Elma, IA

2020 Urban Forest Management Plan
Prepared by Jason Walker
Iowa Department of Natural Resources

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Elma 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 21% of Elma'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 2019, 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 378 trees inventoried.

- Elma's trees provide $59,479 of benefits annually, an average of $157 a tree
- There are over 21 species of trees
- The top three genera are: Maple 35%, Ash 21%, and Oak 16%
- 12 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 12 trees needing removal, 4 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*
- 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
- The city currently does not budget any funds dedicated to tree removal –

Introduction

This plan was developed to assist Elma 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 or treatment and replacement planting. With proper planning and management of the current canopy in Elma, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Elma'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 Elma 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 Elma's urban forestry goals.

Inventory

In 2019, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. 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 wood pecker damage.

Inventory Results

The data collected for the 378 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. Fin

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Elma's trees reduce energy related costs by approximately $17,083 annually (Appendix A, Table 1). These savings are both in Electricity (80.7 MWh) and in Natural Gas (11,179 Therms).

Annual Stormwater Benefits

Elma's trees intercept about 757,567 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $20,530 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 Elma, it is estimated that trees remove 1,048 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 $2,968 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Elma, trees sequester about 280,391 lbs of carbon a year with an associated value of $2,103 (Appendix A, Table 5). In addition, the trees store 2,476,621 lbs of carbon, with a yearly benefit of $18,575 (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. Elma receives $16,795 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, Elma's trees provide $59,479of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 378 trees in Elma provide approximately $157 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Elma has over 21 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Maple	131	35%
Ash	78	21%

Oak	59	16%
Black Walnut	27	7%
Apple (Crab)	26	7%
White Cedar	9	2%
Spruce	9	2%
Boxelder	7	2%
American Basswood	7	2%
Elm	5	1%
Honeylocust	5	1%
Black Cherry	4	1%
Buckthorn	2	1%
Lilac	1	1%
Mulberry	1	<1%
White Pine	1	<1%
River Birch	1	<1%
Buckey	1	<1%
Paper Birch	1	<1%
Broadleaf Deciduous Medium	3	<1%

Age Class

Most of Elma's trees (47%) are between 6 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. Elma's size curve is on the smaller side, indicating a 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 Elma indicate that 86% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 68% of Elma'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 81% of the population.

Canopy Cover

The total canopy with both private and public trees is 8.24%. The canopy cover included in the Elma inventory includes approximately 8.5 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 6%, in 30 years. To achieve this goal it is estimated that 120 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Elma'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	
Single family residential	66%
Park/vacant/other	34%

Location	
Planting strip	84%
Front yard	16%

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

Elma has 12 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 4 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.

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 12 removals, 1 are ash trees. There are a total of 78 ash trees. *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 Elma.

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 maple (35%) (Appendix A, Figure 1). Maples 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, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (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 wood pecker damage.

Budget and Emerald Ash Borer Plan

Six Year Maintenance Plan with $3,500 Annual Budget (Currently $0)

FY 2022

Removal: 4 largest critical concern trees, $2,800
- Planting and Replacement: 5 trees to be planted in open locations, $500
- Young Tree Pruning & Maintenance: $200
- Visual Survey for signs and symptoms of EAB

FY 2023

- Removal: 4 critical concern trees, $2,800
- Planting and Replacement: 5 trees in open locations from year one removals, $500
- Young Tree Pruning & Maintenance: $200
- Visual Survey for signs and symptoms of EAB

FY 2024

- Removal: 4 critical concern trees, $2,800
- Planting and Replacement: 5 trees in open locations from year one removals, $500
- Young Tree Pruning & Maintenance: $200
- Visual Survey for signs and symptoms of EAB

FY 2025

Removal: 4 Ash trees, $2,800
Planting and Replacement: 5 trees in open locations from year one removals, $500
Young Tree Pruning & Maintenance: $200
Visual Survey for signs and symptoms of EAB

FY 2026

Removal: 4 Ash trees, $2,800
Planting and Replacement: 5 trees in open locations from year one removals, $500
Young Tree Pruning & Maintenance: $200
Visual Survey for signs and symptoms of EAB

FY 2027

Removal: 4 Ash trees, $2,800
Planting and Replacement: 5 trees in open locations from year one removals, $500
Young Tree Pruning & Maintenance: $200
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 13 ash trees removed (approximately 17% of ash). It will take approximately 20 years to remove all ash with this budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.
**To remove all ash trees within 6 years, the budget would need to be increased to $9,000 a year. If the budget were increased to $5,000 a year all ash could be removed in 13 years.

