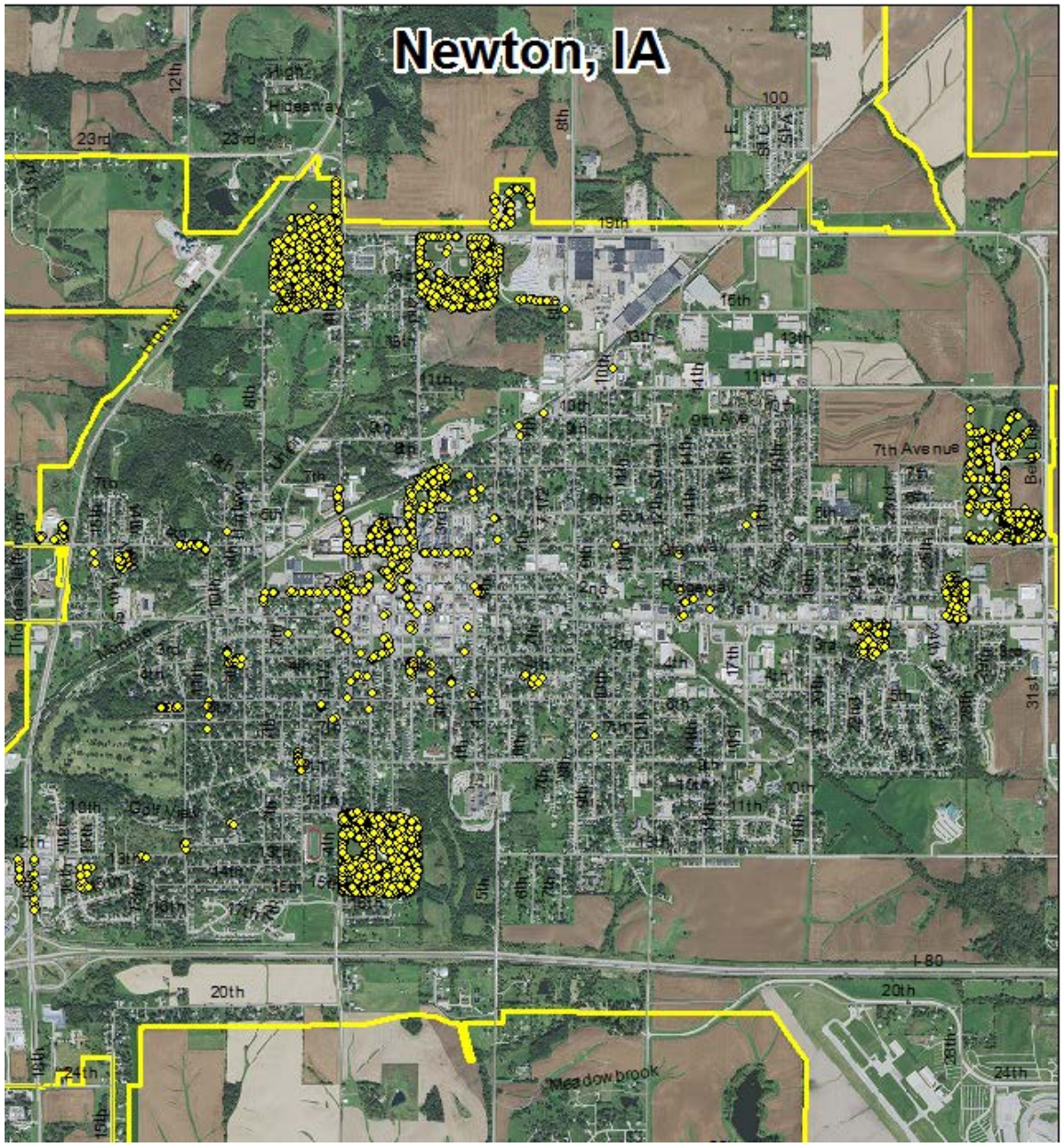
Newton, IA



2017 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Newton with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 6.5% of Newton's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2016, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 3,669 trees inventoried.

- Newton's trees provide $613,845 of benefits annually, an average of $167 a tree
- There are over 80 species of trees
- The top three genera are: bur oak 11.4%, conifer evergreen large 10.2%, and green ash 5.5%
- 29% of trees are in need of some type of management
- 435 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 435 trees needing removal, 193 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 157 of the 237 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 9 years to remove ash along with trees slated for removal – Suggestion: request a budget increase to $10,000 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Newton with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Newton, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Newton's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of Newton and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Newton's urban forestry goals.

Inventory

In 2016, a tree inventory was conducted that included 100% of the city owned trees streets, parks, the arboretum, and cemeteries. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms associated with EAB were noted for all ash trees. The signs and symptoms noted

were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and woodpecker damage.

Inventory Results

The data collected for the 3,669 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Newton's trees reduce energy related costs by approximately $163,959 annually (Appendix A, Table 1). These savings are both in Electricity (783.1 MWh) and in Natural Gas (106,658.6 Therms).

Annual Stormwater Benefits

Newton's trees intercept about 9,589,002 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $259,862 of benefits to the city.

Annual Air Quality Benefits

Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic matter (ozone). In Newton, it is estimated that trees remove 9,421.7 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $25,696 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Newton, trees sequester about 1,483,228 lbs of carbon a year with an associated value of $11,124 (Appendix A, Table 5). In addition, the trees store 35,717,998 lbs of carbon, with a yearly benefit of $267,885 (Appendix A, Table 4).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Newton receives $144,711 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STREETS analysis, Newton's trees provide $613,845 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 3,669 trees in Newton provide approximately $167 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Newton has over 80 different tree species along city streets, parks, cemeteries, and the arboretum (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Bur oak	417	11.39%
Conifer Evergreen Large	374	10.22%
Green ash	204	5.59%
Eastern white pine	197	5.40%
Northern red oak	158	4.33%
Apple	150	4.12%
Eastern red cedar	140	3.87%
Maple	139	3.82%
Hickory	138	3.79%
Northern hackberry	108	2.97%
Other species	1644	44.51%

Age Class

Most of Newton's trees (20%) are between 12 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Newton's size curve is slightly on the smaller side, indicating a slightly younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Newton indicate that 92% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). 64% of Newton's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 16% of the population. This 16% is an estimate of trees that need management follow

up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	375	10%
Crown Raising	169	5%
Tree Staking	17	.5%
Tree Removal	435	12%
Crown Reduction	55	1.5%

Canopy Cover

The total canopy with both private and public trees is 22%, 1544 acres. The canopy cover included in the Newton inventory includes approximately 88 acres (Appendix A, Figure 5). The City's Canopy goal is 23%, in 30 years. To achieve this goal it is estimated that 174 trees need to be planted annually.

Land Use and Location

The majority of Newton's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

Land Use	
Park/vacant/other	85%
Single family residential	7%
Industrial/Large commercial	6%
Multifamily residential	2%

Location	
Front yard	85%
Median	11%
Planting strip	2%
Other maintained locations	1%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed.

Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

Hazardous trees

Newton has 172 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 109 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 253 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 172 critical concern removals, 7 are ash trees. There are a total of 237 ash trees, and 157 of those have signs and symptoms that have been associated with EAB. In addition, there are 18 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Newton.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of

the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with bur oak (45%) (Appendix A, Figure 1). Bur oaks should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, maple, box elder, Chinese elm, willow or black walnut. All trees planted must meet the restrictions in city ordinance 94.05 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and woodpecker damage.

Six Year Maintenance Plan with <u>No Additional Funding</u>

Year 1

Removal: 73 largest critical concern trees
Planting and Replacement: 87 trees to be planted in open locations
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 72 critical concern trees
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 6 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 27 critical concern trees - 46 of any new critical concern trees and ash in poor health
Planting and Replacement: 87 trees to be planted in open locations and locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 72 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 87 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 73 trees - removal of any new critical concern trees and ash in poor health

Planting and Replacement: 87 trees to be planted in open locations and locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 72 trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 87 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

*This 6 year plan will cover all 435 trees slated for removal. The current budget trend should cover the annual cost to complete this in 6 years.
** To remove all trees slated for removal plus all ash trees not slated for removal within 6 years, the budget would need to be increased to $80,350 a year. With the current budget trend it take an additional 3 years to complete the task.

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:
• emerald ash borer

• firewood of all hardwood species (for example ash, oak, maple and hickory)
• nursery stock and green lumber of ash
• any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and uncomposted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 94.05 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm,evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and woodpecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. City Code 94.05 (A) states "*Dead and dangerous trees and branches to be removed*. A property owner shall be responsible for the removal of any dead or otherwise dangerous trees, shrubs or branches which are on the owner's property." City Code

94.05 (G) states "*Removal of trees infected with disease.* A property owner, occupant or agent in charge of any property shall, at such owner's expense, remove all dead trees and dead wood or limbs from trees located on such property."

Budget

Budget Spent on Tree Removal, Maintenance, and Planting History
Total $186,073 over 5 years (average $37,215/year)

FY 2012 Budget
Removal, maintenance, planting: $43,364
FY 2013 Budget
Removal, maintenance, planting: $27,203
FY 2014 Budget
Removal, maintenance, planting: $29,631
FY 2015 Budget
Removal, maintenance, planting: $42,511
FY 2016 Budget
Removal, maintenance, planting: $43,364

*For the past 5 years an average of 50 bur oak and ash have been removed per year. Average cost per tree for removal and replacement is $744. Current policy for tree replacement is 1 for 1.

Present and Next Year's Budget

FY 2017 Budget
Removal, maintenance, planting: $54,930
FY 2018 Budget
Removal, maintenance, planting: $58,490

It will take approximately 9 years to remove all trees slated for removal plus all ash with the current budget.

Proposed Budget Increase
EAB could potentially kill all ash trees in Newton within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $80,350 a year. Additionally, it is recommended that Newton apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Newton

Annual Energy Benefits of Public Trees

2/6/2017

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	144.2	10,943	19,839.8	19,443	30,386	(N/A)	11.4	18.5	72.69
Conifer Evergreen Large	48.1	3,649	6,151.1	6,028	9,677	(N/A)	10.2	5.9	25.81
Green ash	54.9	4,168	7,152.7	7,010	11,178	(N/A)	5.6	6.8	54.52
Eastern white pine	27.1	2,054	3,535.2	3,465	5,519	(N/A)	5.4	3.4	27.87
Northern red oak	30.0	2,275	4,142.1	4,059	6,334	(N/A)	4.3	3.9	39.84
Apple	19.5	1,483	2,963.5	2,904	4,387	(N/A)	4.1	2.7	29.05
Eastern red cedar	13.5	1,024	2,012.6	1,972	2,996	(N/A)	3.9	1.8	21.10
Maple	30.4	2,307	4,080.0	3,998	6,305	(N/A)	3.8	3.8	45.04
Hickory	39.4	2,991	5,442.8	5,334	8,325	(N/A)	3.8	5.1	59.89
Northern hackberry	33.3	2,525	4,678.0	4,584	7,110	(N/A)	3.0	4.3	65.23
Pin oak	36.5	2,770	4,873.6	4,776	7,547	(N/A)	2.8	4.6	73.99
Black walnut	30.7	2,328	4,185.0	4,101	6,429	(N/A)	2.7	3.9	65.60
Chinese elm	34.3	2,603	4,570.3	4,479	7,082	(N/A)	2.6	4.3	73.01
Spruce	11.3	854	1,500.5	1,470	2,325	(N/A)	2.5	1.4	25.00
Honeylocust	17.2	1,308	2,244.8	2,200	3,508	(N/A)	2.3	2.1	41.27
Broadleaf Deciduous Small	4.9	373	809.0	793	1,166	(N/A)	2.1	0.7	15.34
American sycamore	28.0	2,126	3,788.3	3,713	5,838	(N/A)	2.0	3.6	81.08
Sugar maple	17.6	1,339	2,368.4	2,321	3,660	(N/A)	1.9	2.2	53.04
Silver maple	21.0	1,597	2,804.5	2,748	4,346	(N/A)	1.7	2.7	70.09
Red maple	6.8	520	906.5	888	1,408	(N/A)	1.5	0.9	25.60
Oak	5.8	438	724.0	710	1,147	(N/A)	1.5	0.7	21.25
Littleleaf linden	7.3	557	993.4	974	1,531	(N/A)	1.5	0.9	28.35
Blue spruce	6.0	459	794.7	779	1,238	(N/A)	1.4	0.8	23.80
Northern white cedar	8.4	640	1,116.5	1,094	1,734	(N/A)	1.4	1.1	34.68
River birch	11.6	884	1,665.0	1,632	2,516	(N/A)	1.4	1.5	50.32
Norway spruce	5.2	393	658.7	646	1,039	(N/A)	1.1	0.6	25.96
Broadleaf Evergreen Large	12.5	948	1,689.7	1,656	2,604	(N/A)	1.0	1.6	68.52
Norway maple	7.6	579	1,077.5	1,056	1,635	(N/A)	1.0	1.0	43.02
Amur maple	4.7	359	737.3	723	1,081	(N/A)	1.0	0.7	30.89
Broadleaf Deciduous Large	6.1	461	812.5	796	1,257	(N/A)	0.8	0.8	43.35
Ash	5.3	402	770.8	755	1,157	(N/A)	0.7	0.7	46.28
Elm	3.9	299	503.0	493	792	(N/A)	0.7	0.5	32.99
Swamp white oak	2.0	149	288.6	283	432	(N/A)	0.7	0.3	17.99
American basswood	5.3	402	767.8	752	1,155	(N/A)	0.6	0.7	55.00
Black cherry	2.7	202	416.0	408	610	(N/A)	0.6	0.4	29.04
Broadleaf Deciduous Mediu	2.4	181	355.2	348	529	(N/A)	0.5	0.3	26.43
Ginkgo	0.5	42	81.8	80	122	(N/A)	0.5	0.1	6.40
Conifer Evergreen Medium	1.3	95	184.9	181	277	(N/A)	0.4	0.2	17.28
Kentucky coffeetree	0.8	62	115.5	113	176	(N/A)	0.4	0.1	13.50
Pear	2.1	160	306.0	300	460	(N/A)	0.4	0.3	35.38
Austrian pine	1.1	81	150.6	148	229	(N/A)	0.3	0.1	19.05
Basswood	3.9	294	534.7	524	818	(N/A)	0.3	0.5	74.39
Tulip tree	3.2	245	448.0	439	684	(N/A)	0.3	0.4	62.22
Red pine	1.3	95	151.4	148	243	(N/A)	0.3	0.1	24.35
Conifer Evergreen Small	0.3	26	52.6	52	77	(N/A)	0.2	0.0	8.56
Northern pin oak	2.5	189	362.2	355	544	(N/A)	0.2	0.3	60.42
White oak	1.4	105	188.2	184	289	(N/A)	0.2	0.2	36.17
American elm	2.0	150	236.3	232	382	(N/A)	0.2	0.2	47.74
Japanese tree lilac	1.3	96	180.6	177	273	(N/A)	0.2	0.2	34.15
Mountain ash	1.5	118	232.1	227	345	(N/A)	0.2	0.2	43.14
Birch	0.9	69	133.7	131	200	(N/A)	0.2	0.1	33.34
Juniper	0.5	36	73.1	72	108	(N/A)	0.2	0.1	18.02
White ash	1.1	85	139.8	137	222	(N/A)	0.2	0.1	37.02
Paper birch	1.0	74	125.1	123	197	(N/A)	0.1	0.1	39.39
Callery pear	0.7	52	93.5	92	144	(N/A)	0.1	0.1	28.72
Black locust	1.4	106	203.5	199	306	(N/A)	0.1	0.2	61.17

