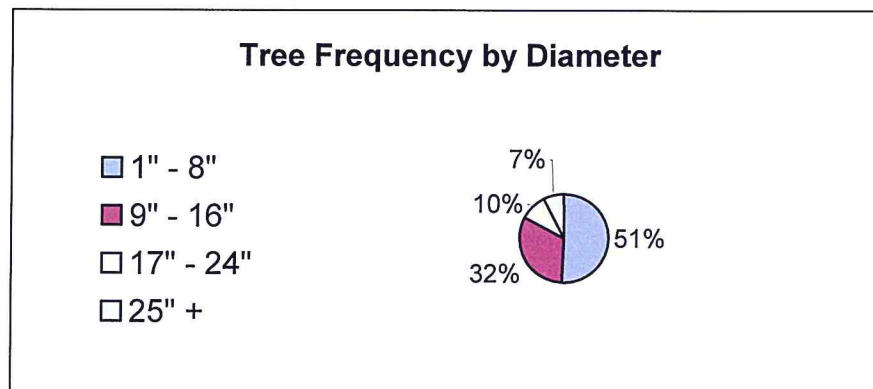
Table 1A
Tree Frequency Report

Code	Species (common name)	Tree Sites	Frequency
00026	Crabapple, Spp.	1160	7.9%
00007	Ash, Green	971	6.6%
00060	Linden, Littleleaf	697	4.7%
00070	Maple, Norway	689	4.7%
00069	Maple, Red	573	3.9%
00071	Maple, Sugar	532	3.6%
00000	Other	5393	68.6%
Total		10,015	100.00%

1.3 SPECIES SIZE

The optimum size and maturity distribution of the tree population under an ideal urban forest planning situation achieves an environmental (not necessarily numeric) balance between large, mature trees and small, younger trees. Recognizing that young, small trees have higher levels of mortality than vigorous large trees, young trees should represent 2 to 3 times the number of mature trees in a population. Vigorously growing middle-aged trees should comprise about half of an urban forest population. Using these rules of thumb, the optimum size and maturity distribution should approximate 35% immature trees, 50% middle-aged trees, and 15% mature trees. Caution must be used in equating maturity class and size, and these guidelines are more appropriate for maturity class than size.³ The following diagram represents Burlington's tree distribution:

Optimum Distribution - 35% immature / 50% middle-aged / 15% mature trees
Burlington's Distribution - 51% immature / 32% middle-aged / 17% mature trees



1.4 PLANTING SITES

Planting sites are designated based on available space, the existence of overhead wires, adjacent vegetation, and proximity to driveways, sidewalks, utility poles, and intersections. As of January 2002, there were 4,768 vacant street tree planting sites in Burlington. The planting sites range from small and medium to large and are categorized by priority. A large percentage of Burlington's vacant planting locations are small, high-priority sites. Therefore, the majority of new plantings in the next 10 years will be small trees in high-priority sites characterized by overhead wires.

1.5 TREE POPULATION

As of the beginning of the year 2002, the City had an estimated 6,987 street trees and 3,028 park trees under its management. The tree mortality rate is estimated at 1.0% per year. The location and species selection for the new plantings will be based on guidance from the Street Tree Planting Plan (Chapter Two).

Table 1B
Current and Projected Annual Tree Population

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Beginning of Year	9,987	10,080	10,157	10,233	10,308	10,383	10,457	10,530	10,602	10,674	10,745
New Plantings	195	180	180	180	180	180	180	180	180	180	180
Mortality	(102)	(103)	(104)	(105)	(105)	(106)	(107)	(108)	(108)	(109)	(110)
End of Year	10,080	10,157	10,233	10,308	10,383	10,457	10,530	10,602	10,674	10,745	10,815

1.6 MONETARY STREET TREE VALUE

Monetary calculations of tree valuations are based on a 'Trunk Formula Method' as described in the ninth Addition of the 'Guide for Plant Appraisal Valuation' by the International Society of Arboriculture, 2000. The 'Trunk Formula Method' approach does not account for the possible under valuation of smaller trees, where the 'Replacement Method' may be more appropriate. The 'Trunk Formula Method' lends itself to the data collected in typical street & park-like inventories.⁴

Results produced by the 'Trunk Formula Method' calculation should be considered a general estimate of the overall tree value and it is not meant as a substitute for individual tree appraisals as performed by a qualified Arborist. **Table 1C** estimates the monetary value of Burlington's street tree population based on an average square inch cost and other plant appraisal factors.

Table 1C
Estimated Tree Value

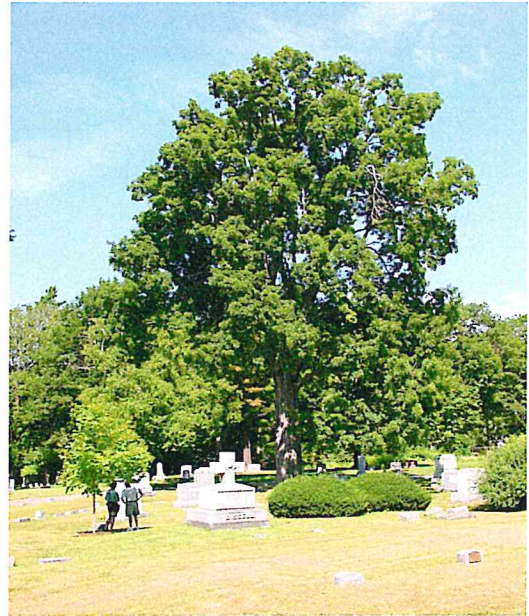
Number of trees valued	10,015
Average cost value per square inch	\$40
Estimated value	\$12,819,200
Per tree value	\$1,280

1.7 PARK AND CEMETERY TREES

Street trees are the primary municipally maintained trees that have been inventoried, with a few exceptions. In addition to street trees, the City maintains trees in three cemeteries, and 28 parks. A park tree is defined as any tree located in or adjacent to any of Burlington's public parks where turf maintenance or formal plantings occur. During the time of preparing this Urban Forestry Master Plan, efforts had been made to inventory all of the park and cemetery trees. The current inventory software can accommodate records for trees in these areas as an actual inventory is conducted. Trees in parks and cemeteries are not arranged in a linear fashion, as are street trees. Therefore it is important to develop effective methods for recording tree location, and to accompany the inventory

data with an accurate map. This is another area where access to a Geographic Information System (GIS) is important.

