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Urban Forestry Best Management Practices for Public Works Managers

Urban Forest Management Plan





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Introduction

Trees on streets and on other publicly owned properties managed by public works agencies provide a multitude of aesthetic and environmental benefits to citizens, businesses and visitors alike. Beyond shade and beauty, trees also have practical benefits and a real monetary value that cities sometimes are unaware of—your urban forest provides valuable public services and could be worth over a million dollars. Unlike other public infrastructure components, properly planted and maintained trees increase in value over time.

An urban forest management plan, based on recent tree inventory data and analysis of available staff, equipment, and budget resources, is an essential tool for protecting this valuable resource. An urban forest management plan is an action plan; it gives public works agencies detailed information, recommendations, and resources needed to effectively and proactively manage public trees.

The purpose of having an urban forest management plan is to ensure that a community will enjoy the benefits of trees through proper arboricultural techniques and management practices. The goal of the plan is to state what is needed to manage the urban forest and to describe activities and services required to execute these responsibilities.

If a management plan is based on analysis from an accurate tree inventory and developed with input from public works staff, arboricultural experts, and the citizens, then the public works agency responsible for the urban forest will realize many benefits:

Increased Public Safety

All public works agencies know that a large part of their primary mission is to assure safety and manage risk related to public infrastructure. A tree inventory and management plan will provide lists of trees requiring priority removal and pruning that a manager can carry out within the limits of budget and time. The inventory can be used subsequently to monitor trees for safety risks on a continual basis. By implementing recommendations made in the management plan, storm damage risks will also decline.

Increased Efficiency

Once an inventory has identified the work to be done and a management plan has prescribed a maintenance program, a manager can execute that work in a much more efficient manner than before. By scheduling all work in a given area to be done at the same time (rather than by reacting to single requests) the savings in travel and setup time are substantial, with historical examples showing about a 50 percent reduction in cost—especially when a system of rotational work and/or preventative maintenance is adopted. There is also increased efficiency in the office created by using an electronic inventory to locate and manipulate records and select and schedule work. The efficient response to citizen requests and questions also improves customer service.

Facilitate Short- And Long-Term Planning

Planning can be made much easier by using the results of the tree inventory and the analysis of an urban forest management plan. Since maintenance and planting needs have been assessed, and other issues such as hardscape conflicts and right-of-way clearances, personnel levels and training, and even public relations are addressed in the plan, short and long-term planning for the forest is made easier.

Justify Budgets

An urban forest management plan provides the data and analysis needed to determine specific levels of funding for tree maintenance and tree planting projected over a multi-year period. With accurate data, a manager can establish, prioritize, and justify annual budget requests. The tasks and associated costs are clearly spelled out in the plan, and can be supported by detailed lists. Many public works managers have found that they have much greater success with budget requests that are based on the analysis of high-quality data. Also, a good inventory provides a solid basis for grant applications.

Documentation

For many reasons, public works managers are frequently asked to provide documentation of their actions. This documentation can range from annual work accomplishments to a contractor's costs per tree, from a removal list to a specific service request. Some requests may be routine, while others may have strong budgetary or even legal implications. The urban forest management plan and most tree inventory software programs make such documentation very easy through reports that are included in the plan or that can be generated from the inventory database. Software packages come with standard reports, and there is usually a mechanism for creating special reports.

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Management Plan Components

The components and variations of urban forest management plans are many, depending on the developmental stage of the urban forestry program within a public works agency. Generally, these elements are included or addressed in the plan:

1. Tree inventory data and analysis
2. Tree inventory and mapping data management software
3. Tree risk reduction/emergency storm response plan
4. Tree board or advisory council development
5. Public relations and education
6. Urban forest cost/benefit analysis

In the following sections, these six basic components of a plan will be discussed in more detail. They will be prioritized for the benefit of managers who are just beginning a program and for managers who have an established program and are looking to improve it.

Tree Inventories

What Is a Tree Inventory?

Public tree inventories are a statistically reliable survey of publicly owned and managed trees, used to determine the location and the exact or estimated measurements of quantity, quality, health, and trends of the urban forest, as well as a description of other urban forest attributes, such as potential planting sites, utilities present, and hardscape features.