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 not composted 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 151.02 (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 wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Works Cited

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Elma

Total Annual Benefits of Public Trees by Species ($)

2/21/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Maple	6,263	755	1,144	6,920	6,885	21,968	(N/A)	36.9
Ash	3,951	421	691	4,322	2,720	12,105	(N/A)	20.4
Oak	3,131	434	556	4,710	2,952	11,783	(N/A)	19.8
Black walnut	1,161	159	191	1,400	1,221	4,133	(N/A)	6.9
Apple	447	43	63	176	158	886	(N/A)	1.5
Northern white cedar	133	11	15	171	156	485	(N/A)	0.8
Spruce	219	22	21	427	303	993	(N/A)	1.7
Boxelder	344	59	56	470	389	1,319	(N/A)	2.2
American basswood	228	31	33	258	213	763	(N/A)	1.3
Elm	315	38	59	453	244	1,109	(N/A)	1.9
Honeylocust	269	44	45	332	888	1,578	(N/A)	2.7
Sugar maple	328	52	58	631	446	1,514	(N/A)	2.5
Black cherry	93	9	14	40	35	191	(N/A)	0.3
Broadleaf Deciduous M	58	7	8	36	65	175	(N/A)	0.3
Buckthorn	24	2	3	9	8	47	(N/A)	0.1
Mulberry	5	1	1	2	2	11	(N/A)	0.0
Eastern white pine	38	4	-2	125	26	192	(N/A)	0.3
River birch	24	3	3	16	26	73	(N/A)	0.1
Ohio buckeye	24	3	3	16	26	73	(N/A)	0.1
Lilac	5	1	1	2	2	11	(N/A)	0.0
Paper birch	21	3	3	16	29	71	(N/A)	0.1
Citywide Total	17,083	2,103	2,968	20,530	16,795	59,479	(N/A)	100.0

Table 2: Annual Stormwater Benefits

Elma

Annual Stormwater Benefits of Public Trees

2/21/2020

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	255,334	6,920	(N/A)	33.6	33.7	54.48
Ash	159,467	4,322	(N/A)	20.6	21.0	55.40
Oak	173,788	4,710	(N/A)	15.6	22.9	79.82
Black walnut	51,672	1,400	(N/A)	7.1	6.8	51.86
Apple	6,485	176	(N/A)	6.9	0.9	6.76
Northern white cedar	6,303	171	(N/A)	2.4	0.8	18.98
Spruce	15,766	427	(N/A)	2.4	2.1	47.47
Boxelder	17,345	470	(N/A)	1.9	2.3	67.15
American basswood	9,529	258	(N/A)	1.9	1.3	36.89
Elm	16,704	453	(N/A)	1.3	2.2	90.53
Honeylocust	12,233	332	(N/A)	1.3	1.6	66.30
Sugar maple	23,291	631	(N/A)	1.1	3.1	157.80
Black cherry	1,460	40	(N/A)	1.1	0.2	9.89
Broadleaf Deciduous Medium	1,335	36	(N/A)	0.8	0.2	12.06
Buckthorn	333	9	(N/A)	0.5	0.0	4.51
Mulberry	69	2	(N/A)	0.3	0.0	1.86
Eastern white pine	4,605	125	(N/A)	0.3	0.6	124.79
River birch	586	16	(N/A)	0.3	0.1	15.88
Ohio buckeye	586	16	(N/A)	0.3	0.1	15.88
Lilac	69	2	(N/A)	0.3	0.0	1.86
Paper birch	608	16	(N/A)	0.3	0.1	16.47
Citywide total	757,567	20,530	(N/A)	100.0	100.0	54.31