After careful consideration, it was determined that park and cemetery tree location data could efficiently be improved through the use of a palm pilot data collector that can be down loaded into Burlington's current inventory software program that will be interfaced with the City's ArcView base maps. As field personnel inspect individual trees, the tree record is recalled to the screen of the palm pilot. The condition and maintenance fields are used to describe the trees and any other additional information is recorded. The appropriate tree location symbol is identified on the map, or removed, if necessary, to the proper location relative to the property lines.



Although the city's parks and cemeteries have not been completely inventoried, some analysis of a few forested parks have been completed in a plot program. In 1995 the Vermont Department of Forests, Parks and Recreation, through their Urban & Community Forestry Program, conducted Park Forest Vegetation Management Plans for Leddy and Ethan Allen Parks.

Here is a brief description of the parks and the results of the initial study:

Ethan Allen Park is located in the "New North End" of Burlington. The sixty-nine acre parcel is bounded on the south by North Avenue, on the west by Ethan Allen Parkway, on the east by the backyards of private residences and on the north by the right-of-way of the "Northern Connector" highway. Ethan Allen Park provides a sylvan oasis in a highly developed suburban neighborhood. Uses include walking, running, nature appreciation, picnicking, and cross-country skiing.⁵

Leddy Park is also located in the "New North End" of Burlington, west of the Ethan Allen Shopping Center on North Avenue and fronting on Lake Champlain. The management plan involved only the forty acres of forest in the park. The remainder of the park is composed of athletic fields and courts, playgrounds, parking areas, ice skating facility and other recreational facilities.⁶

In 1995, the city contracted to have a red and white pine stand thinned in Leddy Park. The thinning was accomplished by a commercial technique that utilized horses to skid out logs. The use of horses was selected because of the low impact to the urban forest. Many of the remaining stands in both Ethan Allen and Leddy Parks are in need of thinning to maintain their health and vigor. Foot traffic in the stands, particularly the conifer plantations, should be controlled to minimize compaction of the soil and subsequent damage to tree roots. Two methods of dealing with the effects of foot traffic are keeping travel on designated paths, and building up a layer of organic matter such as wood chips or bark mulch on the forest floor.

1.8 MAPPING AND SOFTWARE

As previously noted, the street tree inventory data is maintained on the Davey Tree "TreeKeeper" (version 6.0) and palm pilot database software. In addition to the inventory data, the software is used to track maintenance activities and citizen service requests. Several changes to the current inventory system and procedures associated with the system could improve efficiency. The first and most important problem to solve is the process of data entry. Currently, the City Arborist handles the data entry for inventory updates and work histories. There has been a large backlog of data entry due to the work undertaken during the 1998 ice storm. The data obtained which is periodically entered has tremendous value in tracking costs, maintenance to individual trees, and damage relative to individual species.

Data entry is further complicated by the fact that the desktop computers in the Parks and Recreation Department office are not adequately networked with the Trees & Greenways Section. This means that the inventory data must be maintained on a single machine and only one person can access the inventory data at a time.

Since the purchase of the TreeKeeper software, advances have been made that allow the database system to be effectively linked to a computerized mapping system. The Trees and Greenways Section utilizes the Arcview mapping system which is linked to the TreeKeeper database. The Arcview/TreeKeeper 6.0 (AV-TK) interface is a customized Arcview extension that provides users of TreeKeeper 6.0 with simple mapping capabilities.⁷ The following is a general overview of the interface extension:

- The extension provides six commands that simplify common GIS tasks performed on the tree point shapefile initially provided with a tree inventory.
- The shapefile contains the locational information of the trees whose other data attributes are stored in TreeKeeper 6.0.
- All other functions of Arcview are present when the extension is loaded.
- The extension can be loaded or unloaded at any time. However, the custom buttons that allow the interface with TreeKeeper are only present when the extension has been loaded.

1.9 RECOMMENDATIONS

Currently, the City does not operate a dedicated mapping division, but the city's Planning and Zoning Department does maintain computerized maps. In January 2001, the City obtained aerial photographs of Burlington digitized on a 1:1250 scale. These photographs were downloaded into a field inventory computer utilizing Geographic Information Systems (GIS) software. GIS can be a powerful planning and management tool, particularly when multiple layers of information are presented on one system. GIS can provide a link between numerous municipal departments and serve essentially as a "common language" between managers.⁸ It is recommended that the Trees and Greenways Section begin the plan for eventually integrating tree location data into the City's mapping system. The first step, which has been completed, is to exchange information with the Planning and Zoning Department to determine the direction of future mapping projects.



Street Tree Planting Plan - Executive Summary

The Street Tree Planting Plan is a stand-alone document that describes the procedures for planting street trees in the city. It is guided by an overall vision to sustain and enhance the city as a livable community with an extensive, thriving urban forest that provides multiple aesthetic and environmental benefits. Both the Street Tree Planting Plan and the overall Urban Forestry Master Plan are designed to support this vision by providing a comprehensive approach that sets forth a range of appropriate planning, implementation and management tools.