Data commonly collected during an inventory includes:

- Location
- Species
- Diameter
- Condition
- Maintenance need and priority
- Proximity to utility lines, traffic signs and signals
- Sidewalk and other hardscape damage
- Insect and disease problems
- Potential planting sites

Inventories are generally completed by trained Certified Arborists or experienced inventory arborists. The tree attribute and location data are generally collected using handheld computers, geographic information systems (GIS) data, and/or geographic positioning systems (GPS) equipment.

Types of Inventories - Depending on the size of your community and your resources, there are different types of inventories that can be accomplished to provide you with an accurate accounting of public trees.

- **“Windshield” Surveys** – A windshield survey is a simple method of evaluating public trees, and may be a good first step for a new or developing urban forestry program. To perform a windshield survey, an arborist or someone knowledgeable about trees, drives along a community's roads recording certain tree characteristics. Windshield surveys are most efficient when the arborist is looking for only a few particular tree characteristics, such as species, size, maintenance needs, or safety risk level. Windshield surveys have been and continue to be used in many cities and towns throughout the United States. The data collected during such a survey can be kept in written format on simple data forms, or entered into simple spreadsheet programs.

- **Statistical Sample Inventories** – A statistically sound, random sample of an urban forest is a cost-effective way of obtaining an overall picture of the state of the trees. Usually, obtaining data from between 3 to 6 percent of street miles and/or public property acreage will produce results that are accurate to within 10 percent of what a complete inventory would produce.



- **Partial Inventories** – Partial inventories collect tree data on 100 percent of the right-of-way miles or acres, but only in specific areas of a community. When budgets are limited, this approach can be effective and affordable. The public works agency decides which defined areas of the city or county are inventoried: particular wards, neighborhoods, districts, historic areas, etc. Using partial inventories allows the agency to spread the inventory process over a period of time depending on available funds and resources.
- **Complete Inventories** – A 100 percent, or complete, inventory is the best method if the public works agency wants a

highly accurate accounting of the urban forest on a citywide basis. All trees and potential planting sites on all public rights-of-way and public property under the management of public works are located and assessed during a complete inventory.

Using and Managing the Inventory Data

Using commercially available tree management GIS-based asset management software programs, simple computer spreadsheet programs, or other database programs, public works agencies can use the inventory data to create work reports, schedule tree maintenance and planting tasks, track costs, and efficiently respond to citizen requests.

Managing and updating inventory data and work orders can entail a significant investment of time and money, so public works managers need to carefully consider who will be performing this task, and what outputs are desired, and then select a system that is compatible with current agency capabilities and procedures. When the right tree inventory data management system is selected, public works managers are able to use the data for long-range, proactive planning to ensure the continued beauty, vitality, safety, and survival of all public trees.

Inventory Data Analysis

A significant component of an urban forest management plan is a professional analysis of the tree inventory data. Generally, statistical analysis is performed resulting in a number of tables and graphs depicting the

tree population's characteristics. Then, based on that analysis and the results, maintenance and planting priorities are developed and overall management recommendations are made for a multi-year period. Following is a description of the inventory data analysis part of a management plan.

- **Population Characteristics**

The public urban forest is a complex, inter-related system of trees, site conditions, and other infrastructure components. Understanding this dynamic system is important for proper decision making regarding appropriate tree care practices, planting decisions, and urban forest management. The public tree population characteristics section of a management plan provides insight into the current composition and condition of an inventoried tree population.

The characteristics of the urban forest include species, size, condition, and other related tree and site factors. By identifying the species, size, and condition of trees in the urban forest, much is revealed about the forest's composition, relative age, and health. It is important for public works managers to know the kinds of trees as well as the number of trees present. Species composition data are essential because tree species vary considerably in life expectancy and maintenance needs. The types of trees present in a community greatly affect tree maintenance activities and budgets. Similarly, tree diameter and size class data help to define the general age and size

distribution of the total tree population.

By analyzing and using this information, public works and urban forest managers can forecast trends, anticipate maintenance needs, budget for tree-related expenditures, and develop a basis for long-range planning. Knowing urban forest population characteristics facilitates decision making, which then allows proper and timely action to be taken for safety risk-reduction on the public rights-of-way, preventive maintenance to reduce storm damage and planning for needed tree planting operations. This ensures a stable and diverse tree population for the future.

- **Maintenance and Planting Programs**

One objective of an urban forest management plan is to determine the current appropriate maintenance recommendations for the tree population and to prioritize these tasks. Typical maintenance recommendations are: removal, pruning, stump grinding, green waste disposal, fertilization, insect and disease treatment, grate and guard repair, mulching, and watering.