Quaking aspen	0.5	36	68.6	67	103 (N/A)	0.1	0.1	20.64
Dogwood	0.7	54	106.6	104	159 (N/A)	0.1	0.1	31.76
Cottonwood	1.2	91	164.1	161	252 (N/A)	0.1	0.2	63.05
Catalpa	0.9	71	124.2	122	192 (N/A)	0.1	0.1	48.07
Eastern redbud	0.2	16	33.5	33	49 (N/A)	0.1	0.0	12.18
Scotch pine	0.6	42	68.7	67	109 (N/A)	0.1	0.1	27.30
Black maple	0.6	47	89.4	88	134 (N/A)	0.1	0.1	33.60
Mulberry	0.4	32	67.7	66	99 (N/A)	0.1	0.1	24.64
Broadleaf Evergreen Mediur	0.3	19	38.1	37	56 (N/A)	0.1	0.0	18.82
Alder	0.3	26	57.3	56	83 (N/A)	0.1	0.1	27.51
American chestnut	0.4	32	54.4	53	86 (N/A)	0.1	0.1	28.50
Amur corktree	0.1	11	23.0	23	33 (N/A)	0.1	0.0	16.73
Plum	0.1	6	13.5	13	19 (N/A)	0.1	0.0	9.53
Boxelder	0.2	16	29.8	29	45 (N/A)	0.1	0.0	22.45
Eastern cottonwood	1.0	74	126.2	124	197 (N/A)	0.1	0.1	98.63
Yellowwood	0.1	8	16.9	17	24 (N/A)	0.0	0.0	24.47
Japanese maple	0.1	6	12.8	13	18 (N/A)	0.0	0.0	18.19
Black ash	0.2	18	29.5	29	47 (N/A)	0.0	0.0	46.78
Black spruce	0.1	5	10.2	10	15 (N/A)	0.0	0.0	14.80
Lilac	0.2	15	31.6	31	46 (N/A)	0.0	0.0	46.14
Eastern hophornbeam	0.1	6	12.8	13	18 (N/A)	0.0	0.0	18.19
Sumac	0.0	2	3.8	4	5 (N/A)	0.0	0.0	5.40
Willow	0.3	24	47.4	46	71 (N/A)	0.0	0.0	70.84
Ohio buckeye	0.0	3	6.2	6	9 (N/A)	0.0	0.0	8.99
Eastern hemlock	0.1	4	9.5	9	14 (N/A)	0.0	0.0	13.58
Total	783.1	59,434	106,658.6	104,525	163,959 (N/A)	100.0	100.0	44.69

Table 2: Annual Stormwater Benefits

Newton

Annual Stormwater Benefits of Public Trees

2/6/2017

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	1,923,713	52,133	(N/A)	11.4	20.1	124.72
Conifer Evergreen Large	823,244	22,310	(N/A)	10.2	8.6	59.49
Green ash	563,244	15,264	(N/A)	5.6	5.9	74.46
Eastern white pine	529,556	14,351	(N/A)	5.4	5.5	72.48
Northern red oak	297,196	8,054	(N/A)	4.3	3.1	50.65
Apple	87,578	2,373	(N/A)	4.1	0.9	15.72
Eastern red cedar	196,089	5,314	(N/A)	3.9	2.0	37.42
Maple	254,782	6,905	(N/A)	3.8	2.7	49.32
Hickory	431,879	11,704	(N/A)	3.8	4.5	84.20
Northern hackberry	319,487	8,658	(N/A)	3.0	3.3	79.43
Pin oak	453,910	12,301	(N/A)	2.8	4.7	120.60
Black walnut	374,039	10,136	(N/A)	2.7	3.9	103.43
Chinese elm	448,077	12,143	(N/A)	2.6	4.7	125.18
Spruce	212,721	5,765	(N/A)	2.5	2.2	61.99
Honeylocust	186,423	5,052	(N/A)	2.3	1.9	59.44
Broadleaf Deciduous Small	18,276	495	(N/A)	2.1	0.2	6.52
American sycamore	404,291	10,956	(N/A)	2.0	4.2	152.17
Sugar maple	201,569	5,463	(N/A)	1.9	2.1	79.17
Silver maple	318,444	8,630	(N/A)	1.7	3.3	139.19
Red maple	47,104	1,277	(N/A)	1.5	0.5	23.21
Oak	43,529	1,180	(N/A)	1.5	0.5	21.85
Littleleaf linden	58,531	1,586	(N/A)	1.5	0.6	29.37
Blue spruce	83,041	2,250	(N/A)	1.4	0.9	43.28
Northern white cedar	194,129	5,261	(N/A)	1.4	2.0	105.22
River birch	106,872	2,896	(N/A)	1.4	1.1	57.92
Norway spruce	90,150	2,443	(N/A)	1.1	0.9	61.08
Broadleaf Evergreen Large	206,698	5,602	(N/A)	1.0	2.2	147.41
Norway maple	61,519	1,667	(N/A)	1.0	0.6	43.87
Amur maple	22,906	621	(N/A)	1.0	0.2	17.74
Broadleaf Deciduous Large	62,657	1,698	(N/A)	0.8	0.7	58.55
Ash	46,878	1,270	(N/A)	0.7	0.5	50.82
Elm	41,475	1,124	(N/A)	0.7	0.4	46.83
Swamp white oak	11,992	325	(N/A)	0.7	0.1	13.54
American basswood	59,499	1,612	(N/A)	0.6	0.6	76.78
Black cherry	13,192	358	(N/A)	0.6	0.1	17.02
Broadleaf Deciduous Medium	18,324	497	(N/A)	0.5	0.2	24.83
Ginkgo	2,419	66	(N/A)	0.5	0.0	3.45
Conifer Evergreen Medium	16,787	455	(N/A)	0.4	0.2	28.43
Kentucky coffeetree	10,616	288	(N/A)	0.4	0.1	22.13
Pear	8,981	243	(N/A)	0.4	0.1	18.72
Austrian pine	14,047	381	(N/A)	0.3	0.1	31.72
Basswood	53,931	1,462	(N/A)	0.3	0.6	132.87
Tulip tree	42,618	1,155	(N/A)	0.3	0.4	105.00
Red pine	17,304	469	(N/A)	0.3	0.2	46.89
Conifer Evergreen Small	4,529	123	(N/A)	0.2	0.0	13.64
Northern pin oak	27,772	753	(N/A)	0.2	0.3	83.62
White oak	15,097	409	(N/A)	0.2	0.2	51.14
American elm	13,902	377	(N/A)	0.2	0.1	47.09
Japanese tree lilac	5,036	136	(N/A)	0.2	0.1	17.06

Mountain ash	7,870	213 (N/A)	0.2	0.1	26.66
Birch	7,094	192 (N/A)	0.2	0.1	32.04
Juniper	6,881	186 (N/A)	0.2	0.1	31.08
White ash	8,391	227 (N/A)	0.2	0.1	37.90
Paper birch	9,201	249 (N/A)	0.1	0.1	49.87
Callery pear	4,002	108 (N/A)	0.1	0.0	21.69
Black locust	13,896	377 (N/A)	0.1	0.1	75.32
Quaking aspen	3,039	82 (N/A)	0.1	0.0	16.47
Dogwood	3,036	82 (N/A)	0.1	0.0	16.46
Cottonwood	16,690	452 (N/A)	0.1	0.2	113.08
Catalpa	13,073	354 (N/A)	0.1	0.1	88.57
Eastern redbud	1,196	32 (N/A)	0.1	0.0	8.11
Scotch pine	9,016	244 (N/A)	0.1	0.1	61.08
Black maple	4,743	129 (N/A)	0.1	0.0	32.13
Mulberry	2,424	66 (N/A)	0.1	0.0	16.42
Broadleaf Evergreen Medium	2,030	55 (N/A)	0.1	0.0	18.34
Alder	1,703	46 (N/A)	0.1	0.0	15.38
American chestnut	2,681	73 (N/A)	0.1	0.0	24.22
Amur corktree	749	20 (N/A)	0.1	0.0	10.14
Plum	272	7 (N/A)	0.1	0.0	3.68
Boxelder	1,440	39 (N/A)	0.1	0.0	19.51
Eastern cottonwood	14,478	392 (N/A)	0.1	0.2	196.17
Yellowwood	586	16 (N/A)	0.0	0.0	15.88
Japanese maple	264	7 (N/A)	0.0	0.0	7.17
Black ash	1,409	38 (N/A)	0.0	0.0	38.19
Black spruce	755	20 (N/A)	0.0	0.0	20.47
Lilac	1,174	32 (N/A)	0.0	0.0	31.82
Eastern hophornbeam	264	7 (N/A)	0.0	0.0	7.17
Sumac	69	2 (N/A)	0.0	0.0	1.86
Willow	3,764	102 (N/A)	0.0	0.0	102.01
Ohio buckeye	163	4 (N/A)	0.0	0.0	4.41
Eastern hemlock	596	16 (N/A)	0.0	0.0	16.14
Citywide total	9,589,002	259,862 (N/A)	100.0	100.0	70.83