The following is a summary of the Street Tree Planting Plan:

Section 1 - Vision Statement

This section outlines the vision behind the development of the Street Tree Planting Plan. Healthy street trees play an integral role in the city's ecological health, historical identity, aesthetic value, and quality of life. The plan is designed to be used as a framework to guide street tree plantings and treebelt design, both current and future.

Section 2 - Introduction to the Urban Forestry Master Plan

This section places the Street Tree Planting Plan within the overall context of the Urban Forestry Master Plan by outlining the components of the plan and their interrelationships.

Section 3 - Benefits of the Urban Forest

This section discusses the benefits of the urban forest and describes how trees are the lungs of the city: how street trees filter and clean the air. The effect of trees in climatic modification is presented, highlighting the value of shade and windbreaking effects. Street trees also mitigate noise pollution by buffering the noise level of the city. Stormwater runoff and erosion are also reduced by trees. The urban forest sustains wildlife habitat by providing suitable environments and travel corridors for birds and other wildlife. Property values are also influenced by street trees as their presence can increase the value and desirability of an individual lot and residential street. Perhaps most significantly is the relationship of street trees and the urban forest to the quality of life in Burlington: the value of trees in our everyday lives should not be underestimated.

Section 4 – Introduction to the Street Tree Planting Plan

This Section is an introduction to the Street Tree Planting Plan. This introduction underlines the value of street trees and the urban forest and provides a framework and purpose for the overall document. It provides some historical perspective citing the devastating impact of Dutch elm disease, which resulted in the removal of 95% of Burlington's American elms, the predominant street tree of the mid 20th century. More recently, the severe ice storm of 1998 damaged beyond recovery a significant portion of the city's street tree population.

The following key conclusions are also presented in Section 3 of the Street Tree Planting Plan:

Residential Type 2 (typically more recently developed streets with larger lots). Each classification type is further delineated by 4 treebelt widths with Treebelt 1 being 4-6 feet, Treebelt 2 denotes a width of 6-8 feet and Treebelt 3 indicates a width of 8 feet or greater. Streets or sections of streets with no treebelts or with treebelts less than 4 feet wide are also noted. Technical planting specifications are also provided.

Section 10 - Prioritizing Street Tree Planting

This Section discusses priorities for street tree planting:

- Initiate planting in areas of Burlington currently underserved by trees.
- Undertake the infilling of individual streets or sections of streets that are currently underserved by trees.
- Encourage and support planting on private property in the form of setback plantings, which contribute to the streetscape.
- Ongoing maintenance of existing and newly planted street trees. This essential activity protects the city's investment while ensuring that the street tree population thrives and achieves desired aesthetic function qualities.

The above priorities provide a point of departure for the City Arborist, who will use these guidelines as a tool in making final planting decisions.

Section 11 - Design and Planting Recommendations

This Section presents design guidelines for street tree planting in a series of recommendations and graphic illustrations. While the plan strongly urges the burial of utilities, this section provides ideas for achieving desirable aesthetic qualities when planting on streets that have aboveground utilities. Topics covered in this section include:

- 1) Infrastructure and streetscape design
- 2) Achieving balance
- 3) Creating full canopies
- 4) Appropriate planting intervals
- 5) "Species Architecture" and visual quality
- 6) Planting in groupings and medians
- 7) Infill planting and historic settings
- 8) Appropriate scale and size
- 9) Avoiding unfavorable site conditions
- 10) Maximum 10% genus and 5% species

This section includes a recommended process for planning, design and implementation of specific plans for individual streets being designed or reconstructed.

Section 12 - Property Owners' Manual

This Section is intended to be a stand-alone guide for property owners on topics ranging from the benefits of the urban trees to selecting the right tree for the right location to be planted. Proper planting and care for urban trees is also covered in the manual.

Chapter 3



Operations

This chapter describes the activities of city agencies, existing cooperative agreements between them, and the current City Ordinances (Chapter 8) that regulate the urban forest. One of the Urban Forestry Program's most fundamental components is the assistance it receives from its network of affiliates. In fact, Burlington's Urban Forestry Master Plan reflects the input of many of its relationships and contracts with colleges and universities, researchers, authors, resource managers, tree care practitioners and citizens. Also, essential to the network, are the invaluable non-profit organizations and volunteers who devote their time, talent and financial support to the stewardship and planting of public trees.

There are numerous organizations that impact urban forestry management. They include departments, agencies, utilities, and nonprofit organizations, which are engaged in activities that affect various portions of the urban forest. This Chapter identifies their roles and responsibilities and the coordination that exists between them. There is interaction between the following organizations and agencies: Parks and Recreation Commission, Burlington Parks and Recreation Department, Trees and Greenways Section, Department of Public Works, Burlington Electric Department, Burlington Planning Commission and Department of Planning and Zoning, Community and Economic Development Office, Burlington Public Schools, Branch Out Burlington!, Winooski Valley Park District, Chittenden County Solid Waste District, Vermont Department of Forests, Parks and Recreation, University of Vermont, and the Northern Vermont Resource Conservation and Development Council.



3.1 CITY OF BURLINGTON

Parks and Recreation Commission

The Parks and Recreation Commission consists of five citizens who serve without compensation. Duties as outlined in the City Charter include:

- Directs the Parks and Recreation Department
- Providing assistance in the development of the Urban Forestry Master Plan.
- Advising the City Arborist and the Director of Parks and Recreation on the preparation of the annual urban forestry budget request.