The highest priority maintenance recommendations of removal and pruning pertain primarily to protecting public safety and are based on the existence of potential risks to the right-of-way, public property, and the citizens and their property at the time of the inventory. Rather than being priority safety pruning and removal activities, other maintenance

recommendations are practices directed at improving the overall health, longevity, and aesthetics of the urban forest.

Often, the plan will provide additional resources and information regarding current industry standards and specifications for performing tree maintenance tasks. The plan can make recommendations for in-house staffing levels and equipment and/or determine if contractors can more efficiently perform a task or function. Operational reviews are commonly incorporated into the urban forest management plan.

The urban forest management plan looks at all inventory data and recommends an implementation schedule and prioritization scheme that allows public works agencies to develop cost-effective strategies for urban forest maintenance programs based on an accurate evaluation of current tree population characteristics and on future tree-related expenditures.

- **Planting Programs**

Urban forest management plans address planting needs also and can use inventory data to develop and guide public tree planting programs. Tree species selection and planting location designations are significant components of an urban forestry program. Decisions of what kind of tree to plant and where to plant it are critical due to the long-term impact of these decisions.

The tree inventory reveals the number of vacant planting sites, the size and types of these locations, the current species distribution, and other pertinent data.

The urban forest management plan looks at this data to develop an overall planting strategy and address many issues related to new tree planting and care. The plan identifies the areas with the greatest need for improvement, recommends species appropriate for the available planting spaces, discusses specific maintenance plans for newly establishing trees, and provides technical information about proper tree planting techniques.

Using the urban forest management plan with its accurate data and professional interpretation and planning, a public works agency can plant trees that will ultimately be healthier, safer, have greater life expectancies, have fewer conflicts with utilities and other infrastructure, be less expensive to maintain, and maximize the benefits to the community provided by public trees.

- **Insect and Disease Threats and Control**

American cities and counties have dealt with insect and disease threats to public forests for more than a hundred years. Historically, many communities have suffered significant tree loss and damage from such threats as the chestnut blight, Dutch elm disease, and the gypsy moth. The twenty-first century and the new global economy bring new threats to our urban forests, such as the Emerald Ash Borer, Asian Longhorned Beetle, and Sudden Oak Death.

Through careful analysis of local conditions and species composition, provisions in the management plan can be included to attempt to mitigate the disruption to its urban forest caused by the existing or potential insect and disease infestations. Taking a proactive approach to these kinds of threats enable the public works agency to address public and private needs in an efficient and effective manner.

With the urban forest management plan as a guide, public works managers can endeavor to distribute the costs associated with significant tree loss and damage from insects, disease and natural disasters over a manageable time period, as well as lessen the social and economic impact that such an extensive loss will have on the quality of life in our community.

- **Budgets**

Urban forest management plans generally include a multi-year, prioritized program for all basic urban forestry activities and provide relative costs that could be incurred by the recommended activities. These budget figures are usually based on local contractual charges for maintenance and planting tasks and on in-house costs for performing the needed services.

Urban forestry program budgets in management plans typically are presented on an annual basis for a period of five to ten years. The budget is recommended to address the highest priority removal and

maintenance recommendations first. This is intended to reduce potential high-risk situations for the public and all associated liabilities. Then the public works agency can phase in the recommended routine pruning and planting cycles to distribute the annual budget funds more evenly. It is not uncommon for the budgets presented in the management plan to exceed the current resources of the public works agency. However, with the information about how much funding is required to properly maintain and sustain the public urban forest and improve public safety, public works agencies and managers should know what financial commitment is necessary and then take steps in subsequent years to attain the level of funding required.

Tree Inventory and Mapping Data Management Software

Computerized facility and asset inventories, location information, and work order systems are common tools used by public works managers every day. Managing tree inventory information is not that different than managing any other public infrastructure component and there are a variety of computerized systems and software programs to help in this task.

On the most basic level, tree inventory data can be entered and maintained in any simple spreadsheet or database software program. These programs are inexpensive, easy to use, and usually already exist on most office computers. Simple data sorting and querying can quickly provide information on urban forest conditions and tasks.