Table 3: Annual Air Quality Benefits

Newton

Annual Air Quality Benefits of Public Trees

2/6/2017

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Bur oak	296.5	47.4	134.3	13.3	1,557	689.4	100.3	95.6	653.3	4,292	0.0	0	2,030.0	5,849	(N/A)	11.4	13.99
Conifer Evergreen Large	95.0	18.8	78.5	11.7	627	225.1	33.1	31.6	217.7	1,413	-396.0	-1,485	315.6	555	(N/A)	10.2	1.48
Green ash	71.3	11.4	34.3	3.2	380	259.0	37.9	36.2	248.9	1,621	0.0	0	702.2	2,001	(N/A)	5.6	9.76
Eastern white pine	62.5	12.4	50.7	7.7	410	127.4	18.7	17.8	122.6	798	-280.1	-1,051	139.7	158	(N/A)	5.4	0.80
Northern red oak	62.4	10.8	30.4	2.8	337	143.3	20.8	19.9	135.8	892	-89.6	-336	336.6	893	(N/A)	4.3	5.61
Apple	27.8	4.6	13.0	1.3	148	95.8	13.8	13.1	88.5	591	-0.2	-1	257.7	738	(N/A)	4.1	4.88
Eastern red cedar	38.9	7.7	30.9	4.8	253	65.7	9.5	9.0	61.1	406	-107.9	-405	119.6	255	(N/A)	3.9	1.79
Maple	60.4	10.3	28.2	2.7	322	144.2	21.1	20.1	137.7	900	-20.4	-76	404.3	1,146	(N/A)	3.8	8.18
Hickory	53.0	8.5	25.5	2.4	283	188.6	27.4	26.1	178.6	1,174	0.0	0	510.1	1,456	(N/A)	3.8	10.48
Northern hackberry	52.4	9.1	26.5	2.3	285	160.2	23.2	22.1	150.9	995	0.0	0	446.8	1,280	(N/A)	3.0	11.75
Pin oak	85.4	15.0	43.0	3.8	465	173.0	25.3	24.1	165.3	1,080	-156.7	-588	378.1	958	(N/A)	2.8	9.39
Black walnut	51.6	8.2	23.9	2.3	272	146.3	21.3	20.3	139.0	912	0.0	0	413.0	1,184	(N/A)	2.7	12.08
Chinese elm	75.2	12.0	33.8	3.4	394	162.7	23.8	22.7	155.4	1,016	0.0	0	488.9	1,410	(N/A)	2.6	14.54
Spruce	24.8	4.9	20.3	3.0	163	53.2	7.8	7.4	51.0	333	-110.0	-413	62.5	83	(N/A)	2.5	0.90
Honeylocust	36.2	6.0	16.5	1.6	191	81.1	11.9	11.3	78.0	508	-28.3	-106	214.3	593	(N/A)	2.3	6.97
Broadleaf Deciduous Small	3.9	0.6	2.1	0.2	21	24.7	3.5	3.3	22.3	151	0.0	0	60.5	172	(N/A)	2.1	2.26
American sycamore	70.9	11.3	31.4	3.2	370	133.3	19.4	18.5	126.9	831	0.0	0	414.9	1,202	(N/A)	2.0	16.69
Sugar maple	27.9	4.8	13.8	1.2	151	83.7	12.2	11.7	79.9	523	-21.9	-82	213.2	591	(N/A)	1.9	8.57
Silver maple	58.9	10.0	28.6	2.6	317	99.5	14.5	13.9	95.2	622	-31.6	-118	291.7	820	(N/A)	1.7	13.23
Red maple	9.6	1.6	4.7	0.4	52	32.4	4.7	4.5	31.0	202	-3.4	-13	85.5	241	(N/A)	1.5	4.38
Oak	3.8	0.6	2.1	0.2	21	26.9	4.0	3.8	26.1	169	0.0	0	67.6	191	(N/A)	1.5	3.53
Littleleaf linden	8.6	1.5	4.5	0.4	47	35.0	5.1	4.9	33.3	218	-4.4	-17	88.8	249	(N/A)	1.5	4.61
Blue spruce	11.3	2.2	9.4	1.4	75	28.5	4.2	4.0	27.4	178	-30.3	-114	58.1	140	(N/A)	1.4	2.68
Northern white cedar	23.6	4.7	18.7	2.9	153	39.8	5.8	5.6	38.2	249	-112.7	-423	26.5	-20	(N/A)	1.4	-0.40
River birch	21.7	3.7	10.7	1.0	117	56.3	8.2	7.8	52.9	349	-5.1	-19	157.1	448	(N/A)	1.4	8.95
Norway spruce	10.4	2.1	8.6	1.3	69	24.2	3.6	3.4	23.5	152	-44.2	-166	32.9	55	(N/A)	1.1	1.38
Broadleaf Evergreen Large	31.6	6.3	25.6	3.9	207	59.3	8.6	8.2	56.1	369	-94.6	-355	105.0	221	(N/A)	1.0	5.82
Norway maple	11.5	2.0	5.8	0.5	63	36.8	5.3	5.1	34.6	228	-2.8	-10	98.8	280	(N/A)	1.0	7.38
Amur maple	7.5	1.2	3.5	0.3	40	23.4	3.3	3.2	21.4	144	0.0	0	63.8	183	(N/A)	1.0	5.23
Broadleaf Deciduous Large	7.4	1.2	3.6	0.3	40	28.8	4.2	4.0	27.5	180	0.0	0	77.1	220	(N/A)	0.8	7.57
Ash	9.2	1.6	4.6	0.4	50	25.7	3.7	3.5	24.0	159	-2.2	-8	70.6	201	(N/A)	0.7	8.03
Elm	7.1	1.1	3.2	0.3	37	18.5	2.7	2.6	17.8	116	0.0	0	53.4	153	(N/A)	0.7	6.38
Swamp white oak	1.6	0.3	0.9	0.1	9	9.6	1.4	1.3	8.9	59	-0.5	-2	23.6	67	(N/A)	0.7	2.77
American basswood	8.1	1.4	4.0	0.4	44	25.7	3.7	3.5	24.1	159	-6.9	-26	64.0	177	(N/A)	0.6	8.44
Black cherry	4.4	0.7	2.0	0.2	23	13.2	1.9	1.8	12.1	81	0.0	0	36.2	104	(N/A)	0.6	4.95

Broadleaf Deciduous Medium	3.2	0.5	1.7	0.1	17	11.6	1.7	1.6	10.8	72	-0.8	-3	30.4	86 (N/A)	0.5	4.31
Ginkgo	0.2	0.0	0.2	0.0	1	2.7	0.4	0.4	2.5	16	-0.1	0	6.2	17 (N/A)	0.5	0.92
Conifer Evergreen Medium	2.2	0.4	1.9	0.3	15	6.1	0.9	0.8	5.7	38	-5.8	-22	12.4	30 (N/A)	0.4	1.90
Kentucky coffeetree	1.4	0.2	0.7	0.1	8	3.9	0.6	0.5	3.7	25	0.0	0	11.2	32 (N/A)	0.4	2.48
Pear	2.9	0.5	1.3	0.1	15	10.2	1.5	1.4	9.6	63	0.0	0	27.5	79 (N/A)	0.4	6.04
Austrian pine	1.7	0.3	1.5	0.2	11	5.1	0.7	0.7	4.8	32	-4.9	-18	10.2	25 (N/A)	0.3	2.07
Basswood	8.2	1.3	3.7	0.4	43	18.5	2.7	2.6	17.6	115	0.0	0	55.0	158 (N/A)	0.3	14.40
Tulip tree	6.4	1.0	2.9	0.3	33	15.5	2.3	2.1	14.6	96	0.0	0	45.1	130 (N/A)	0.3	11.80
Red pine	1.9	0.4	1.6	0.2	13	5.8	0.9	0.8	5.7	37	-6.7	-25	10.6	24 (N/A)	0.3	2.41
Conifer Evergreen Small	0.6	0.1	0.5	0.1	4	1.7	0.2	0.2	1.5	10	-2.4	-9	2.5	5 (N/A)	0.2	0.56
Northern pin oak	6.3	1.1	3.0	0.3	34	12.1	1.7	1.7	11.3	75	-1.4	-5	36.0	103 (N/A)	0.2	11.46
White oak	1.9	0.3	0.9	0.1	10	6.6	1.0	0.9	6.3	41	0.0	0	17.9	51 (N/A)	0.2	6.37
American elm	4.0	0.7	1.9	0.2	21	9.1	1.4	1.3	9.0	58	0.0	0	27.5	79 (N/A)	0.2	9.88
Japanese tree lilac	1.6	0.3	0.7	0.1	8	6.1	0.9	0.8	5.7	38	0.0	0	16.2	46 (N/A)	0.2	5.78
Mountain ash	2.8	0.5	1.3	0.1	15	7.6	1.1	1.0	7.0	47	0.0	0	21.4	61 (N/A)	0.2	7.68
Birch	1.3	0.2	0.7	0.1	7	4.4	0.6	0.6	4.1	27	-0.3	-1	11.7	33 (N/A)	0.2	5.52
Juniper	1.2	0.2	1.0	0.1	8	2.4	0.3	0.3	2.2	15	-3.8	-14	4.0	8 (N/A)	0.2	1.40
White ash	0.6	0.1	0.4	0.0	4	5.2	0.8	0.7	5.1	33	0.0	0	13.0	37 (N/A)	0.2	6.09
Paper birch	1.0	0.2	0.5	0.0	6	4.6	0.7	0.6	4.4	29	0.0	0	12.1	34 (N/A)	0.1	6.88
Callery pear	0.5	0.1	0.3	0.0	3	3.3	0.5	0.5	3.1	20	-0.2	-1	8.1	23 (N/A)	0.1	4.58
Black locust	2.9	0.5	1.4	0.1	16	6.8	1.0	0.9	6.4	42	-0.7	-3	19.4	55 (N/A)	0.1	11.08
Quaking aspen	0.1	0.0	0.1	0.0	1	2.3	0.3	0.3	2.1	14	0.0	0	5.3	15 (N/A)	0.1	2.99
Dogwood	0.9	0.2	0.4	0.0	5	3.5	0.5	0.5	3.2	22	0.0	0	9.3	27 (N/A)	0.1	5.31
Cottonwood	2.9	0.5	1.3	0.1	15	5.7	0.8	0.8	5.5	36	0.0	0	17.6	51 (N/A)	0.1	12.71
Catalpa	2.4	0.4	1.1	0.1	12	4.4	0.6	0.6	4.2	28	0.0	0	13.8	40 (N/A)	0.1	10.00
Eastern redbud	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	3.0	9 (N/A)	0.1	2.17
Scotch pine	1.0	0.2	0.9	0.1	7	2.6	0.4	0.4	2.5	16	-3.8	-14	4.2	9 (N/A)	0.1	2.13
Black maple	1.0	0.2	0.5	0.0	5	3.0	0.4	0.4	2.8	18	-0.3	-1	7.9	22 (N/A)	0.1	5.62
Mulberry	0.9	0.1	0.4	0.0	5	2.1	0.3	0.3	1.9	13	0.0	0	6.1	18 (N/A)	0.1	4.38
Broadleaf Evergreen Medium	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	-0.5	-2	2.4	6 (N/A)	0.1	2.10
Alder	0.5	0.1	0.2	0.0	3	1.7	0.2	0.2	1.6	11	0.0	0	4.7	13 (N/A)	0.1	4.48
American chestnut	0.2	0.0	0.1	0.0	1	2.0	0.3	0.3	1.9	12	0.0	0	4.8	13 (N/A)	0.1	4.47
Amur corktree	0.1	0.0	0.0	0.0	0	0.7	0.1	0.1	0.7	4	0.0	0	1.7	5 (N/A)	0.1	2.34
Plum	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3 (N/A)	0.1	1.33
Boxelder	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	-0.1	0	2.3	7 (N/A)	0.1	3.26
Eastern cottonwood	3.2	0.5	1.4	0.1	16	4.6	0.7	0.6	4.4	29	0.0	0	15.5	45 (N/A)	0.1	22.55
Yellowwood	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3 (N/A)	0.0	3.47
Japanese maple	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	0.0	2.55
Black ash	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8 (N/A)	0.0	7.92
Black spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	2 (N/A)	0.0	1.53
Lilac	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8 (N/A)	0.0	8.35
Eastern hophornbeam	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	0.0	2.55
Sumac	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.71
Willow	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14 (N/A)	0.0	13.58
Ohio buckeye	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1 (N/A)	0.0	1.21
Eastern hemlock	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1 (N/A)	0.0	1.48
Citywide total	1,500.4	257.5	813.6	91.1	8,370	3,731.7	543.7	518.5	3,547.6	23,260	-1,582.4	-5,934	9,421.7	25,696 (N/A)	100.0	7.00

Table 4: Annual Carbon Stored

Newton

Stored CO2 Benefits of Public Trees

2/6/2017

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	9,946,882	74,602	(N/A)	11.4	27.8	178.47
Conifer Evergreen La	962,164	7,216	(N/A)	10.2	2.7	19.24
Green ash	2,378,909	17,842	(N/A)	5.6	6.7	87.03
Eastern white pine	701,602	5,262	(N/A)	5.4	2.0	26.58
Northern red oak	1,353,181	10,149	(N/A)	4.3	3.8	63.83
Apple	435,190	3,264	(N/A)	4.1	1.2	21.62
Eastern red cedar	127,041	953	(N/A)	3.9	0.4	6.71
Maple	656,829	4,926	(N/A)	3.8	1.8	35.19
Hickory	1,724,086	12,931	(N/A)	3.8	4.8	93.03
Northern hackberry	811,342	6,085	(N/A)	3.0	2.3	55.83
Pin oak	2,314,119	17,356	(N/A)	2.8	6.5	170.16
Black walnut	1,706,064	12,795	(N/A)	2.7	4.8	130.57
Chinese elm	2,576,631	19,325	(N/A)	2.6	7.2	199.22
Spruce	272,819	2,046	(N/A)	2.5	0.8	22.00
Honeylocust	466,839	3,501	(N/A)	2.3	1.3	41.19
Broadleaf Deciduous	70,620	530	(N/A)	2.1	0.2	6.97
American sycamore	2,426,016	18,195	(N/A)	2.0	6.8	252.71
Sugar maple	816,141	6,121	(N/A)	1.9	2.3	88.71
Silver maple	1,451,481	10,886	(N/A)	1.7	4.1	175.58
Red maple	109,579	822	(N/A)	1.5	0.3	14.94
Oak	130,614	980	(N/A)	1.5	0.4	18.14
Littleleaf linden	189,675	1,423	(N/A)	1.5	0.5	26.34
Blue spruce	78,188	586	(N/A)	1.4	0.2	11.28
Northern white cedar	290,255	2,177	(N/A)	1.4	0.8	43.54
River birch	359,105	2,693	(N/A)	1.4	1.0	53.87
Norway spruce	107,918	809	(N/A)	1.1	0.3	20.23
Broadleaf Evergreen]	366,054	2,745	(N/A)	1.0	1.0	72.25
Norway maple	191,619	1,437	(N/A)	1.0	0.5	37.82
Amur maple	118,214	887	(N/A)	1.0	0.3	25.33
Broadleaf Deciduous	245,980	1,845	(N/A)	0.8	0.7	63.62
Ash	152,552	1,144	(N/A)	0.7	0.4	45.77
Elm	250,163	1,876	(N/A)	0.7	0.7	78.18
Swamp white oak	28,430	213	(N/A)	0.7	0.1	8.88
American basswood	302,719	2,270	(N/A)	0.6	0.8	108.11
Black cherry	69,048	518	(N/A)	0.6	0.2	24.66
Broadleaf Deciduous	53,963	405	(N/A)	0.5	0.2	20.24
Ginkgo	3,592	27	(N/A)	0.5	0.0	1.42
Conifer Evergreen M	14,910	112	(N/A)	0.4	0.0	6.99
Kentucky coffeetree	48,872	367	(N/A)	0.4	0.1	28.20
Pear	44,212	332	(N/A)	0.4	0.1	25.51
Austrian pine	10,425	78	(N/A)	0.3	0.0	6.52
Basswood	272,460	2,043	(N/A)	0.3	0.8	185.77
Tulip tree	212,472	1,594	(N/A)	0.3	0.6	144.87
Red pine	15,134	114	(N/A)	0.3	0.0	11.35
Conifer Evergreen Sn	2,148	16	(N/A)	0.2	0.0	1.79
Northern pin oak	103,602	777	(N/A)	0.2	0.3	86.34
White oak	62,853	471	(N/A)	0.2	0.2	58.93
American elm	80,993	607	(N/A)	0.2	0.2	75.93
Japanese tree lilac	23,744	178	(N/A)	0.2	0.1	22.26
Mountain ash	42,825	321	(N/A)	0.2	0.1	40.15
Birch	21,425	161	(N/A)	0.2	0.1	26.78
Juniper	4,138	31	(N/A)	0.2	0.0	5.17
White ash	18,905	142	(N/A)	0.2	0.1	23.63
Paper birch	34,507	259	(N/A)	0.1	0.1	51.76
Callery pear	9,466	71	(N/A)	0.1	0.0	14.20