Table 3: Annual Air Quality Benefits

Elma

Annual Air Quality Benefits of Public Trees

2/21/2020

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Maple	60.9	10.4	28.4	2.7	324	143.6	21.0	20.0	137.3	897	-20.5	-77	403.8	1,144	(N/A)	33.6	9.01
Ash	31.2	5.4	15.5	1.4	169	88.6	12.8	12.2	83.2	549	-7.4	-28	242.9	691	(N/A)	20.6	8.86
Oak	22.0	3.5	10.4	1.0	117	70.7	10.3	9.8	66.8	440	0.0	0	194.4	556	(N/A)	15.6	9.43
Black walnut	5.3	0.8	2.7	0.2	29	26.2	3.8	3.6	24.7	163	0.0	0	67.4	191	(N/A)	7.1	7.09
Apple	1.1	0.2	0.6	0.1	6	9.3	1.3	1.2	8.3	56	0.0	0	22.0	63	(N/A)	6.9	2.40
Northern white cedar	0.6	0.1	0.6	0.1	4	2.9	0.4	0.4	2.6	18	-1.9	-7	5.7	15	(N/A)	2.4	1.63
Spruce	1.8	0.3	1.5	0.2	12	5.2	0.8	0.7	5.1	33	-6.2	-23	9.4	21	(N/A)	2.4	2.37
Boxelder	2.2	0.4	1.1	0.1	12	7.7	1.1	1.1	7.3	48	-0.9	-4	20.0	56	(N/A)	1.9	8.05
American basswood	1.1	0.2	0.6	0.0	6	5.0	0.7	0.7	4.6	31	-1.0	-4	12.0	33	(N/A)	1.9	4.74
Elm	2.6	0.4	1.2	0.1	14	7.3	1.1	1.0	7.0	46	0.0	0	20.7	59	(N/A)	1.3	11.84
Honeylocust	2.3	0.4	1.1	0.1	12	6.2	0.9	0.9	5.9	39	-1.7	-6	16.0	45	(N/A)	1.3	8.91
Sugar maple	4.3	0.7	2.0	0.2	23	7.6	1.1	1.1	7.3	47	-3.3	-12	20.9	58	(N/A)	1.1	14.42
Black cherry	0.3	0.1	0.2	0.0	2	2.0	0.3	0.3	1.8	12	0.0	0	5.0	14	(N/A)	1.1	3.55
Broadleaf Deciduous Medium	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	0.0	0	2.9	8	(N/A)	0.8	2.72
Buckthorn	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.5	1.63
Mulberry	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)	0.3	0.71
Eastern white pine	0.6	0.1	0.4	0.1	4	0.9	0.1	0.1	0.8	5	-2.9	-11	0.3	-2	(N/A)	0.3	-1.58
River birch	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)	0.3	3.47
Ohio buckeye	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)	0.3	3.47
Lilac	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)	0.3	0.71
Paper birch	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.3	2.99
Citywide total	136.6	23.1	66.5	6.3	735	386.5	56.2	53.6	365.9	2,405	-45.9	-172	1,048.6	2,968	(N/A)	100.0	7.85

Table 4: Annual Carbon Stored

Elma

Stored CO2 Benefits of Public Trees

2/21/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	660,400	4,953	(N/A)	33.6	26.7	39.00
Ash	516,218	3,872	(N/A)	20.6	20.8	49.64
Oak	711,087	5,333	(N/A)	15.6	28.7	90.39
Black walnut	173,041	1,298	(N/A)	7.1	7.0	48.07
Apple	22,145	166	(N/A)	6.9	0.9	6.39
Northern white cedar	3,224	24	(N/A)	2.4	0.1	2.69
Spruce	13,964	105	(N/A)	2.4	0.6	11.64
Boxelder	68,287	512	(N/A)	1.9	2.8	73.16
American basswood	40,280	302	(N/A)	1.9	1.6	43.16
Elm	87,556	657	(N/A)	1.3	3.5	131.33
Honeylocust	28,945	217	(N/A)	1.3	1.2	43.42
Sugar maple	131,126	983	(N/A)	1.1	5.3	245.86
Black cherry	5,761	43	(N/A)	1.1	0.2	10.80
Broadleaf Deciduous	2,420	18	(N/A)	0.8	0.1	6.05
Buckthorn	1,086	8	(N/A)	0.5	0.0	4.07
Mulberry	178	1	(N/A)	0.3	0.0	1.33
Eastern white pine	7,490	56	(N/A)	0.3	0.3	56.18
River birch	1,101	8	(N/A)	0.3	0.0	8.26
Ohio buckeye	1,101	8	(N/A)	0.3	0.0	8.26
Lilac	178	1	(N/A)	0.3	0.0	1.33
Paper birch	1,035	8	(N/A)	0.3	0.0	7.76
Citywide total	2,476,621	18,575	(N/A)	100.0	100.0	49.14