More commonly, tree inventory data and mapped location information are best maintained and managed using commercially available software programs specifically designed for urban forest management. These programs are customized for the public works agency to facilitate updating and editing, and are capable of instantly providing useful information and producing reports such as:

- **Work histories and costs for each tree**
- **Citizen service and information requests**
- **Work orders**
- **Available planting sites**
- **Tree valuation**
- **Maps**



As a management tool, a computerized tree inventory and data management software program promotes efficient allocation of work crews and equipment; expedites responses to service requests; identifies safety risks; facilitates accurate cost analysis; provides data for communicating with the public, elected officials, and other departments; can provide information needed for grant applications; tracks permits; and projects future work programs and required budgets.

The management plan will generally assess the needs, capabilities, and responsibilities of the public works agency and make an appropriate recommendation of what individual or combination of software programs and data management systems is right for the agency.



There are a number of commercially available tree management software programs from arboricultural consulting companies. There is also free, public-domain software, such as the U.S. Forest Service's Mobile Community Tree Inventory (MCTI) program that can be run on personal digital assistants or desktop computers.

Tree Risk Reduction Plan/ Emergency Storm Response Plan

The urban forest management plan can and should have sections devoted to urban forest risk reduction and an emergency response and recovery plan that provides information about general tree risk reduction and gives directions to the public works agency during an extreme storm emergency.

When developing an emergency management plan, dealing with serious public safety and health issues is an obvious component, but including trees and woody debris in mitigation efforts must not be overlooked.

When catastrophic disasters, such as tornadoes, ice storms, hurricanes, and severe straight-line winds strike a metropolitan center, thousands of cubic yards of debris are produced. Trees and vegetation can account for approximately 30 percent of this debris volume.

Beyond the task of collecting and disposing of this debris, additional management considerations include increased threat to life from hanging limbs and uprooted trees, hindrance to life-saving efforts by blocked streets and driveways, power outages and power restoration efforts, and personal and public property damage. The impact of these additional tree-related considerations is not always quantifiable but can overwhelm public services and slow down the short and long-term recovery process.

A comprehensive urban forest management program greatly reduces storm hazards through proper planting, preventive maintenance, and systematic risk reduction. However, when disasters occur, an emergency plan as an addendum to this plan can provide solid data, facts, and protocols to assure service continuity and timely recovery and restoration. The overall objective is to create an emergency preparedness program that details improved policies and procedures, increasing the efficiency and productivity of emergency storm response operations.

Risk reduction plans can also address threats to public safety, health and public works operational responsibilities and issues that are non-storm emergencies, such as:

- Clearing leaves and woody debris from gutters and storm drains
- Sidewalk, street, and building clearance standards
- Line-of-sight conflicts for street and safety signage
- Blockage of street lamps and traffic lights
- Conflicts with overhead and underground utilities

Both the emergency response plan and risk reduction plans should be created as a collaborative effort between all key agencies and stakeholder in the community. With the public works department as the lead, information and input from police and fire, parks, purchasing, city or county administration, controlling utility companies, local and state emergency management agencies, and contractors should be obtained and considered when developing these plans.



Tree Board or Advisory Council Development

Greening and maintaining a community's urban forest is a long-term commitment dependent on not only the professional management and expertise of public works staff but also on the support and involvement of the citizens. Unlike fire hydrants and sidewalks, an urban forest is a public asset that can generate both positive and negative emotional responses. An important step in dealing with this unique characteristic of an infrastructure component is forming and supporting a group of local citizens who are dedicated to the care and maintenance of the community trees while assisting the public works agency in its mission.

This group is often called a tree board or an urban forestry advisory council and can provide a number of services to public works agencies. They can educate the citizens at large on the importance of trees, interact directly with elected officials in support of the program, assist in maintenance tasks like small tree maintenance, mulching, planting, and watering, and apply for grants and generate private financial donations.

Their singular mission, however, is to recommend unbiased, citizen-based direction and alternatives regarding community tree management to public works managers. They serve in an advisory capacity only, and depend on public works personnel to actually implement most of their recommendations. Still, the ultimate responsibility for the community's urban forestry program rests with the public works agency.

The urban forest management plan should include information on creating a local community forestry program in areas that do not already have one, and for sustaining one that already exists.

Public Relations and Education

On a basic and general level, having a computerized tree inventory and urban forest management plan facilitates and improves public relations and education. For instance, most citizen callers are pleased when they have reached someone who knows their tree and can answer general questions or respond directly to their request because of quick access to information such as tree attributes and scheduled work. Computerized tree inventories are also useful tools for public education. The inventory data, maps or summary reports can be distributed in print or on a website so the public can access them. In this way, the public can gain a better understanding of the work of urban forestry and become more willing to support its program.