- Advising the City Arborist and the Director of Parks and Recreation on the preparation of the annual urban forestry budget request.
- Reviewing plans and policies related to urban forestry and other matters brought forward by the City Arborist.
- Preparing and submitting an annual report containing a section dealing with the relations with, and concerns of, the various City Departments.

Department of Parks and Recreation

The Department of Parks and Recreation is responsible for the planning and management of the city's parks system under the direction of the Parks and Recreation Commission. This system includes city and district parks, neighborhood parks, playfields, special use areas and a boathouse located in Burlington harbor. The department also provides recreational programming, such as youth and adult sports leagues, and maintains and operates a municipal ice arena.

Trees and Greenways Section

Under the direction of the Department of Parks and Recreation, the Trees and Greenways Section is responsible for planting and maintaining approximately 10,000 street and park trees. It is through the Trees and Greenways Section that this Urban Forestry Master Plan has been developed. Information regarding the operations, staffing and equipment needs of the Trees and Greenways Section is provided later in this chapter.

Department of Public Works (DPW)

The DPW aspires to improve Burlington's quality of life through stewardship of the environment and infrastructure. In part, they are responsible for the design and construction of the transportation infrastructure; street trees are recognized as part of that system. The following is a summary of DPW's connection with Burlington's urban forests and the Trees and Greenways Section:

- Coordinates with the City Arborist to ensure that street trees are considered in the design stage of new construction projects. For example, traffic circles and diverters, which are designed primarily to slow or direct traffic flow (traffic calming), also provide areas for landscaping throughout neighborhoods.
- Involved with interactions between trees and sidewalks, cutouts, curbs and streets, primarily to improve pedestrian safety and experience.
- Routinely coordinates with the City Arborist to reduce damage to trees because of hardscape (curb and sidewalk) repair and vice versa.
- Prunes trees at intersections to improve visibility.

Burlington Electric Department (BED)

BED serves all of the Burlington area and provides affordable, reliable electric service and a full range of energy services including generation, transmission, distribution and other retail and administrative support services. The Trees and Greenways Section interacts with BED regarding streetscape design, with the primary concern being the design of lighting and pole hardware as it relates to tree height and spread. BED contracts with the Parks and Recreation Department for maintenance of trees under power lines which the Trees and Greenways Section manages. As a policy, the Trees and Greenways Section does not plant large trees under utility lines. BED also maintains landscaping around power substations.

The Burlington Planning Commission and Department of Planning and Zoning

The Burlington Planning Commission and Department of Planning and Zoning (Department), provide guidelines through the Open Space Plan, for the City's long-term growth and help shape that growth through the development review process. The Department provides support for the Planning Commission, the Design Review Board, the Conservation Board, the Historic Preservation Review Committee, and the Zoning Board of Adjustment. The Department is responsible for regulating the development of sensitive use areas such as wetlands. They also approve land subdivision, new development, landscaping and screening of parking lots, and other landscape requirements. They are responsible for zoning and various policies that could impact the urban forest.

Community and Economic Development Office (CEDO)

The mission of CEDO is to achieve economic justice within Burlington, a sustainable city. To this end, CEDO mobilizes resources and in partnership with the citizenry, develops affordable housing; works to revitalize the waterfront, downtown, and local neighborhoods; and increases economic opportunities for all. The Enterprise Community Public Safety Project, which CEDO co-directs, has resulted in support for traffic calming, park revitalization, and tree planting in numerous neighborhoods. The Trees and Greenways Section coordinates with CEDO on projects related to the planting of street and park trees in areas eligible for Community Development Block Grants.⁹

3.2 OTHER ORGANIZATIONS AND AGENCIES

Branch Out Burlington! (BOB!)

BOB! is a non-profit organization that facilitates neighborhood street tree plantings and natural area reforestation projects throughout Burlington. They work closely with the Trees and Greenways Section to assist neighborhoods in planting the appropriate trees in the right locations.

BOB! promotes partnerships and coordinates efforts of many groups and volunteers to plant, care for, and preserve urban trees. They have a strong focus on education and strengthening neighborhoods. Some of their education and public involvement programs include: The Awesome Tree Contest, a quarterly newsletter, distribution of tree care brochures, sponsoring of public service announcements, conferences, and neighborhood tree/park walks. Volunteers distribute tree care literature and informational door hangers in assigned neighborhoods.

Winooski Valley Park District (WVPD)

Burlington contains approximately 980 acres of public parkland, of which 530 acres is owned by the City and managed by the Department of Parks and Recreation. The remaining acreage is owned and managed by the WVPD, primarily in the form of conservation lands offering access and footpaths to shorelines. Established in 1972 by cities and towns along the Winooski River, the WVPD preserves open space and natural areas for the purposes of conservation, environmental protection and recreation. Both the District and the City work collaboratively on the management of recreational lands and open spaces.

Chittenden County Solid Waste District

The Chittenden County Solid Waste District owns and oversees 12 solid waste or recycling facilities in Chittenden County for its 16 member municipalities. The Wood and Yard Waste Depot (Depot) in Burlington's Intervale, processes clean wood waste, leaves, and brush. Located at 181 Intervale Road, the Depot serves residents and businesses that are members of the District. The Wood Depot program is funded from revenue of woodchip sales to the McNeil Generating Station for use in generating electricity. In 2001, approximately 4,500 tons of wood chips were produced at the Depot.

Vermont Department of Forests, Parks and Recreation (VDFPR)

The Vermont Department of Forests, Parks and Recreation provides technical and financial assistance to the City of Burlington in the management of their urban forest. VDFPR's Urban and Community Forestry program assisted the City of Burlington in producing Park Forest Management Plans for several parks within the city. VDFPR provides grant funds through the "Trees for Local Communities" (TLC) program, for the purpose of developing and implementing local urban and community forestry programs. The City of Burlington has applied for and received TLC grants that were awarded on a 50/50-match basis since 1992. More recent grants assisted in evaluating the damage to the urban landscape and replanting public trees that were lost as a result of a 1998 ice storm. It was through these grants that the importance of developing an Urban Forestry Master Plan for the city was truly realized and partially funded.