Table 5: Annual Carbon Sequestered

Elma

Annual CO Benefits of Public Trees

2/21/2020

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
Maple	53,287	400	-3,170	-274	-26	50,842	381	100,685	755 (N/A)	33.6	35.9	5.95
Ash	28,081	211	-2,478	-184	-20	30,744	231	56,163	421 (N/A)	20.6	20.0	5.40
Oak	36,724	275	-3,413	-159	-27	24,725	185	57,876	434 (N/A)	15.6	20.6	7.36
Black walnut	12,990	97	-831	-58	-7	9,143	69	21,244	159 (N/A)	7.1	7.6	5.90
Apple	2,809	21	-106	-29	-1	3,054	23	5,727	43 (N/A)	6.9	2.0	1.65
Northern white cedar	537	4	-15	-11	0	972	7	1,482	11 (N/A)	2.4	0.5	1.23
Spruce	1,121	8	-67	-18	-1	1,886	14	2,921	22 (N/A)	2.4	1.0	2.43
Boxelder	5,549	42	-328	-21	-3	2,696	20	7,896	59 (N/A)	1.9	2.8	8.46
American basswood	2,667	20	-193	-13	-2	1,710	13	4,172	31 (N/A)	1.9	1.5	4.47
Elm	2,886	22	-420	-16	-3	2,592	19	5,042	38 (N/A)	1.3	1.8	7.56
Honeylocust	3,878	29	-140	-11	-1	2,196	16	5,923	44 (N/A)	1.3	2.1	8.88
Sugar maple	4,889	37	-629	-20	-5	2,687	20	6,927	52 (N/A)	1.1	2.5	12.99
Black cherry	609	5	-28	-5	0	681	5	1,257	9 (N/A)	1.1	0.4	2.36
Broadleaf Deciduous Medi	544	4	-12	-3	0	416	3	945	7 (N/A)	0.8	0.3	2.36
Buckthorn	152	1	-5	-2	0	161	1	306	2 (N/A)	0.5	0.1	1.15
Mulberry	38	0	-1	-1	0	37	0	74	1 (N/A)	0.3	0.0	0.55
Eastern white pine	256	2	-36	-4	0	311	2	528	4 (N/A)	0.3	0.2	3.96
River birch	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.1	2.95
Ohio buckeye	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.1	2.95
Lilac	38	0	-1	-1	0	37	0	74	1 (N/A)	0.3	0.0	0.55
Paper birch	209	2	-5	-1	0	159	1	361	3 (N/A)	0.3	0.1	2.71
Citywide total	157,710	1,183	-11,889	-831	-95	135,401	1,016	280,391	2,103 (N/A)	100.0	100.0	5.56