Through years of experience, urban forest managers across the country have found that public education is the true key to reaching the goals of an urban forestry program in a community. A public works agency will be able to effectively achieve urban forest management goals only by educating citizens, elected officials, and other public agencies working within the community. Ordinances, management plans, guidelines, policies and

procedures alone will not guarantee success. An urban forest management plan will recommend specific actions to increase and support public relations and education about trees and the urban forestry program. Such recommendations may include:

- Holding a seminar or public meeting to discuss the tree inventory project, its results, and its importance for the community.
- Developing monthly evening or weekend seminars directed at residents related to tree care and landscaping. Bring in local guest experts from various disciplines in the green industry.
- Writing a monthly tree-related article for local newspapers and community websites, or preparing a press release for each new project.
- Sending letters to residents in areas where tree maintenance or planting projects will be conducted each year.
- Developing a tree care door hanger or brochure to go to each residence where new trees are planted to encourage them to help maintain the tree and not damage it during mowing.

Urban Forest Cost/Benefit Analysis

The public trees growing in any community are valuable municipal resources. They provide tangible and intangible benefits for diverse services such as pollution control, energy reduction, storm water management, property values, wildlife habitat, education, and aesthetics. Previously, the services and benefits trees provided in the urban and suburban setting were considered to be unquantifiable. However, by using extensive scientific studies and practical research, these benefits can now be confidently calculated using models contained in i-Tree software and current tree inventory information.

The i-Tree suite of free software tools was recently released by the U. S. Forest Service and can be used to assess and manage community forests. With these tools, public works and urban forest managers can

accurately quantify the benefits of urban forests and understand and balance the costs of managing an urban forest.

Using the tree inventory data and applying i-Tree's STRATUM (street tree resource analysis tool for urban forest managers) an urban forest management plan can assess and quantify the functions of the public tree resource and place a dollar value on the annual environmental benefits they provide. However, enhancing, protecting, and maintaining this municipal resource has costs; public works agencies annually allocate public funds for planting, removal, pruning, emergency cleanup, inspection, and administration of the urban forestry program. The STRATUM model accounts for costs of managing an urban forest and provides results in terms of net benefits.



An urban forest management plan that includes such a cost-benefit analysis will help the public works manager:

- Obtain economic evaluations of street trees using annual budget and expenditure data to assess the management program.
- Justify funding and perform strategic planning for the urban forest.
- Gain more public support for the value of trees to economic development, environmental health, and quality of life issues in the community.
- Determine the annual amount of pollution removed by the urban forest, the percent of air quality improvement, the amount of carbon sequestered, the amount of energy consumption reductions, and estimated increases in property values and aesthetics.

This kind of cost/benefit analysis may provide public works managers with the justification for more attention and funding for urban forestry planning, design, management, and maintenance. The science behind these models and type of analysis is sound and has been published in peer-reviewed journals.

The challenge now is to apply the science to enhance the quality of life in our communities by improving the condition and extent of the urban forest.

Urban Forest Management Plan Summary

The urban forest management plan should be considered a “living,” working document. The work programs recommended in it should be reviewed annually and adjustments made appropriately for the following year. The entire document itself should be reviewed on a five or ten year basis to determine if management and urban forest conditions have changed significantly.

The management of public trees is challenging, to say the least. Public works managers have the daunting task of balancing the recommendations of experts, the wishes of council members and other elected officials, the needs of citizens, the pressures of local economics, the concerns for liability issues, the physical aspects of trees, the forces of nature and severe weather events, and the desire for all of these factors to be met simultaneously.

Without a management plan, the governments and individuals responsible for taking care of an urban forest will not be effective in meeting the true needs of the trees and the community. A management plan establishes a clear set of priorities and objectives related to the goal of maintaining a productive and beneficial community forest.

You’ve heard the riddle, “How do you eat an elephant?” The answer is, “One bite at a time.” This is also good advice for creating or improving an urban forest management plan. If you are just beginning an urban forest management plan project, try to accomplish these tasks first:

- Conduct a windshield survey or sample tree inventory that is managed and updated on paper or in a computerized spreadsheet program.
- Based on the data you collect, create a management plan with sections that address the highest priority maintenance and planting tasks with estimated budgets for this work.