Black locust	48,075	361	(N/A)	0.1	0.1	72.11
Quaking aspen	5,173	39	(N/A)	0.1	0.0	7.76
Dogwood	14,633	110	(N/A)	0.1	0.0	21.95
Cottonwood	97,710	733	(N/A)	0.1	0.3	183.21
Catalpa	82,296	617	(N/A)	0.1	0.2	154.31
Eastern redbud	6,784	51	(N/A)	0.1	0.0	12.72
Scotch pine	9,026	68	(N/A)	0.1	0.0	16.92
Black maple	11,247	84	(N/A)	0.1	0.0	21.09
Mulberry	13,677	103	(N/A)	0.1	0.0	25.64
Broadleaf Evergreen l	1,452	11	(N/A)	0.1	0.0	3.63
Alder	8,559	64	(N/A)	0.1	0.0	21.40
American chestnut	5,741	43	(N/A)	0.1	0.0	14.35
Amur corktree	1,319	10	(N/A)	0.1	0.0	4.95
Plum	922	7	(N/A)	0.1	0.0	3.46
Boxelder	2,201	17	(N/A)	0.1	0.0	8.26
Eastern cottonwood	111,964	840	(N/A)	0.1	0.3	419.86
Yellowwood	1,101	8	(N/A)	0.0	0.0	8.26
Japanese maple	908	7	(N/A)	0.0	0.0	6.81
Black ash	3,624	27	(N/A)	0.0	0.0	27.18
Black spruce	284	2	(N/A)	0.0	0.0	2.13
Lilac	6,743	51	(N/A)	0.0	0.0	50.57
Eastern hophornbeam	908	7	(N/A)	0.0	0.0	6.81
Sumac	178	1	(N/A)	0.0	0.0	1.33
Willow	14,280	107	(N/A)	0.0	0.0	107.10
Ohio buckeye	218	2	(N/A)	0.0	0.0	1.64
Eastern hemlock	257	2	(N/A)	0.0	0.0	1.93
Citywide total	35,717,998	267,885	(N/A)	100.0	100.0	73.01

Table 5: Annual Carbon Sequestered

Newton

Annual CO Benefits of Public Trees

2/6/2017

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	310,019	2,325	-47,745	-1,604	-370	241,834	1,814	502,504	3,769 (N/A)	11.4	19.2	9.02
Conifer Evergreen Large	47,970	360	-4,618	-864	-41	80,640	605	123,128	923 (N/A)	10.2	4.7	2.46
Green ash	117,015	878	-11,419	-552	-90	92,109	691	197,153	1,479 (N/A)	5.6	7.5	7.21
Eastern white pine	24,174	181	-3,368	-521	-29	45,400	340	65,685	493 (N/A)	5.4	2.5	2.49
Northern red oak	27,899	209	-6,496	-385	-52	50,281	377	71,300	535 (N/A)	4.3	2.7	3.36
Apple	26,893	202	-2,089	-270	-18	32,772	246	57,306	430 (N/A)	4.1	2.2	2.85
Eastern red cedar	3,039	23	-610	-247	-6	22,632	170	24,814	186 (N/A)	3.9	0.9	1.31
Maple	34,515	259	-3,153	-279	-26	50,981	382	82,064	615 (N/A)	3.8	3.1	4.40
Hickory	94,027	705	-8,276	-410	-65	66,098	496	151,439	1,136 (N/A)	3.8	5.8	8.17
Northern hackberry	40,748	306	-3,896	-316	-32	55,812	419	92,349	693 (N/A)	3.0	3.5	6.35
Pin oak	165,762	1,243	-11,108	-402	-86	61,226	459	215,479	1,616 (N/A)	2.8	8.2	15.84
Black walnut	70,063	525	-8,189	-328	-64	51,445	386	112,992	847 (N/A)	2.7	4.3	8.65
Chinese elm	62,548	469	-12,368	-379	-96	57,519	431	107,320	805 (N/A)	2.6	4.1	8.30
Spruce	10,266	77	-1,310	-217	-11	18,878	142	27,617	207 (N/A)	2.5	1.1	2.23
Honeylocust	24,905	187	-2,245	-136	-18	28,905	217	51,429	386 (N/A)	2.3	2.0	4.54
Broadleaf Deciduous Smal	7,448	56	-339	-79	-3	8,241	62	15,271	115 (N/A)	2.1	0.6	1.51
American sycamore	50,762	381	-11,645	-322	-90	46,973	352	85,768	643 (N/A)	2.0	3.3	8.93
Sugar maple	40,663	305	-3,919	-194	-31	29,586	222	66,136	496 (N/A)	1.9	2.5	7.19
Silver maple	98,071	736	-6,967	-246	-54	35,297	265	126,155	946 (N/A)	1.7	4.8	15.26
Red maple	12,337	93	-527	-66	-4	11,483	86	23,228	174 (N/A)	1.5	0.9	3.17
Oak	11,837	89	-628	-60	-5	9,677	73	20,825	156 (N/A)	1.5	0.8	2.89
Littleleaf linden	20,776	156	-915	-87	-8	12,317	92	32,091	241 (N/A)	1.5	1.2	4.46
Blue spruce	4,993	37	-375	-105	-4	10,138	76	14,651	110 (N/A)	1.4	0.6	2.11
Northern white cedar	4,559	34	-1,393	-192	-12	14,144	106	17,118	128 (N/A)	1.4	0.7	2.57
River birch	15,193	114	-1,726	-123	-14	19,539	147	32,884	247 (N/A)	1.4	1.3	4.93
Norway spruce	3,762	28	-518	-101	-5	8,687	65	11,830	89 (N/A)	1.1	0.5	2.22
Broadleaf Evergreen Large	19,738	148	-1,757	-112	-14	20,951	157	38,820	291 (N/A)	1.0	1.5	7.66
Norway maple	11,497	86	-922	-77	-7	12,793	96	23,292	175 (N/A)	1.0	0.9	4.60
Amur maple	7,985	60	-567	-66	-5	7,929	59	15,279	115 (N/A)	1.0	0.6	3.27
Broadleaf Deciduous Largı	13,709	103	-1,181	-64	-9	10,185	76	22,650	170 (N/A)	0.8	0.9	5.86
Ash	6,907	52	-733	-58	-6	8,878	67	14,994	112 (N/A)	0.7	0.6	4.50
Elm	6,063	45	-1,201	-45	-9	6,606	50	11,423	86 (N/A)	0.7	0.4	3.57

Swamp white oak	3,755	28	-139	-21	-1	3,290	25	6,885	52 (N/A)	0.7	0.3	2.15
American basswood	17,588	132	-1,453	-63	-11	8,895	67	24,967	187 (N/A)	0.6	1.0	8.92
Black cherry	2,566	19	-331	-41	-3	4,466	33	6,659	50 (N/A)	0.6	0.3	2.38
Broadleaf Deciduous Medi	3,750	28	-260	-27	-2	3,990	30	7,454	56 (N/A)	0.5	0.3	2.80
Ginkgo	472	4	-17	-12	0	919	7	1,361	10 (N/A)	0.5	0.1	0.54
Conifer Evergreen Mediun	770	6	-72	-23	-1	2,106	16	2,781	21 (N/A)	0.4	0.1	1.30
Kentucky coffeetree	1,807	14	-235	-11	-2	1,378	10	2,939	22 (N/A)	0.4	0.1	1.70
Pear	3,650	27	-212	-25	-2	3,536	27	6,949	52 (N/A)	0.4	0.3	4.01
Austrian pine	810	6	-50	-19	-1	1,789	13	2,530	19 (N/A)	0.3	0.1	1.58
Basswood	8,834	66	-1,308	-43	-10	6,503	49	13,985	105 (N/A)	0.3	0.5	9.54
Tulip tree	7,229	54	-1,020	-36	-8	5,423	41	11,596	87 (N/A)	0.3	0.4	7.91
Red pine	1,236	9	-73	-20	-1	2,103	16	3,246	24 (N/A)	0.3	0.1	2.43
Conifer Evergreen Small	229	2	-10	-8	0	564	4	775	6 (N/A)	0.2	0.0	0.65
Northern pin oak	1,131	8	-497	-31	-4	4,172	31	4,776	36 (N/A)	0.2	0.2	3.98
White oak	3,052	23	-302	-15	-2	2,319	17	5,054	38 (N/A)	0.2	0.2	4.74
American elm	2,244	17	-390	-19	-3	3,322	25	5,157	39 (N/A)	0.2	0.2	4.84
Japanese tree lilac	2,044	15	-114	-15	-1	2,126	16	4,041	30 (N/A)	0.2	0.2	3.79
Mountain ash	3,195	24	-206	-20	-2	2,599	19	5,569	42 (N/A)	0.2	0.2	5.22
Birch	1,523	11	-104	-10	-1	1,526	11	2,936	22 (N/A)	0.2	0.1	3.67
Juniper	162	1	-20	-9	0	806	6	940	7 (N/A)	0.2	0.0	1.17
White ash	2,379	18	-91	-10	-1	1,883	14	4,160	31 (N/A)	0.2	0.2	5.20
Paper birch	2,133	16	-166	-10	-1	1,643	12	3,601	27 (N/A)	0.1	0.1	5.40
Callery pear	1,225	9	-45	-6	0	1,149	9	2,322	17 (N/A)	0.1	0.1	3.48
Black locust	2,066	15	-231	-14	-2	2,352	18	4,173	31 (N/A)	0.1	0.2	6.26
Quaking aspen	1,044	8	-25	-6	0	794	6	1,807	14 (N/A)	0.1	0.1	2.71
Dogwood	763	6	-70	-10	-1	1,200	9	1,883	14 (N/A)	0.1	0.1	2.82
Cottonwood	2,298	17	-469	-14	-4	2,020	15	3,835	29 (N/A)	0.1	0.1	7.19
Catalpa	1,587	12	-395	-11	-3	1,560	12	2,741	21 (N/A)	0.1	0.1	5.14
Eastern redbud	505	4	-33	-3	0	352	3	820	6 (N/A)	0.1	0.0	1.54
Scotch pine	606	5	-43	-9	0	926	7	1,479	11 (N/A)	0.1	0.1	2.77
Black maple	496	4	-54	-6	0	1,034	8	1,469	11 (N/A)	0.1	0.1	2.75
Mulberry	525	4	-66	-7	-1	712	5	1,165	9 (N/A)	0.1	0.0	2.18
Broadleaf Evergreen Medi	169	1	-7	-4	0	422	3	581	4 (N/A)	0.1	0.0	1.45
Alder	706	5	-41	-5	0	583	4	1,243	9 (N/A)	0.1	0.0	3.11
American chestnut	863	6	-28	-4	0	710	5	1,541	12 (N/A)	0.1	0.1	3.85
Amur corktree	320	2	-7	-2	0	240	2	551	4 (N/A)	0.1	0.0	2.07
Plum	123	1	-4	-1	0	130	1	246	2 (N/A)	0.1	0.0	0.92
Boxelder	361	3	-11	-2	0	346	3	694	5 (N/A)	0.1	0.0	2.60
Eastern cottonwood	958	7	-537	-12	-4	1,626	12	2,034	15 (N/A)	0.1	0.1	7.63
Yellowwood	224	2	-5	-1	0	176	1	393	3 (N/A)	0.0	0.0	2.95
Japanese maple	114	1	-4	-1	0	124	1	232	2 (N/A)	0.0	0.0	1.74
Black ash	386	3	-17	-2	0	395	3	762	6 (N/A)	0.0	0.0	5.71
Black spruce	39	0	-1	-1	0	106	1	142	1 (N/A)	0.0	0.0	1.07
Lilac	478	4	-32	-3	0	335	3	778	6 (N/A)	0.0	0.0	5.84
Eastern hophornbeam	114	1	-4	-1	0	124	1	232	2 (N/A)	0.0	0.0	1.74
Sumac	38	0	-1	-1	0	37	0	74	1 (N/A)	0.0	0.0	0.55
Willow	370	3	-69	-4	-1	539	4	837	6 (N/A)	0.0	0.0	6.27
Ohio buckeye	96	1	-2	-1	0	65	0	158	1 (N/A)	0.0	0.0	1.18
Eastern hemlock	53	0	-1	-1	0	94	1	145	1 (N/A)	0.0	0.0	1.08
Citywide total	1,483,228	11,124	-171,474	-9,530	-1,358	1,313,469	9,851	2,615,694	19,618 (N/A)	100.0	100.0	5.35