Table 6: Annual Social and Aesthetic Benefits

Elma

Annual Aesthetic/Other Benefits of Public Trees

2/21/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Maple	6,885	(N/A)	33.6	41.0	54.22
Ash	2,720	(N/A)	20.6	16.2	34.87
Oak	2,952	(N/A)	15.6	17.6	50.04
Black walnut	1,221	(N/A)	7.1	7.3	45.22
Apple	158	(N/A)	6.9	0.9	6.07
Northern white cedar	156	(N/A)	2.4	0.9	17.30
Spruce	303	(N/A)	2.4	1.8	33.72
Boxelder	389	(N/A)	1.9	2.3	55.57
American basswood	213	(N/A)	1.9	1.3	30.43
Elm	244	(N/A)	1.3	1.5	48.71
Honeylocust	888	(N/A)	1.3	5.3	177.69
Sugar maple	446	(N/A)	1.1	2.7	111.51
Black cherry	35	(N/A)	1.1	0.2	8.67
Broadleaf Deciduous Medium	65	(N/A)	0.8	0.4	21.78
Buckthorn	8	(N/A)	0.5	0.1	4.23
Mulberry	2	(N/A)	0.3	0.0	2.06
Eastern white pine	26	(N/A)	0.3	0.2	26.25
River birch	26	(N/A)	0.3	0.2	26.22
Ohio buckeye	26	(N/A)	0.3	0.2	26.22
Lilac	2	(N/A)	0.3	0.0	2.06
Paper birch	29	(N/A)	0.3	0.2	28.56
Citywide total	16,795	(N/A)	100.0	100.0	44.43

Table 7: Summary of Benefits in Dollars

Elma

Total Annual Benefits of Public Trees by Species ($)

2/21/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Maple	6,263	755	1,144	6,920	6,885	21,968	(N/A)	36.9
Ash	3,951	421	691	4,322	2,720	12,105	(N/A)	20.4
Oak	3,131	434	556	4,710	2,952	11,783	(N/A)	19.8
Black walnut	1,161	159	191	1,400	1,221	4,133	(N/A)	6.9
Apple	447	43	63	176	158	886	(N/A)	1.5
Northern white cedar	133	11	15	171	156	485	(N/A)	0.8
Spruce	219	22	21	427	303	993	(N/A)	1.7
Boxelder	344	59	56	470	389	1,319	(N/A)	2.2
American basswood	228	31	33	258	213	763	(N/A)	1.3
Elm	315	38	59	453	244	1,109	(N/A)	1.9
Honeylocust	269	44	45	332	888	1,578	(N/A)	2.7
Sugar maple	328	52	58	631	446	1,514	(N/A)	2.5
Black cherry	93	9	14	40	35	191	(N/A)	0.3
Broadleaf Deciduous M	58	7	8	36	65	175	(N/A)	0.3
Buckthorn	24	2	3	9	8	47	(N/A)	0.1
Mulberry	5	1	1	2	2	11	(N/A)	0.0
Eastern white pine	38	4	-2	125	26	192	(N/A)	0.3
River birch	24	3	3	16	26	73	(N/A)	0.1
Ohio buckeye	24	3	3	16	26	73	(N/A)	0.1
Lilac	5	1	1	2	2	11	(N/A)	0.0
Paper birch	21	3	3	16	29	71	(N/A)	0.1
Citywide Total	17,083	2,103	2,968	20,530	16,795	59,479	(N/A)	100.0