If you already have an existing, basic tree management plan, consider improving it by accomplishing these tasks:

- Complete a 100 percent public tree inventory with GIS or GPS tree location mapping, if it doesn’t already exist.
- Obtain a customized tree inventory data management software program to help you carry out the plan’s recommendations and record your work accomplishments.
- Create or update your management plan to include analysis and recommendations for preventive maintenance cycles; a community-wide planting program;

expanded public relations and education; and risk reduction programs.

If you have an existing comprehensive urban forest management plan, the next time it is reviewed, consider addressing and including these components:

- Comprehensive risk reduction and emergency storm response plans.
- Operational review with recommendations for improved work procedures, equipment inventory, budget level, and administrative efficiencies.
- Ordinance, policies, and procedures review and recommended revisions
- Tree cost-benefit analysis.

Whatever level your urban forestry program is at currently, and depending on where you want to go with it in the future, an urban forest management plan can help guide you to achieving your goals. There are many sources of information and assistance at your disposal just for the asking.

The existence of an urban forest management plan in a community indicates a high level of commitment to protecting trees, and it indicates a higher level of education and knowledge about natural resource issues in general. The benefits of trees can be maximized when both professional management resources and an educated public coexist.

With a tree inventory and urban forest management plan, a public works agency can objectively consider each specific issue and balance these pressures with a knowledgeable understanding of trees and their needs. If balance is achieved, the community's beauty will flourish and the health and safety of its trees and citizens will be maintained.

For More Information

Your State Urban Forestry Coordinator

www.arboday.org/programs/urbanforesters.cfm

USDA Northeastern Area Urban and Community Forest Resources

“A GUIDE: DEVELOPING A STREET AND PARK TREE MANAGEMENT PLAN”

<http://www.na.fs.fed.us/urban/inforesources/mgmtplanguide/mgtplanguide.pdf>

Wisconsin Department of Natural Resources Bureau of Forestry

“A Technical Guide to Developing Urban Forestry Strategic and Management Plans”

<http://www.dnr.state.wi.us/org/land/Forestry/uf/resources/uf%20planning%20guide.pdf>

Urban Forestry South

“Urban and Community Forestry Strategic Plans”

<http://www.urbanforestrysouth.org/Resources/Collections/u-cf-strategic-plans-1/view>

National Arbor Day Foundation

Tree City USA Bulletins

www.arboday.org/programs/treecitybulletinsbrowse.cfm

USDA Northeast Center for Urban and Community Forest Resources

“Community Tree Inventory: Data Collection”

www.umass.edu/urbantree/inventorywhitepaper.pdf

National Arbor Day Foundation

Tree City USA Bulletins

www.arboday.org/programs/treecitybulletinsbrowse.cfm



USDA Northeastern Area Urban and Community Forest Resources

“Tree Inventory and Management Software List with Descriptions”

www.na.fs.fed.us/urban/inforesources/inventory/InventorySoftwareListDetails.pdf

USDA Northeastern Area Urban and Community Forest Resources

“A Guide to Street Tree Inventory Software”

www.na.fs.fed.us/spfo/pubs/uf/streettree/toc.htm

USFS i-Tree Tools

<http://www.itreetools.org>

Cost/Benefit Analysis

USFS i-Tree Tools

[/www.itreetools.org](http://www.itreetools.org)

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Series Research and Education Steering Committee

Thank You

Rachel Barker
Project Manager
Natural Resource Consulting, Inc.
Tallassee, AL

George Gonzalez
Chief Forester
Los Angeles, CA
Bureau of Street Services

Andy Hillman
City Forester
City of Ithaca, NY DPW

Gene Hyde
City Forester
City of Chattanooga, TN DPW

Walter E. Veselka, PE
Public Works Director
City of Bristol, CT

Peter J. Woodcock
Public Works Superintendent
(retired)
Croton on Hudson, NY

Colene Vogel
Technical Services Program Manager
American Public Works Association
Kansas City, MO

Jerri LaHaie, CAE
Executive Director
Society of Municipal Arborists
Watkinsville, GA

Keith W. Cline
ISA Certified Arborist (MA-0030)
Program Manager
USDA Forest Service
Urban and Community Forestry
Program
Washington, D.C.

Jennifer Gulick
Davey Resource Group
Walton, KY







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