Table 6: Annual Social and Aesthetic Benefits

Newton

Annual Aesthetic/Other Benefits of Public Trees

2/6/2017

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Bur oak	22,979	(N/A)	11.4	15.9	54.97
Conifer Evergreen Large	11,053	(N/A)	10.2	7.6	29.48
Green ash	10,175	(N/A)	5.6	7.0	49.63
Eastern white pine	5,152	(N/A)	5.4	3.6	26.02
Northern red oak	2,225	(N/A)	4.3	1.5	14.00
Apple	1,562	(N/A)	4.1	1.1	10.35
Eastern red cedar	1,266	(N/A)	3.9	0.9	8.92
Maple	4,714	(N/A)	3.8	3.3	33.67
Hickory	7,769	(N/A)	3.8	5.4	55.89
Northern hackberry	5,575	(N/A)	3.0	3.9	51.15
Pin oak	12,402	(N/A)	2.8	8.6	121.59
Black walnut	5,489	(N/A)	2.7	3.8	56.01
Chinese elm	4,728	(N/A)	2.6	3.3	48.74
Spruce	2,257	(N/A)	2.5	1.6	24.27
Honeylocust	5,846	(N/A)	2.3	4.0	68.77
Broadleaf Deciduous Small	419	(N/A)	2.1	0.3	5.51
American sycamore	3,516	(N/A)	2.0	2.4	48.83
Sugar maple	4,191	(N/A)	1.9	2.9	60.74
Silver maple	7,259	(N/A)	1.7	5.0	117.08
Red maple	1,740	(N/A)	1.5	1.2	31.63
Oak	1,368	(N/A)	1.5	0.9	25.33
Littleleaf linden	2,294	(N/A)	1.5	1.6	42.49
Blue spruce	1,142	(N/A)	1.4	0.8	21.97
Northern white cedar	929	(N/A)	1.4	0.6	18.58
River birch	1,475	(N/A)	1.4	1.0	29.51
Norway spruce	1,017	(N/A)	1.1	0.7	25.42
Broadleaf Evergreen Large	3,560	(N/A)	1.0	2.5	93.69
Norway maple	1,166	(N/A)	1.0	0.8	30.68
Amur maple	470	(N/A)	1.0	0.3	13.44
Broadleaf Deciduous Large	1,250	(N/A)	0.8	0.9	43.10
Ash	697	(N/A)	0.7	0.5	27.87
Elm	648	(N/A)	0.7	0.4	26.98
Swamp white oak	434	(N/A)	0.7	0.3	18.07
American basswood	1,248	(N/A)	0.6	0.9	59.44
Black cherry	149	(N/A)	0.6	0.1	7.08
Broadleaf Deciduous Medium	415	(N/A)	0.5	0.3	20.77
Ginkgo	59	(N/A)	0.5	0.0	3.11
Conifer Evergreen Medium	291	(N/A)	0.4	0.2	18.22
Kentucky coffeetree	197	(N/A)	0.4	0.1	15.17
Pear	214	(N/A)	0.4	0.1	16.46
Austrian pine	254	(N/A)	0.3	0.2	21.20
Basswood	631	(N/A)	0.3	0.4	57.40
Tulip tree	554	(N/A)	0.3	0.4	50.39
Red pine	336	(N/A)	0.3	0.2	33.58
Conifer Evergreen Small	145	(N/A)	0.2	0.1	16.06
Northern pin oak	105	(N/A)	0.2	0.1	11.65
White oak	289	(N/A)	0.2	0.2	36.16
American elm	310	(N/A)	0.2	0.2	38.75

Japanese tree lilac	119 (N/A)	0.2	0.1	14.88
Mountain ash	190 (N/A)	0.2	0.1	23.81
Birch	162 (N/A)	0.2	0.1	27.03
Juniper	78 (N/A)	0.2	0.1	12.95
White ash	329 (N/A)	0.2	0.2	54.85
Paper birch	202 (N/A)	0.1	0.1	40.32
Callery pear	133 (N/A)	0.1	0.1	26.70
Black locust	188 (N/A)	0.1	0.1	37.64
Quaking aspen	143 (N/A)	0.1	0.1	28.56
Dogwood	44 (N/A)	0.1	0.0	8.75
Cottonwood	166 (N/A)	0.1	0.1	41.51
Catalpa	125 (N/A)	0.1	0.1	31.16
Eastern redbud	29 (N/A)	0.1	0.0	7.23
Scotch pine	159 (N/A)	0.1	0.1	39.70
Black maple	90 (N/A)	0.1	0.1	22.38
Mulberry	31 (N/A)	0.1	0.0	7.72
Broadleaf Evergreen Medium	66 (N/A)	0.1	0.0	21.93
Alder	42 (N/A)	0.1	0.0	13.87
American chestnut	103 (N/A)	0.1	0.1	34.32
Amur corktree	39 (N/A)	0.1	0.0	19.55
Plum	6 (N/A)	0.1	0.0	3.22
Boxelder	54 (N/A)	0.1	0.0	27.10
Eastern cottonwood	57 (N/A)	0.1	0.0	28.57
Yellowwood	26 (N/A)	0.0	0.0	26.22
Japanese maple	6 (N/A)	0.0	0.0	6.40
Black ash	39 (N/A)	0.0	0.0	39.16
Black spruce	21 (N/A)	0.0	0.0	21.08
Lilac	29 (N/A)	0.0	0.0	28.80
Eastern hophornbeam	6 (N/A)	0.0	0.0	6.40
Sumac	2 (N/A)	0.0	0.0	2.06
Willow	31 (N/A)	0.0	0.0	31.46
Ohio buckeye	13 (N/A)	0.0	0.0	12.89
Eastern hemlock	15 (N/A)	0.0	0.0	15.42
Citywide total	144,711 (N/A)	100.0	100.0	39.44

Table 7: Summary of Benefits in Dollars

Newton

Total Annual Benefits of Public Trees by Species ($)

2/6/2017

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Bur oak	30,386	3,769	5,849	52,133	22,979	115,116	(N/A)	18.8
Conifer Evergreen Large	9,677	923	555	22,310	11,053	44,519	(N/A)	7.3
Green ash	11,178	1,479	2,001	15,264	10,175	40,096	(N/A)	6.5
Eastern white pine	5,519	493	158	14,351	5,152	25,672	(N/A)	4.2
Northern red oak	6,334	535	893	8,054	2,225	18,041	(N/A)	2.9
Apple	4,387	430	738	2,373	1,562	9,490	(N/A)	1.5
Eastern red cedar	2,996	186	255	5,314	1,266	10,017	(N/A)	1.6
Maple	6,305	615	1,146	6,905	4,714	19,685	(N/A)	3.2
Hickory	8,325	1,136	1,456	11,704	7,769	30,390	(N/A)	5.0
Northern hackberry	7,110	693	1,280	8,658	5,575	23,316	(N/A)	3.8
Pin oak	7,547	1,616	958	12,301	12,402	34,824	(N/A)	5.7
Black walnut	6,429	847	1,184	10,136	5,489	24,086	(N/A)	3.9
Chinese elm	7,082	805	1,410	12,143	4,728	26,168	(N/A)	4.3
Spruce	2,325	207	83	5,765	2,257	10,637	(N/A)	1.7
Honeylocust	3,508	386	593	5,052	5,846	15,384	(N/A)	2.5
Broadleaf Deciduous Sn	1,166	115	172	495	419	2,366	(N/A)	0.4
American sycamore	5,838	643	1,202	10,956	3,516	22,155	(N/A)	3.6
Sugar maple	3,660	496	591	5,463	4,191	14,401	(N/A)	2.3
Silver maple	4,346	946	820	8,630	7,259	22,001	(N/A)	3.6
Red maple	1,408	174	241	1,277	1,740	4,839	(N/A)	0.8
Oak	1,147	156	191	1,180	1,368	4,041	(N/A)	0.7
Littleleaf linden	1,531	241	249	1,586	2,294	5,901	(N/A)	1.0
Blue spruce	1,238	110	140	2,250	1,142	4,880	(N/A)	0.8
Northern white cedar	1,734	128	-20	5,261	929	8,032	(N/A)	1.3
River birch	2,516	247	448	2,896	1,475	7,582	(N/A)	1.2
Norway spruce	1,039	89	55	2,443	1,017	4,643	(N/A)	0.8
Broadleaf Evergreen La	2,604	291	221	5,602	3,560	12,278	(N/A)	2.0
Norway maple	1,635	175	280	1,667	1,166	4,923	(N/A)	0.8
Amur maple	1,081	115	183	621	470	2,470	(N/A)	0.4
Broadleaf Deciduous La	1,257	170	220	1,698	1,250	4,594	(N/A)	0.7
Ash	1,157	112	201	1,270	697	3,437	(N/A)	0.6
Elm	792	86	153	1,124	648	2,802	(N/A)	0.5
Swamp white oak	432	52	67	325	434	1,308	(N/A)	0.2
American basswood	1,155	187	177	1,612	1,248	4,380	(N/A)	0.7
Black cherry	610	50	104	358	149	1,270	(N/A)	0.2
Broadleaf Deciduous M	529	56	86	497	415	1,583	(N/A)	0.3
Ginkgo	122	10	17	66	59	274	(N/A)	0.0
Conifer Evergreen Medi	277	21	30	455	291	1,074	(N/A)	0.2
Kentucky coffeetree	176	22	32	288	197	715	(N/A)	0.1
Pear	460	52	79	243	214	1,048	(N/A)	0.2
Austrian pine	229	19	25	381	254	907	(N/A)	0.1
Basswood	818	105	158	1,462	631	3,175	(N/A)	0.5
Tulip tree	684	87	130	1,155	554	2,610	(N/A)	0.4
Red pine	243	24	24	469	336	1,097	(N/A)	0.2
Conifer Evergreen Smal	77	6	5	123	145	355	(N/A)	0.1
Northern pin oak	544	36	103	753	105	1,540	(N/A)	0.3
White oak	289	38	51	409	289	1,077	(N/A)	0.2
American elm	382	39	79	377	310	1,186	(N/A)	0.2

Japanese tree lilac	273	30	46	136	119	605 (N/A)	0.1
Mountain ash	345	42	61	213	190	852 (N/A)	0.1
Birch	200	22	33	192	162	610 (N/A)	0.1
Juniper	108	7	8	186	78	388 (N/A)	0.1
White ash	222	31	37	227	329	846 (N/A)	0.1
Paper birch	197	27	34	249	202	709 (N/A)	0.1
Callery pear	144	17	23	108	133	426 (N/A)	0.1
Black locust	306	31	55	377	188	957 (N/A)	0.2
Quaking aspen	103	14	15	82	143	357 (N/A)	0.1
Dogwood	159	14	27	82	44	326 (N/A)	0.1
Cottonwood	252	29	51	452	166	950 (N/A)	0.2
Catalpa	192	21	40	354	125	732 (N/A)	0.1
Eastern redbud	49	6	9	32	29	125 (N/A)	0.0
Scotch pine	109	11	9	244	159	532 (N/A)	0.1
Black maple	134	11	22	129	90	386 (N/A)	0.1
Mulberry	99	9	18	66	31	221 (N/A)	0.0
Broadleaf Evergreen Me	56	4	6	55	66	188 (N/A)	0.0
Alder	83	9	13	46	42	193 (N/A)	0.0
American chestnut	86	12	13	73	103	286 (N/A)	0.0
Amur corktree	33	4	5	20	39	102 (N/A)	0.0
Plum	19	2	3	7	6	37 (N/A)	0.0
Boxelder	45	5	7	39	54	150 (N/A)	0.0
Eastern cottonwood	197	15	45	392	57	707 (N/A)	0.1
Yellowwood	24	3	3	16	26	73 (N/A)	0.0
Japanese maple	18	2	3	7	6	36 (N/A)	0.0
Black ash	47	6	8	38	39	138 (N/A)	0.0
Black spruce	15	1	2	20	21	59 (N/A)	0.0
Lilac	46	6	8	32	29	121 (N/A)	0.0
Eastern hophornbeam	18	2	3	7	6	36 (N/A)	0.0
Sumac	5	1	1	2	2	11 (N/A)	0.0
Willow	71	6	14	102	31	224 (N/A)	0.0
Ohio buckeye	9	1	1	4	13	29 (N/A)	0.0
Eastern hemlock	14	1	1	16	15	48 (N/A)	0.0
Citywide Total	163,959	19,618	25,696	259,862	144,711	613,845 (N/A)	100.0