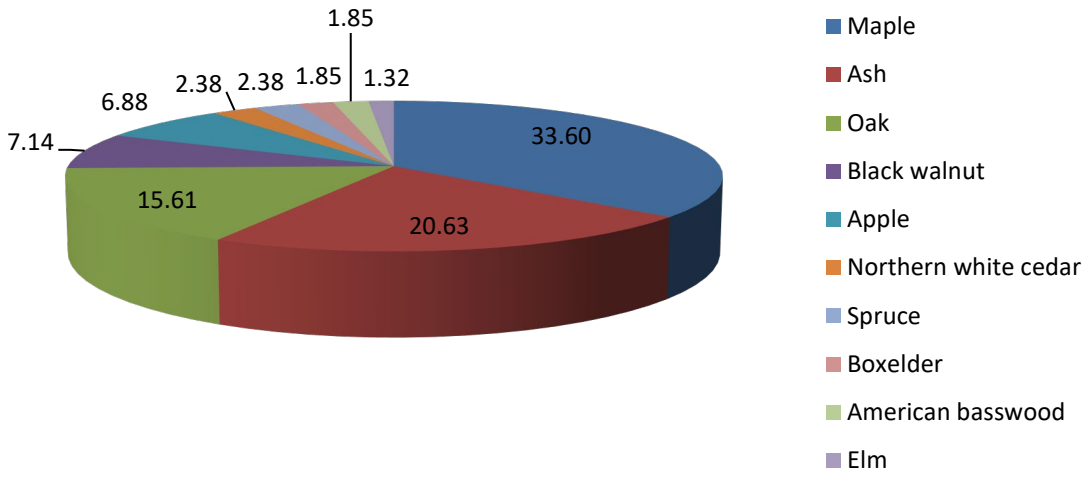

Figure 1: Species Distribution

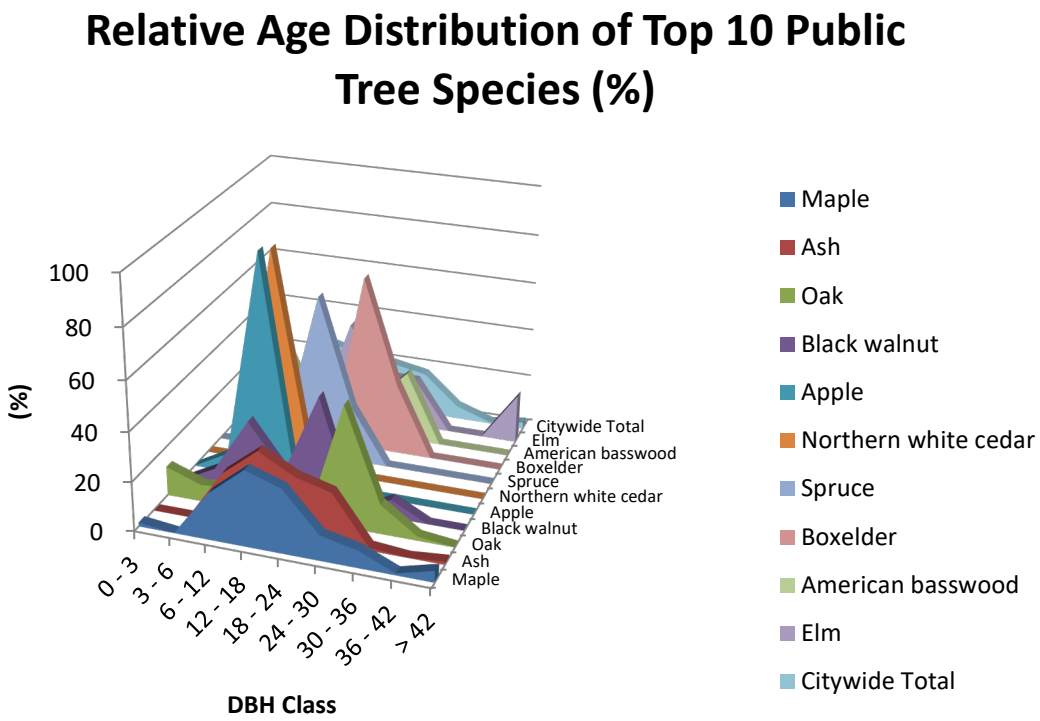

Figure 2: Relative Age Class