Northern Vermont Resource Conservation and Development Council (NVRC&D)

NVRC&D promotes forestry issues on a statewide basis. Representatives from around the state work cooperatively on educational programs and special projects. They were contracted by VDFPR to administer the Ice Storm Grants program.

University of Vermont (UVM)

UVM provides plant diagnostic assistance to the City Arborist. The Extension Service also provides lab assistance with the Urban Forestry and Horticultural Department.

3.3 BURLINGTON'S PUBLIC SCHOOLS AND PRIVATE CITIZENS

Burlington's public schools and private citizens participate in many partnership projects with the Trees and Greenways Section. This participation includes partnerships between the National Science Foundation and other private and public groups providing for middle and high school children the opportunity to assist in data collection and field surveys, primarily in natural areas. In addition, schools participate in Arbor Day tree planting ceremonies.

Many individuals and organizations have an interest in and role to play in the stewardship of the urban forest. Among the most important are Burlington's citizens. Property owners are obligated to maintain the treebelt adjacent to their property. This obligation is outlined in the City's Tree Ordinance (Chapter 8).

3.4 TREES AND GREENWAYS SECTION

Primary authority for the management of all public trees and other vegetation mandated by the City of Burlington's Charter falls with the Parks and Recreation Department, Trees and Greenways Section. They are responsible for management of all parks and

greenways within the City, which includes horticulture, turf and urban forest management. Specifically, the Trees and Greenways Section:

- Manages street trees, park ornamental trees and 160 acres of urban forest.
- Manages areas ranging from annual and perennial bedding plants to shade and ornamental trees.
- Provides consulting and horticultural services to other Departments, through interagency agreements, such as; contracts with the Burlington Electric Department to perform line clearing; a cooperative agreement with the Department of Public Works for mowing the City's closed landfills; and a contract with the Winooski Valley Parks District to mow various recreational fields.
- Organizes and administers projects with the Vermont Youth Conservation Corps.
- Responsible for the Pest Management Program for Parks, which also involves educational and policy components.
- Provides Arbor Day programs to Burlington public schools.

The Trees and Greenways Section is involved with numerous work tasks. The following categories are not listed in order of importance or amount of time spent performing.

Work Categories

Tree Removal	The removal of dead and hazardous trees along city streets, in parks and other public places. This does not include stump removal (that work is contracted out).
Tree Pruning / Training	The reasons for tree pruning / training may include, but are not limited to, reducing hazards, maintaining or improving tree health and structure, improving aesthetics, or satisfying a specific need such as: removing diseased, dead, dying, decayed, interfering or obstructing branches; training young trees; or utility line clearance. Before pruning or training, the primary objective is clearly defined by the city staff. That objective is accomplished in the manner most beneficial to the health of the tree. ¹⁰
Tree Fertilizing	The reason for fertilization is to supply nutrients determined to be deficient, to achieve a clearly defined objective which is accomplished in the manner most beneficial to the tree. All fertilizers used are in accordance with manufacturer's recommendations. Root pest management and soil modification to improve nutrient uptake are considered prior to fertilization. Tree fertilization activities may also include vertical mulching. ¹¹
Cable and Bracing	Trees can benefit from the support and strength provided by guy wires, cables and bracing. Sometimes trees develop in such a manner that they are structurally weak, making them susceptible to damage from winds, storms, or even the weight of their own foliage. In newly transplanted trees, guys prevent windthrow until the roots become established. In established trees, cables and braces are used to prevent or reduce storm damage. ¹²

Tree Planting	Planting of ornamental and shade trees including all operations done at the time of planting such as fertilizing, watering, hole preparation, mulching and staking are performed by the Trees and Greenways Section. Work in this category includes time spent planning for species and site selection, and acquisition and preparation of plant and support materials. Subsequent maintenance such as watering and pruning for all trees planted during the current fiscal year that are not under maintenance contracts is also a responsibility.
Stump Removal	Removing stumps with a stump cutter including replacing topsoil, reseeding, and disposal of stump cuttings.
Tree Spraying	Preparation and application of pesticides for control and/or eradication of tree disease and insect pest.
Emergency Calls	Any tree work done, including pruning, removal or tree/debris disposal, as a result of a storm, high winds, rain, etc., whether done during or after regular working hours.
Equipment Maintenance	Maintenance of all tools and equipment associated with arboriculture work. Tools and equipment to include are hand tools, pruning and climbing equipment, chain saws, sprayers, an aerial bucket truck and a brush chipper and chip truck.

Staff Hour Distributions

Based on the number of trees in the current tree population, and the average time to prune a tree, it has been determined that an average of 2,431 staff-hours per year is being expended for pruning. **Table 3A** shows the current distribution of staff-hours within the Trees and Greenways Section. Alternatives to the current pruning cycle will be necessary to achieve the desired maintenance schedule and will be discussed further in Chapter 4. The actual annual allocation of staff-hours to tree maintenance and management was compiled using labor distribution records. The distribution breakdown between Arborist Technician and Arborist was estimated, based on normal crew composition for each work category.