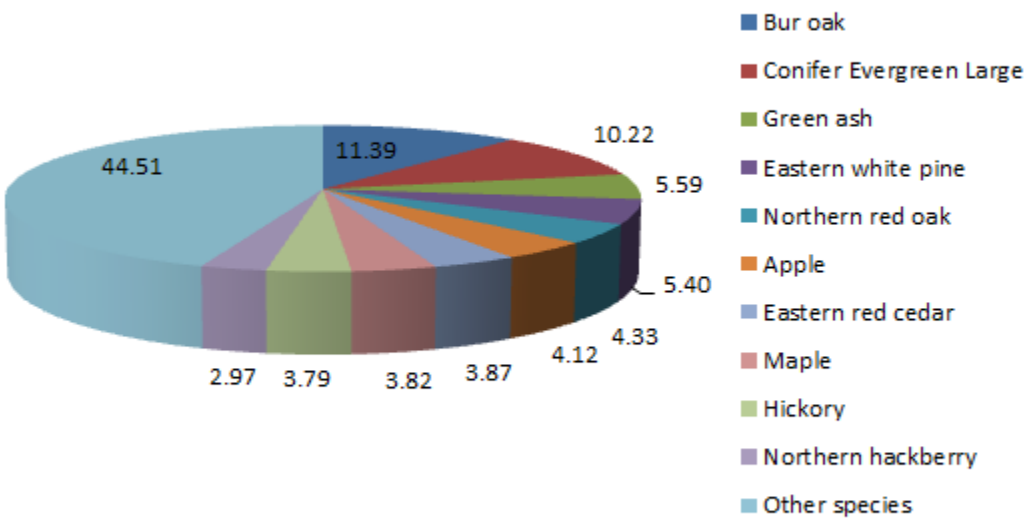

Figure 1: Species Distribution

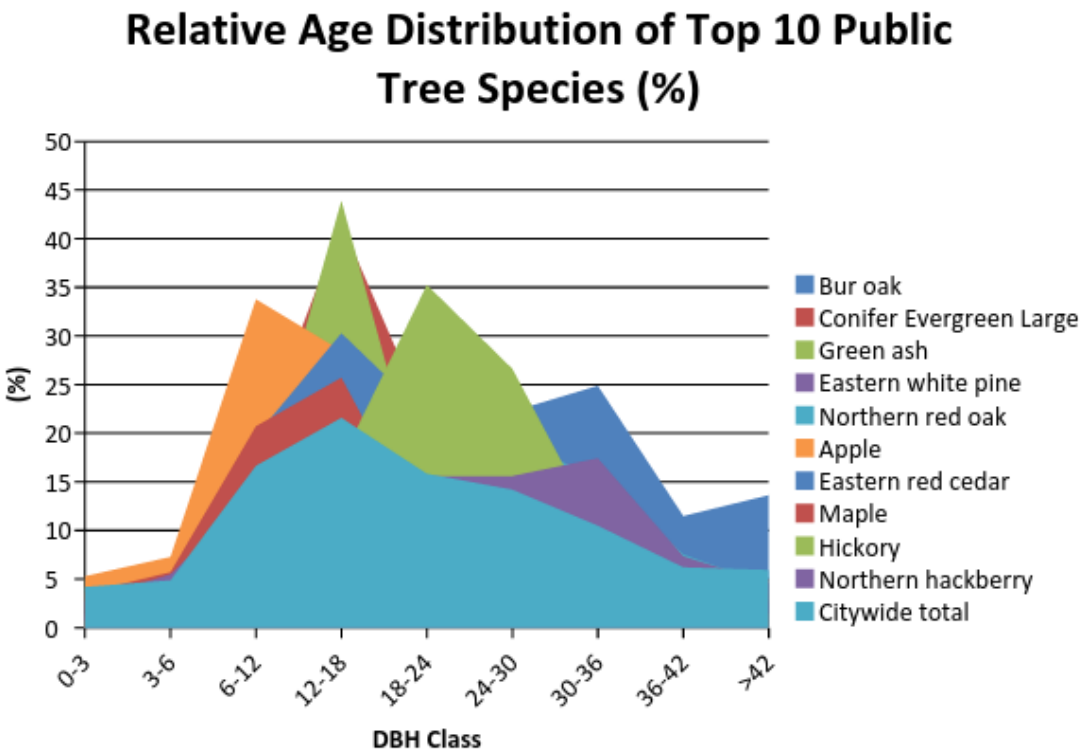

Figure 2: Relative Age Class

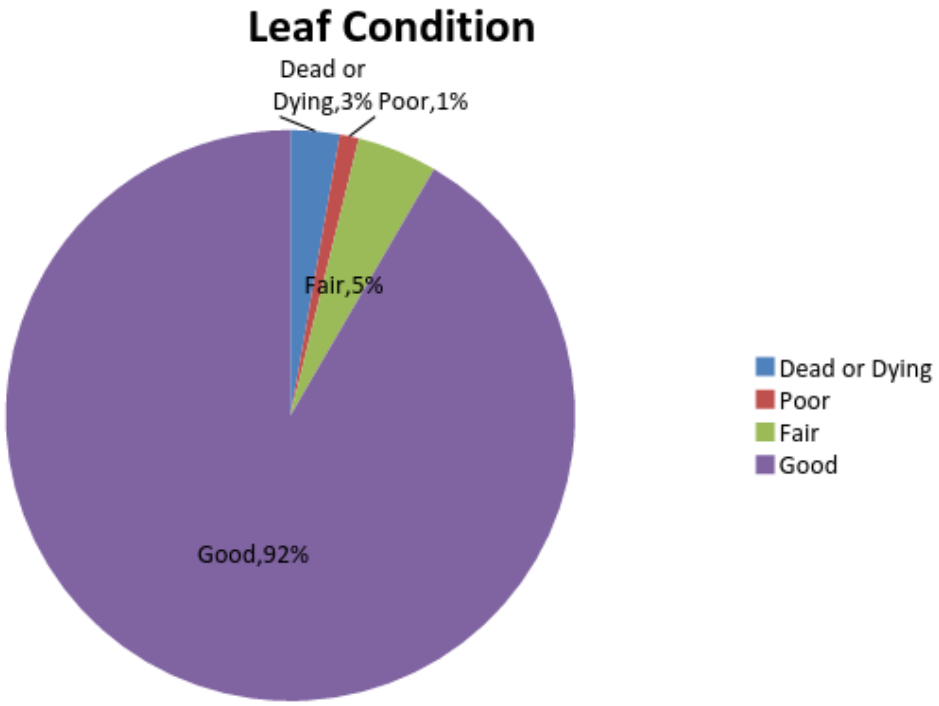

Figure 3: Foliage Condition

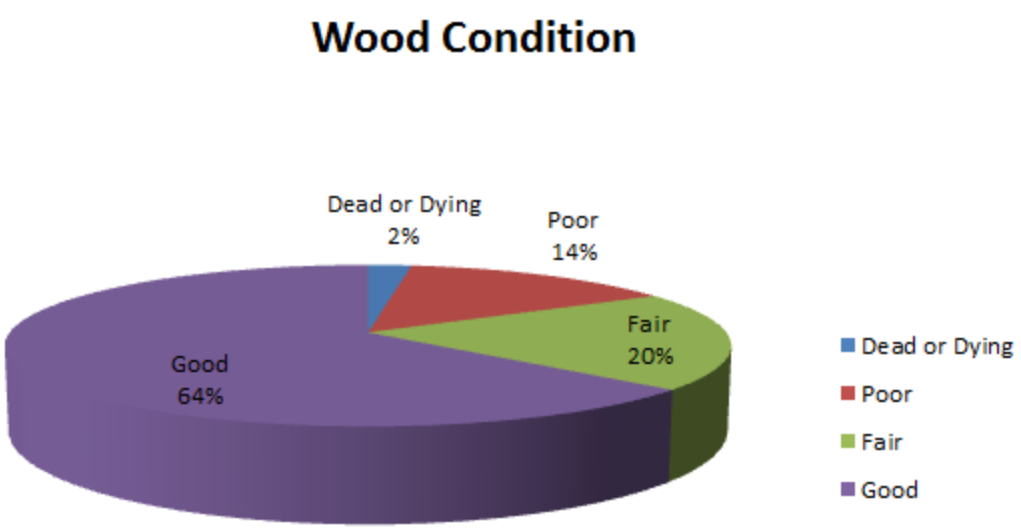

Figure 4: Wood Condition

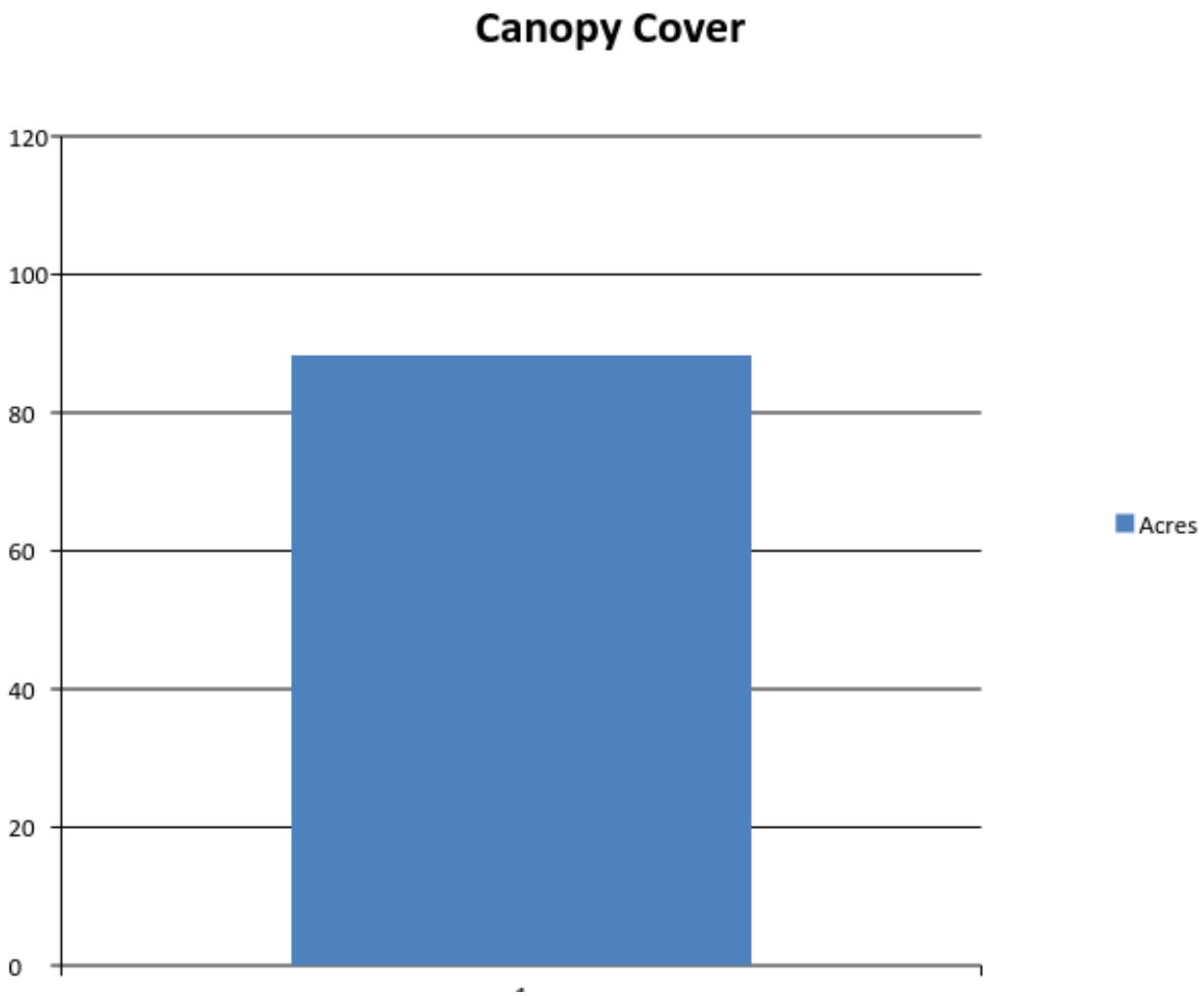

Figure 5: Canopy Cover in Acres

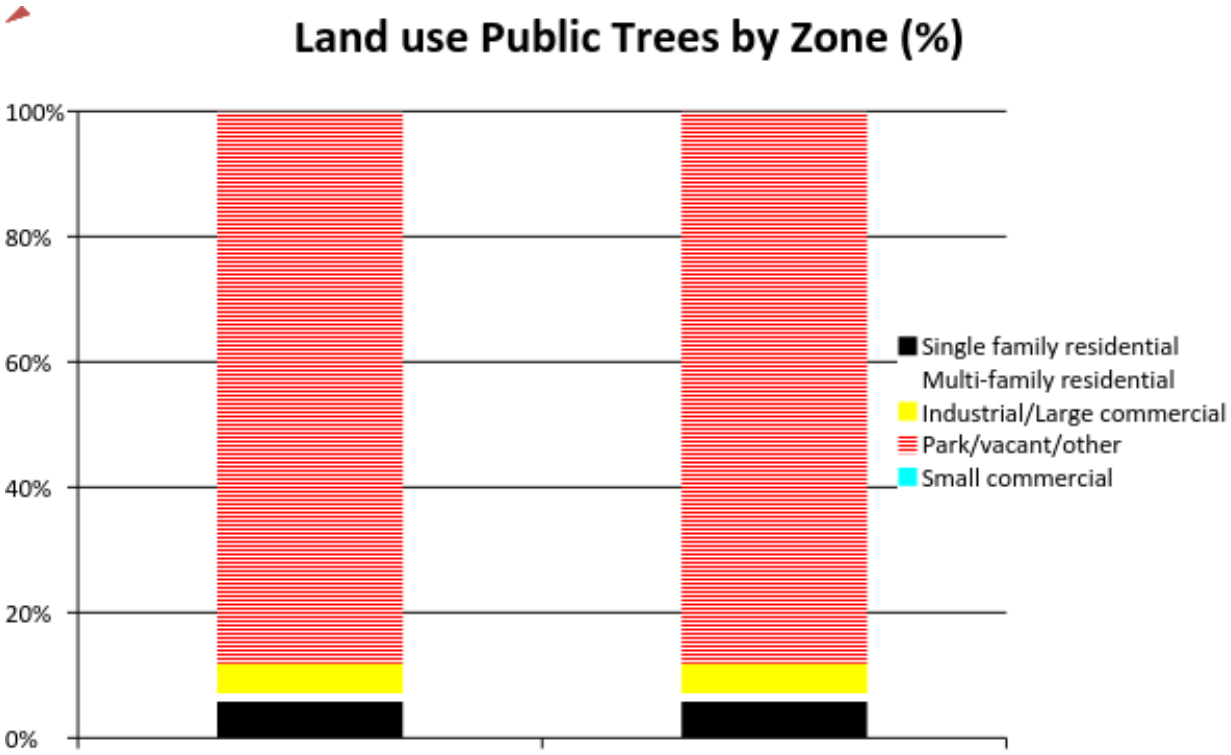

Figure 6: Land Use of city/park trees

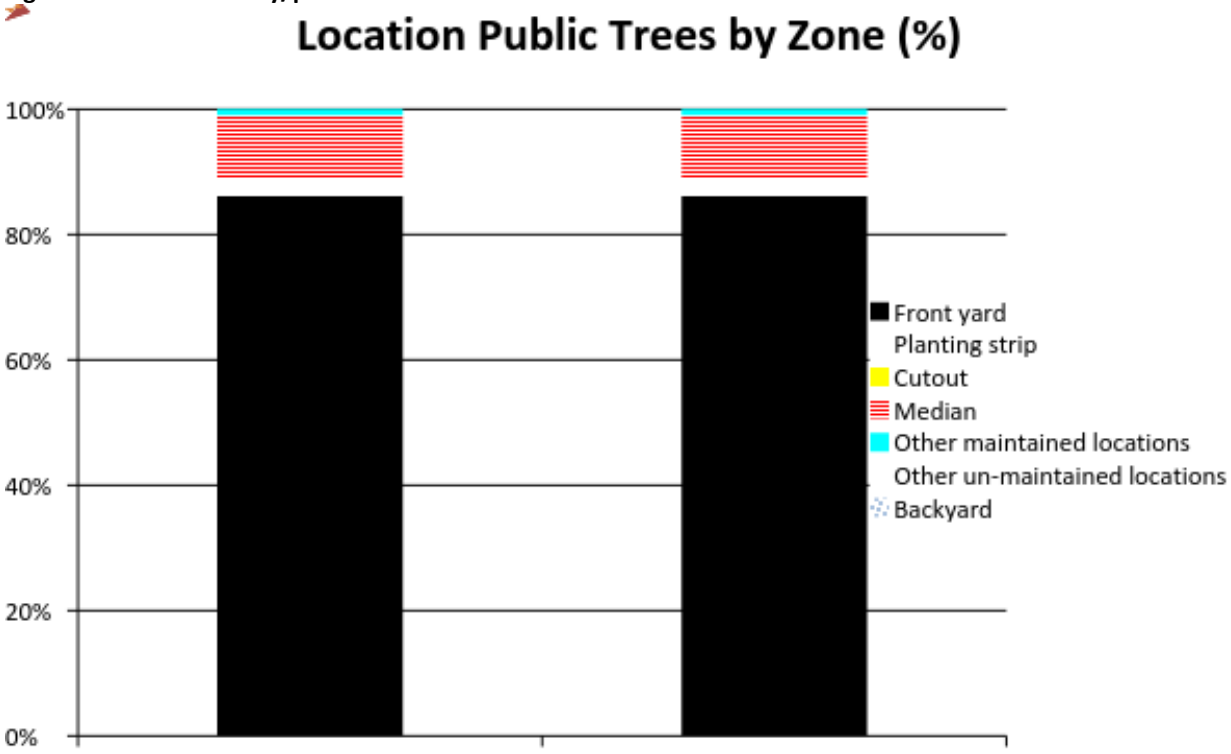

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

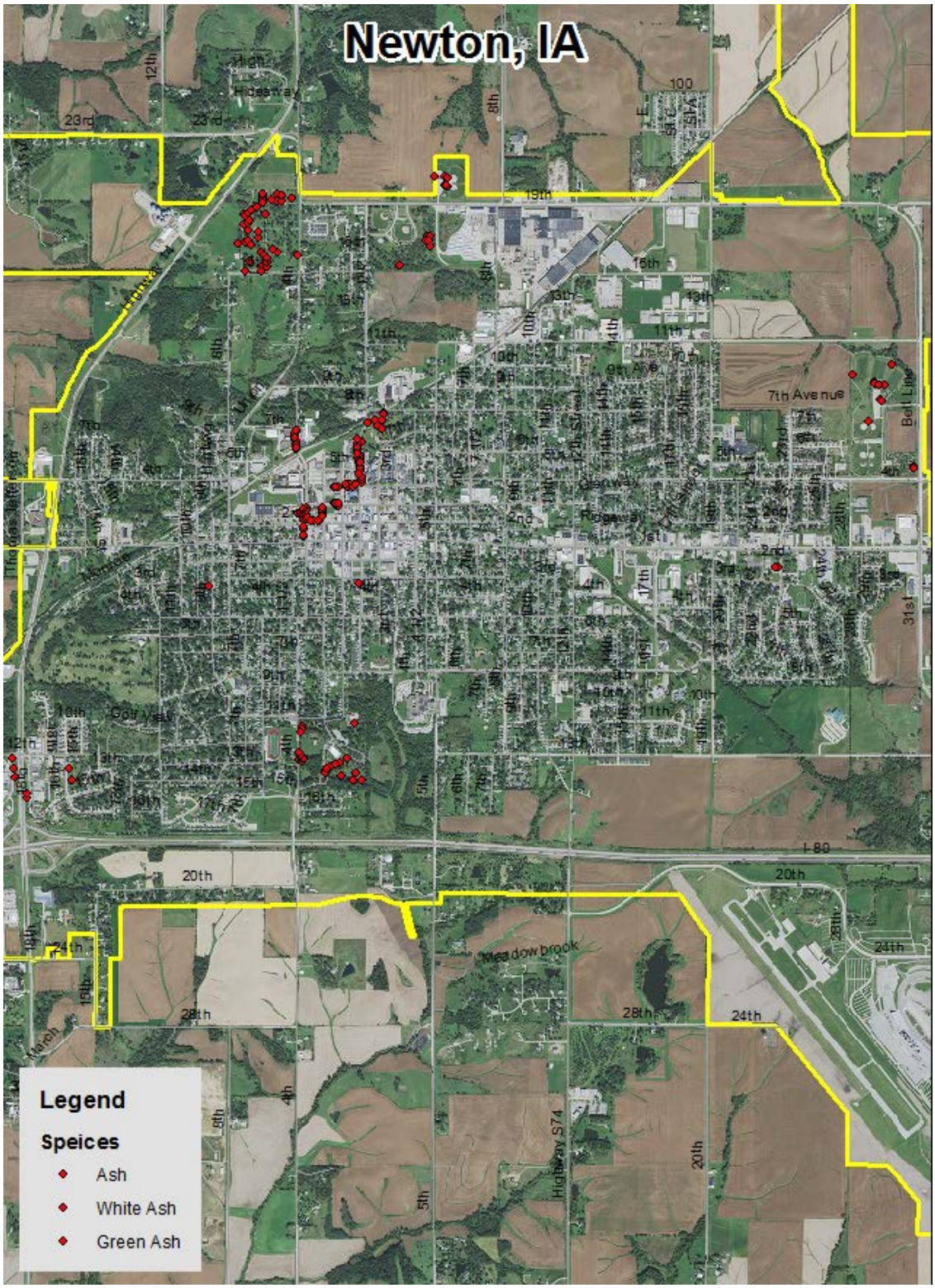

Figure 1: Location of Ash Trees

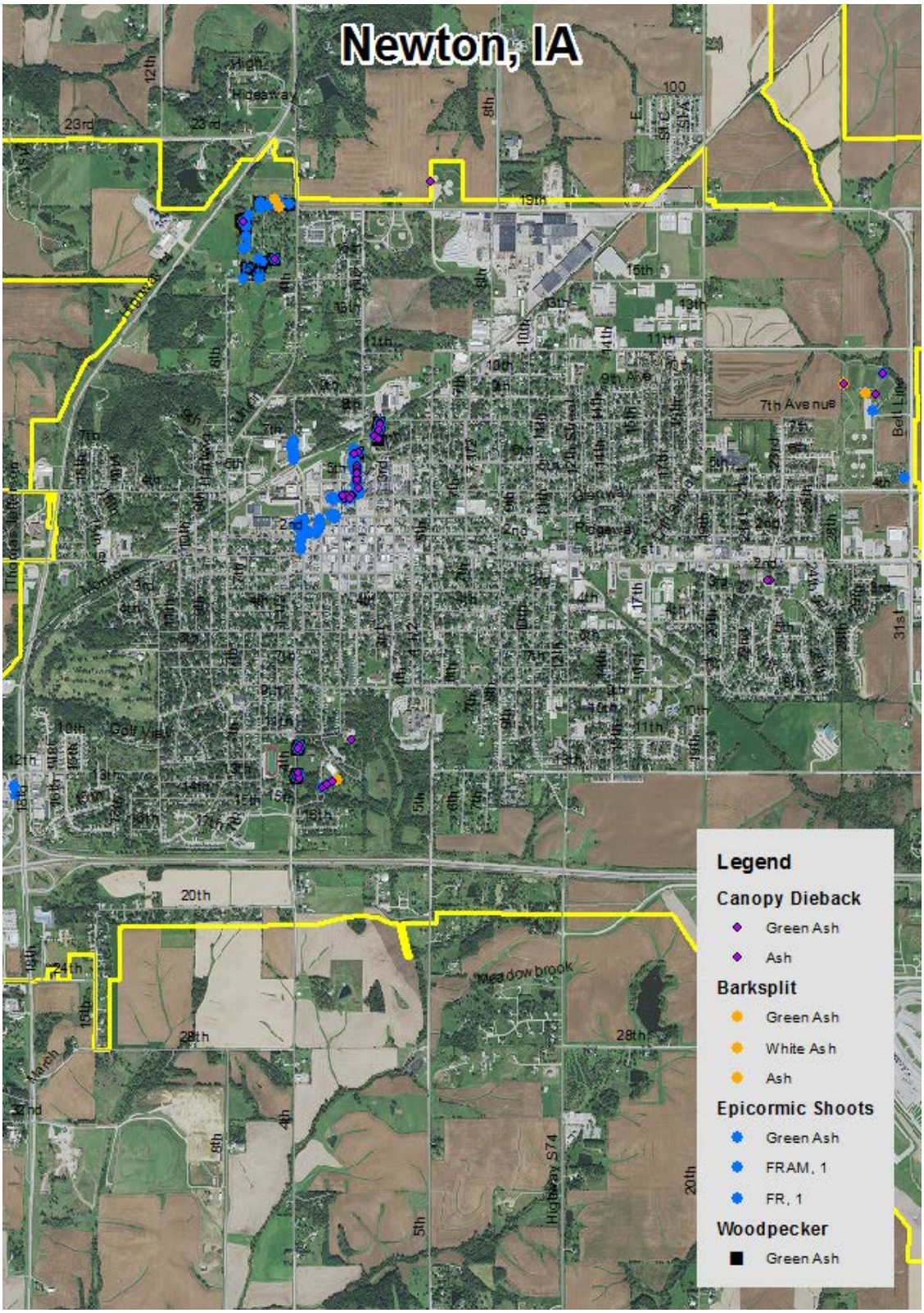

Figure 2: Location of EAB symptoms

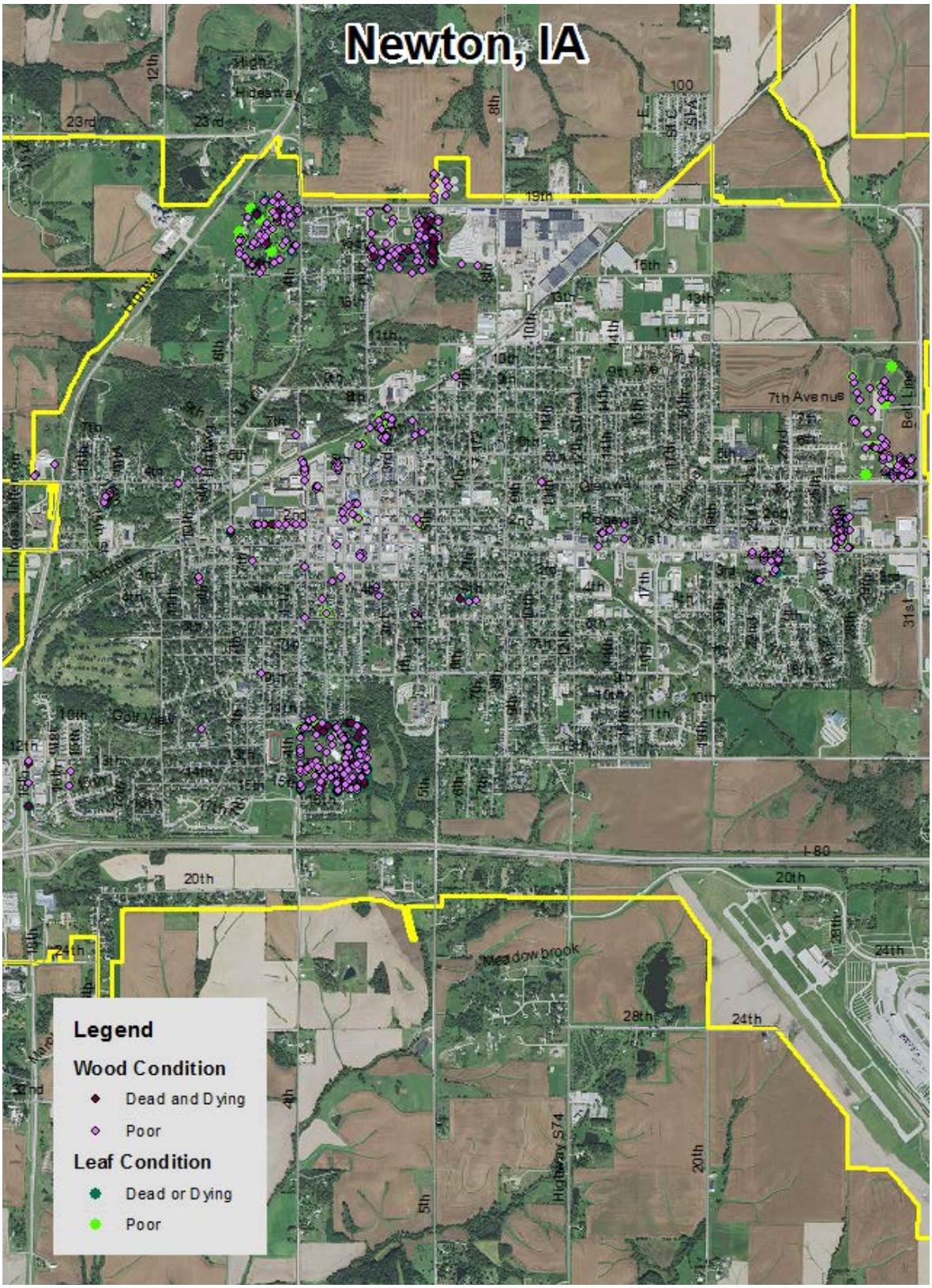

Figure 3: Location of Poor Condition Trees

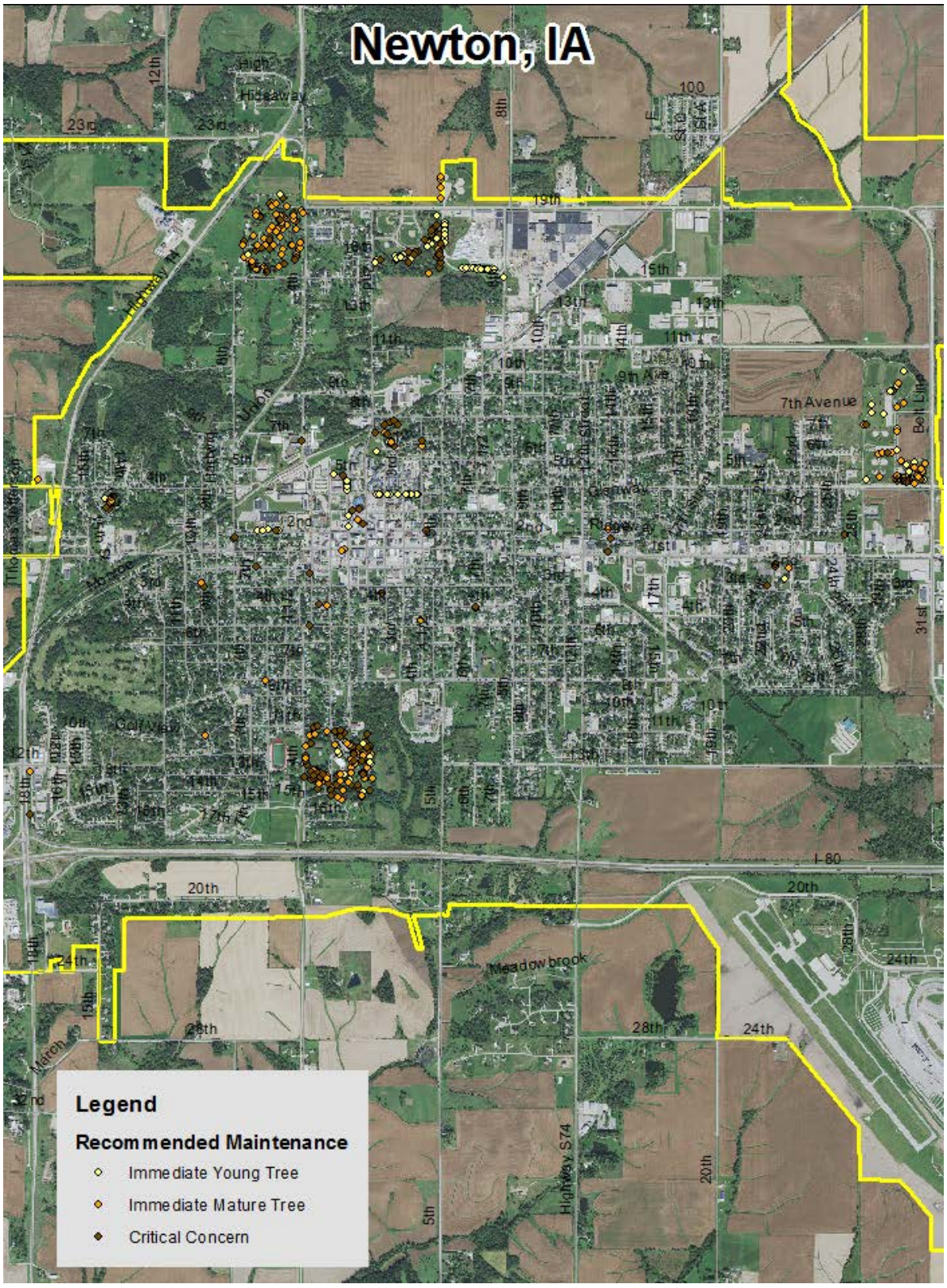

Figure 4: Location of Trees with Recommended Maintenance

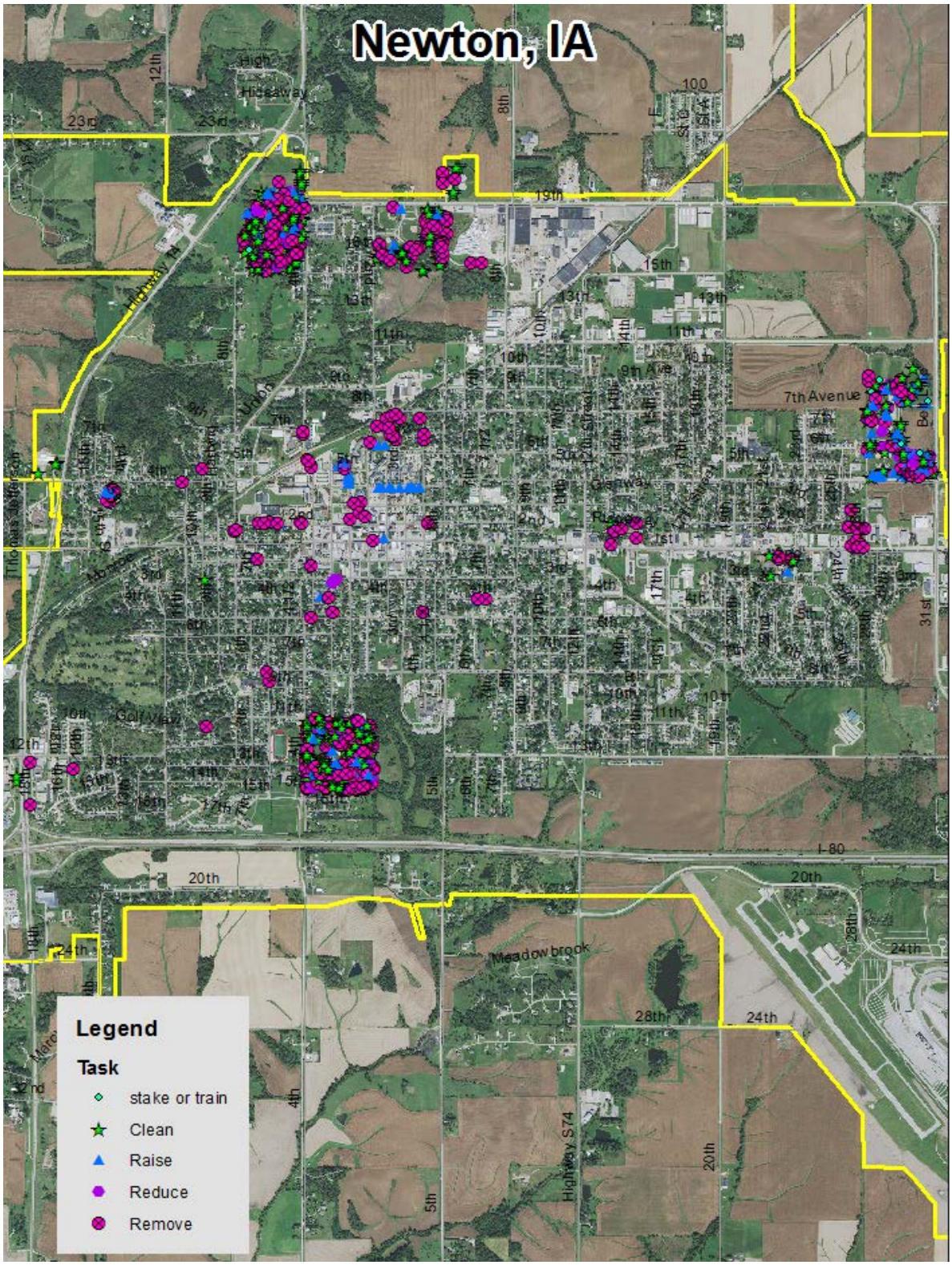

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Newton Tree Ordinances

(A) *Dead and dangerous trees and branches to be removed.* A property owner shall be responsible for the removal of any dead or otherwise dangerous trees, shrubs or branches which are on the owner's property.

(B) *Removal permit required.*

(1) Before cutting down or otherwise removing a tree or branch of a tree located in the publicly owned property or right-of-way abutting the owner's property where there is a possibility the cutting of such tree or branch will fall on a sidewalk, alley, street or any other public right-of-way, the owner shall first obtain a free permit from the City Administrator or the City Administrator's designee.

(2) Application for such permit shall state the location, kind and approximate size of the tree to be removed and by whom the work is to be done.

(C) *Liability of owner.*

(1) The property owner shall be liable for all damages to any person or property resulting from the removal of shrubs, trees or branches from the property owner's property.

(2) Without in any way limiting the liability of such owner, this liability shall specifically include damages to public sidewalks, curbing, pavement and public utility equipment.

(D) *Owner's failure to remove dead or dangerous trees and branches.* The failure to remove any tree or branch by the owner pursuant to division (A) above for the period of 14 days after either written or oral notice from the City Administrator or the City Administrator's designee shall subject the offender to the penalty of this chapter and the tree or branch shall be regarded as a nuisance and shall be abated accordingly.

(E) *Trimming of trees.* The owner or agent of the abutting property shall keep the trees on, or overhanging, the street trimmed so that all branches will be at least 15 feet above the surface of the street and eight feet above the sidewalks.

(F) *Trees not trimmed.* The leaving of any tree defined in division (E) above untrimmed for a period of five days, subject to commercial removal service availability, after either written or oral notice from the City Administrator or the City Administrator's designee shall be regarded as a nuisance and will be enforced under § 10.99(B) of this code of ordinances.