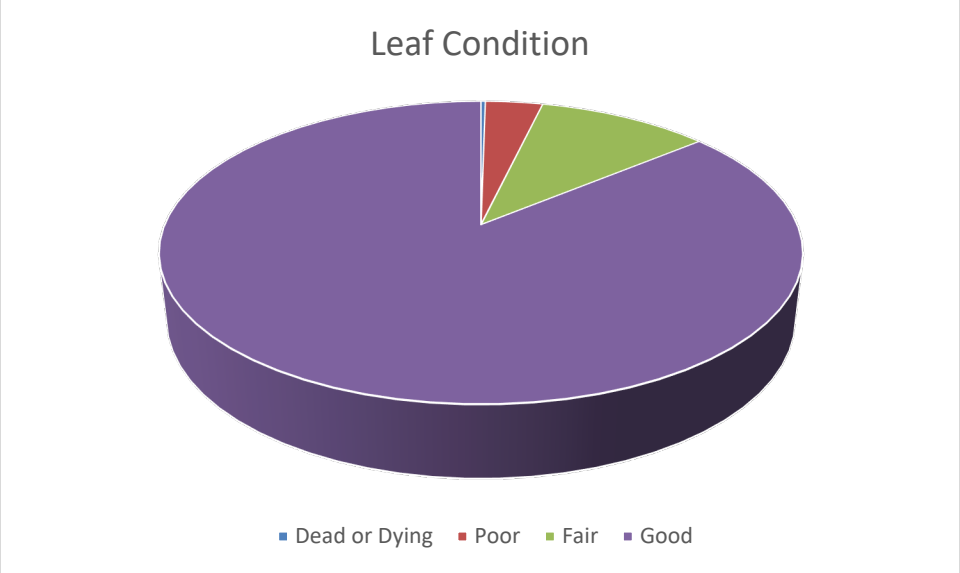

Figure 3: Foliage Condition

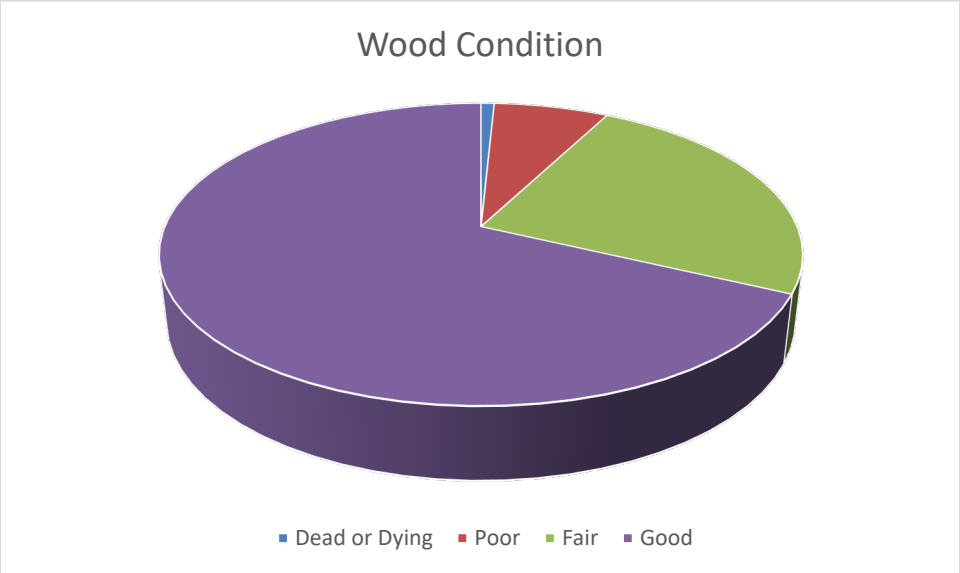

Figure 4: Wood Condition