Table 3A
Current Distribution of Hours Worked – Trees & Greenways

Work Category	Arborist Arborist	Arborist Technician	Arborist Technician	Arborist Technician	Admin.	Seasonal Technician	Total
Administration	1,000	252	132	200	240		1,824
Turf Maintenance	8		87				95
Horticulture	72	200	200	80		204	756
Line Clearing		200	200				400
Removals		120	120	120		100	460
Fertilizing/Watering	20	160	120	400		485	1,185
Cabling and Bracing	40	80	80	80			280
Pruning/Training	50	577	700	784		320	2,431
Diagnostic	300	75	25				400
Other (banners, etc.)	286	200	200	200		160	1,046
Vacation, sick, holidays	304	216	216	216			952
Total Hours	2,080	2,080	2,080	2,080	240	1,269	9,829

Position Descriptions

City Arborist – The Trees and Greenways Section is managed by the City Arborist. In recent years the job description for the City Arborist has changed to include more responsibilities associated with urban forestry management and have expanded to be comprehensive in dealing with all aspects of the urban forest. The City Arborist's responsibilities include:

- Managing the Trees and Greenways Section annual budget.
- Coordinating planning, planting, inspection and maintenance of street, park and cemetery trees.
- Enforcing city codes for root and tree pruning, tree planting and removal and enforcing tree cutting ordinances to preserve significant trees on undeveloped and underdeveloped properties.
- Providing emergency response services to mitigate hazardous situations involving trees such as storm damage.
- Providing advice and physical support for citizen and business groups to achieve large-scale tree planting projects.
- Providing support to 'Branch Out Burlington!' and other nonprofit organizations to promote trees and enhance the urban forest.
- Educating the public through flyers, workshops, presentations to community groups and the use of brochures developed by organizations such as National Arbor Day Foundation and Tree City USA.
- Coordinating and promoting Arbor Day tree planting ceremonies at local schools.

Arborist Technician – This is a skilled laborer capable of performing all arboricultural work, under the direction of the City Arborist. Equipment operation includes the aerial bucket truck, wood chippers, chainsaws, sprayers and specialized hand climbing hardware. This position involves 100% fieldwork, both directly with the Arborist, and independently as a crew foreman. The following is a breakdown of the Arborist Technician's responsibilities:

- Prune, cable and brace, fertilize, aerate, vertical mulch, and root pruning.
- Removal of trees and shrubs from park and other public lands due to hazard potential or unsightliness.
- Tree trimming and removal around electric utility poles.
- Planting and maintenance of trees, shrubs and flowers in city greenbelts and parks.
- Inspect and diagnose insect and disease problems. Obtain and maintain Vermont Pesticide Applicator's License.
- Perform routine maintenance on equipment such as daily greasing, air filter cleaning, fluid level checks, brushhog, sickle bar and batwing blade sharpening or replacement.
- Train regular and seasonal staff on proper arboricultural techniques including hand climbing, pruning, aerial lift operation, and the basics of pruning young trees.

Both City Arborist and Arborist Technician positions require incumbents to be International Society of Arboriculture Certified Arborist's

Seasonal Arborist Assistant - This is a temporary labor position, utilizing available seasonal personnel usually between May and September. The Seasonal Arborist Assistant is responsible for the following:

- Landscape maintenance of City greenways and traffic islands. Assists with pruning and removal of street and park trees.
- Assists with street tree inventory program.
- Assists with annual & perennial flower planting and cultural maintenance.
- Pruning, mulching, edging, weeding and watering of ornamental shrubs.
- Mowing and string trimming around flower & shrub beds.

3.5 EQUIPMENT INVENTORY

The primary Trees and Greenways Section equipment currently includes:

- 1 Bucket truck (not equipped with chip body)
- 1 Chip truck with chipper
- 1 Wood dump truck
- 1 Trailer type hydraulic sprayer

The bucket truck is essential to the Trees and Greenways Section operations. Typically, the bucket truck is accompanied by a two-person crew, which includes an aerial worker and a ground worker. Ideally, the bucket truck should be replaced every 7 years.



3.6 RECOMMENDATIONS

The greatest strength of the Trees and Greenways Section lies with its personnel. The staff is dedicated and competent, from the leadership provided by the City Arborist, and through the skilled work of the Arborist Technicians. There is a need to create additional field (pruning crew) positions in the Trees and Greenways Section as the city's tree population increases. These would be in the form of full-time permanent and seasonal positions.

Additional Equipment Required

In approximately 10 years, the City should reach the optimum tree size distribution (*refer to section 1.3*). To adequately maintain the increased number of large, mature trees, an additional bucket truck will be needed at some point in the future. It may be advantageous in the future to equip at least one of the bucket trucks with a chip body. This will allow the flexibility of working with or without the support of a chipper truck. A spare chipper will need to be available for use with this truck when it is not used by chip crews.

One additional dump truck and two additional pick-up trucks will be needed to transport crews and equipment and to haul tree debris. Past and existing practices have included utilizing Parks' maintenance trucks for tree maintenance work. It must be noted that these trucks are vitally needed for general park maintenance. Any expansion of the tree maintenance program would require acquisition of the two pick-up trucks specifically for the Trees and Greenways Section. Under the existing system, trucks are not available for tree work without impacting park maintenance work. The trucks currently being used are designed for park maintenance and are not ideally equipped for tree work.

An additional brush chipper could be used for both pruning and removal work. It is a labor saving piece of equipment. In most instances, an entire day's worth of tree branches from either a pruning or removal crew can be chipped and contained in one truckload. This saves several time-consuming trips to the McNeil Generating Plant, Intervale Composting Facility or the Chittenden County's Wood and Yard Waste Depot.

In addition to the bucket truck, useful equipment to add to the current inventory includes a truck mountable watering tank that can be used for watering newly planted trees and for water-soluble fertilization of trees planted within the previous three years. A pressurized system with soil injectors is recommended because it is much faster, thus saving labor costs.