(G) *Removal of trees infected with disease.* A property owner, occupant or agent in charge of any property shall, at such owner's, occupant's or agent's own expense, remove all dead trees and dead wood or limbs from trees located on such property.

(H) *Failure to comply.* If the owner, occupant or agent in charge of property fails to comply with a notice ordering removal of dead or infected trees, brush, limbs or debris issued pursuant to division (G) above, the City Administrator or the City Administrator's designee shall cause such trees, brush, limbs or debris to be removed and the costs of such removal assessed against the property.

(I) ***PARKING*** is defined as that part of the street, avenue or highway in the city not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

(J) *Planting restrictions.* No tree shall be planted in any street or parking unless a permit has been issued in accordance with the following.

(1) *Application.* An application or permit to plant a tree or trees shall be filed with the city. Said application shall show the following:

(a) Name and application of the owner of property adjacent to the area in which it is desired to plant a tree or trees;

(b) Street address of property adjacent to the area trees are to be planted if different than above; and

(c) Species and exact location of each tree for which permit is desired.

(2) *Agreement.* There shall be submitted with each application an agreement signed by the owner or owners agent of adjacent property whereby said owner agrees to indemnify the city against all costs or losses which may accrue now or in the future in connection with the requested planting. This agreement shall be in such form as approved by the City Attorney and shall be filed with the county recorder upon approval by the Council.

(3) *Review by City Administrator.* The City Administrator shall review and approve, approve with modifications or deny such application.

(4) *Council appeal.* The applicant may appeal the decision of the City Administrator to the Council who shall affirm or modify the decision of the City Administrator.

(K) *Removal of trees.*

(1) The City Administrator shall cause to be removed, on the order of the Council, any tree on the streets of the city which interferes with the making of improvements or with travel thereon.

(2) The City Administrator shall additionally cause to be removed any trees on the street, not on private property, which have become diseased, which constitute a danger to the public or which may otherwise be declared a nuisance.

(L) *Trees subject to removal.* The Council, having determined by specific resolution, that the health of the trees within the city is threatened by a fatal disease, fungus or infestation hereby declares the following shall be removed:

(1) *Living or standing trees.* Any living or standing tree or part thereof infected with the disease, fungus or infestation;

(2) *Dead trees.* Any dead tree or part thereof including logs, branches, stumps, firewood or other material which has not received effective treatment of the disease, fungus or infestation; and

(3) *Cottonwood trees.* Cotton-bearing cottonwood trees and all other cotton-bearing poplar trees are subject to removal as a general nuisance.

(M) *Duty to remove.* No person, firm or corporation shall permit any tree or material as defined in division (L) above to remain on the premises owned, controlled or occupied by the person, firm or corporation within the city.

(N) *Inspection.* The City Administrator shall inspect or cause to be inspected all premises and places within the city to determine whether any condition as defined in division (A) above exists thereon, and shall also inspect or cause to be inspected any elm trees reported or suspected to be infected with the Dutch Elm Disease or any elm bark-bearing material reported or suspected to be infected with a fatal disease, fungus or infestation.

(O) *Removal from city property.* If the City Administrator upon inspection or examination, in person or by some qualified person acting for the City Administrator, shall determine that any condition as herein defined exists in or upon any public street, alley, park or any public place, including the strip between the curb and the lot line of private property, within the city and that

the danger of other trees within the city is imminent, the City Administrator shall immediately cause it to be removed and burned or otherwise correct the same in such manner as to destroy or prevent as fully as possible the spread of disease or the insect pests or vectors known to carry such disease fungus.

(P) *Removal from private property.*

(1) If the City Administrator upon inspection or examination, in person or by some qualified person acting for the City Administrator, shall determine with reasonable certainty that any condition as herein defined exists in or upon private premises and that the danger to other elm trees within the city is imminent, the City Administrator shall immediately notify by certified mail the owner, occupant or person in charge of such property, to correct such condition within 14 days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt thereof, the Council may cause the nuisance to be removed and the costs assessed against the property as provided herein.

(2) If the City Administrator is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected with disease, fungus or infestation, the City Administrator is authorized to remove or cut specimens from said tree and obtain a diagnosis of such specimens.

(2011 Code, § 13.0207) (Ord. 2209, passed 6-4-2013) Penalty, see § 10.99

http://library.amlegal.com/nxt/gateway.dll/Iowa/newton_ia/titleixgeneralregulations/chapter94publicnuisances?f=templates$fn=default.htm$3.0$vid=amlegal:newton_ia$anc=JD_94.05 v

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Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 9th St., Des Moines, IA 50319.

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-725-8200.