Details about staffing and associated costs can be found in Chapter 6.

Chapter 4



Maintenance

The Burlington Trees and Greenways Section operates at a high level of efficiency because of prioritization of work categories, effective scheduling, and reduced travel time of tree crews. The removal of hazardous trees is a top priority. The staff can significantly reduce the frequency and severity of hazardous conditions associated with trees through proper routine maintenance. Hazardous trees are identified during annual inspections and removed in order of priority.

While Burlington's Trees and Greenways Section has achieved high levels of efficiency, additional gains can be made, primarily through the reduction of the current 6.5-year routine pruning cycle to a 4-year cycle, thus reducing the time spent for emergency response calls. The number of additional trees to be pruned per year to achieve a 4-year cycle is 697.

The largest obstacle to reducing the routine pruning cycle from 6.5 to 4 years is hiring more field positions. Burlington would benefit greatly from the utilization of a permanent small-tree pruning crew. This crew would be responsible for the cyclical pruning of young trees and clearance pruning. Such a crew could be assembled with permanent positions and supplemented with temporary help.

4.1 MAINTENANCE ACTIVITIES

The Trees and Greenways Section facilitates, monitors, and performs tree care services, which are vital components of the City's tree care program. Out of necessity, the staff focuses much of their time on urgent care services, referred to as "crisis management". It is not uncommon, for example, for a crew to set-up a job site only to be called away to respond to an emergency on the other side of town.

In contrast, the work that is assigned to contractors is usually routed by geographic area. By doing so, time management and productivity are maximized. Providing service by area reduces downtime associated with travel and set-up, thus reducing the overall cost. Due to a lack of personnel and equipment, it is often less expensive to contract out some types of work. Contractor crews have been assigned work on a geographical basis utilizing pre-planned schedules for planting, stump removal and tree maintenance.

Table 4A summarizes urban forest related activities and the staff performing those activities. At the time of this report (FY 2002) the Trees and Greenways Section consisted of:

1	Managing Arborist
3	Arborist Technicians (full-time)
2 ½	Seasonal Arborist Technician Assistants (Temporary full and part-time)

Table 4A

Table 4A
Current Distribution of Tree-Related Staff Hours

Task	Arborist	Arborist Technician	Arborist Technician	Arborist Technician	Seasonal Admin. Technicians	Total
Administration	1,000	252	132	200	240	1,824
Line Clearing		200	200			400
Removals		120	120	120	100	460
Fertilizing/Watering	20	160	120	400	485	1,185
Cabling and Bracing	40	80	80	80		280
Pruning/Training	50	577	700	784	320	2,431
Diagnostic	300	75	25			400
Total Hours FY2002	1,410	1,464	1,377	1,584	240	6,980

4.2 SCHEDULED MAINTENANCE

One of the biggest challenges facing the Trees and Greenways Section is to provide for the need to maintain the City's trees in an orderly and systematic way. The most effective approach in meeting the challenge is a process referred to as scheduled maintenance (or preventative maintenance). It is the best way to achieve and sustain a healthy and safe urban forest.

Scheduled maintenance allows the City Arborist to monitor tree safety and structure, thereby reducing the frequency and costs of emergency services.¹³ Although scheduled maintenance requires greater expenditures than currently available, in the long-term it's far more cost effective and safer than management by crisis.

Scheduled maintenance will help reduce the pruning cycle, increase efficiency, reduce costs and enhance the sustainability of the City's urban forest. Work will be routed on a geographic basis. Work crews will be scheduled to a different ward every four to six weeks to ensure an equitable distribution of tree care services citywide. The crew supervisor's primary objectives will be to maximize productivity, minimize travel and downtime, and perform preventative maintenance services. Providing service on a scheduled/geographic basis is fundamental to improving the care of Burlington's trees and the efficiency and quality of service of its Trees and Greenways Section.

As overall tree health and condition improves with routine maintenance, the size of Burlington's street tree population will expand. If all maintenance variables were to remain constant, the financial implication is that more money will be needed to maintain the growing resource. However, entering into a program of regular, cyclic pruning will increase the efficiency of the Trees and Greenways forestry crews and therefore decreases average cost of pruning per tree. Systematic and proper pruning of immature trees will also decrease maintenance cost per tree in the future. Improved tree health and higher efficiency of tree maintenance crews will mostly offset the cost of caring for a larger tree population.

By extending the life expectancy of public trees, the economic and environmental benefits derived from large mature trees including improved air quality, energy conservation, carbon sequestration, reduced stormwater runoff, increased real estate value, and improved aesthetics are magnified. These benefits considerably outweigh the

additional cost for proper management, particularly when considering improved public safety resulting from a healthy urban forest.¹⁴

4.3 SERVICES

Essentially the Trees and Greenways Section provides five types of tree service:

- (1) Tree pruning and training
- (2) Tree and stump removal
- (3) Tree cabling & bracing
- (4) Tree fertilization / soil improvements
- (5) Watering

Currently, some maintenance services provided are on a request basis. The process is usually initiated by a citizen call followed by a staff member inspecting the tree(s) for the requested service. At current levels of staffing and funding, service request is an ineffective and inefficient management system. It lends itself to the gradual decline of the health and safety of the City's urban forest. Rather than committing limited resources to moving from one location to another servicing individual requests in all areas of the City, the Trees and Greenways Section should begin phasing-in a system of scheduled maintenance performed on a geographic (Wards) basis.



Due to safety concerns, emergency work takes precedence over all services requests and is performed as circumstances warrant. Although the City crew remains available to respond to urgent care needs, as circumstances require, the balance of available staffing and funding is devoted to providing scheduled maintenance on a pre-planned basis.

Although a system of scheduled maintenance will improve the use of limited staffing and funding, increase productivity, reduce down-time, and generally enhance the safety of the City's trees, the system will not be without its critics. In fact, it will likely produce some difficult problems particularly in the area of public relations. The most likely problem will occur when a citizen calls for service and learns that the trees in the neighborhood, in the absence of an emergency, are scheduled for maintenance within the 4-years cycle. There's a good probability that their next call will be to the Mayor, the City Parks and Recreation Commission or the media.¹⁵

4.4 TREE PRUNING AND TRAINING

The pruning of trees is one of the most essential services the Trees and Greenways Section performs. The City requires qualifications to assure that all new staff are capable of performing the necessary tasks needed for effective tree pruning and training. Those minimum qualifications include experience in tree and shrub pruning and caring for annual & perennial flowers. (Refer to Chapter 3)

Public safety, environmental health, and quality of life are all intimately associated with the care of the urban forest. Moreover, proper tree care reduces the overall costs of managing the City's public trees, including survival and development of newly planted trees, mitigation of insects and diseases, tree pruning, tree removal, and emergency services. Conversely, improper care can increase the costs of each aspect while simultaneously compromising public safety and reducing the value and benefits of trees.

In an effort for the city to promote practices that encourage the development and preservation of tree structure and health, the (ANSI) A300 "Standard Practices for Tree, Shrub and Other Woody Plant Maintenance" guidelines have been adopted. The Trees and Greenways Section uses the American National Standards Institute (ANSI) A300 standards to guide the work of its crews. The guidelines are used as a tool, recognizing that trees are individually unique in form and structure, and their pruning needs may not always fit strict rules.¹⁶ The City Arborist must take responsibility for special pruning practices that may vary from the actual guidelines. Below is a summary of those guidelines.

Types of Pruning Cuts

An understanding of how a tree responds to various types of pruning cuts leads to a more reasoned approach to pruning.

Thinning Cut- A thinning cut removes a branch at its origin.

Heading – Heading is cutting a currently growing or one-year-old shoot back to a bud, or cutting an older branch or stem back to a stub or lateral branch not sufficiently large enough to assume the terminal role. Heading should never be used in mature trees, since it forces the growth of vigorous, weakly attached sprouts originating just below such cuts, and the tree's natural form is altered.

When removing a live branch, pruning cuts should be made just outside the branch bark ridge and collar. This location of cut is in contrast to a "flush cut" which is made inside the branch bark ridge and collar. Flush cuts should be avoided because they result in a larger wound and expose the trunk tissues to the possibility of decay. If no collar is visible, the angle of the cut should approximate the angle formed by the branch bark ridge and trunk. Pruning cuts should be clean and smooth; leaving the bark at the edge of the cut firmly attached to the wood. A three-cut process will reduce chances of injury when removing large limbs.¹⁷

Climbing

Special care should be taken by the climber to ensure that the tree is safe to climb before entering it. Climbing techniques can affect tree health by preventing, or creating injuries to the tree. All tree workers will comply with the (ANSI) Z-133 safety standards.

Pre-Climbing Examination – A thorough inspection of the tree's structure for possible hazards should be made of every tree before climbing. A tree worker's safety inspection should also include an examination of the tree's root collar, where the roots flare out into the soil.

Climbing Practices – Climbing spurs or gaffs shall not be used when pruning a tree.

Training Young Trees

Properly trained trees will develop into structurally strong trees well suited to the site and their intended landscape function. These trees will fulfill their intended function sooner and should require little corrective pruning as they mature. Young trees that reach a large mature size should have a sturdy, tapered trunk with well-spaced branches.

Training Techniques

Trunk Development – For most trees, maintain a single, straight trunk or central leader. At least one half of the foliage should be on branches arising in the lower two-thirds of a tree. Branches should have a similar distribution of foliage along their lengths. This will increase trunk taper and more uniformly distribute branch weight and wind stress along the trunk.

Permanent Branch Selection – Potential permanent branches can be spaced 6 to 12 inches apart by thinning. By the fifth year, these branches should be thinned to at least 18 inches apart, if at maturity the trunk diameter is expected to be greater than 18 inches. Permanent branches should be selected to maintain an even radial distribution. Where branches are growing one directly above the other, maintain at least 15-36 inches above the lower branch on small to medium-size trees, and 60 inches on large-growing trees.

Temporary Branches – Retain small branches along the trunk for 1 to 5 years to increase lower-trunk size and taper and to protect the trunk from injury by the sun and vandals. Preferred vertical spacing of temporary branches is 4 to 6 inches, with none within 6 inches of potential main branches. Select the least vigorous shoots for temporary branches.

Branch Structure – Structural pruning maintains the size of permanent lateral branches to less than ½ the diameter of the parent branch or trunk. Thinning laterals from a branch will reduce the weight of the branch, slow its growth and develop a stronger branch attachment.

Pruning Techniques

As trees mature, their need for structural pruning should decrease. Pruning should then focus on maintaining tree structure, form, health and appearance.

Crown Cleaning – Crown cleaning is the removal of dead, dying, diseased, crowded, weakly attached, low-vigor branches, and watersprouts from a tree's crown.

Crown Thinning – Crown thinning is the selective removal of branches to increase light penetration and air movement through the crown. When thinning the crown of mature trees you should seldom remove more than ¼ of the live foliage.

Crown Raising – Crown raising removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas.

Crown Reduction – Drop crotching cuts to reduce the size of the crown results in fewer sprouts and can maintain the structural integrity and natural form of the tree, delaying the need to re-prune.

Crown Restoration – Crown restoration is intended to improve the structure and appearance of trees that have sprouted vigorously after being broken, topped or severely