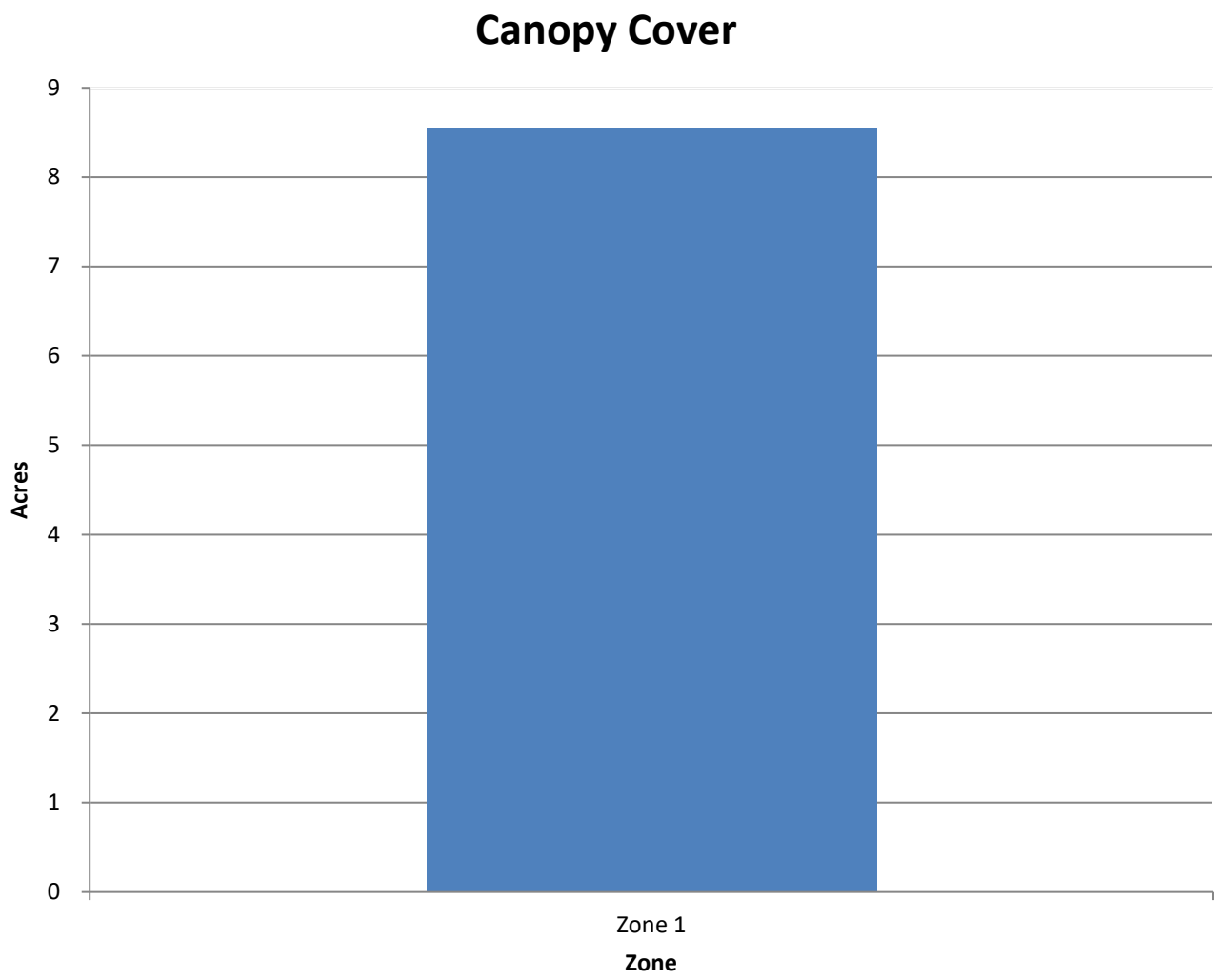

Figure 5: Canopy Cover in Acres

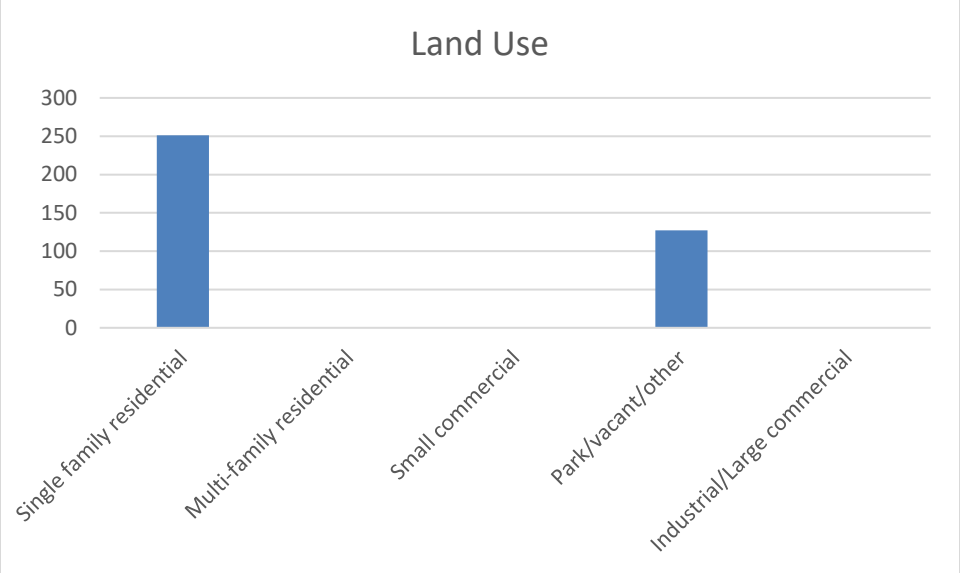

Figure 6: Land Use of city/park trees

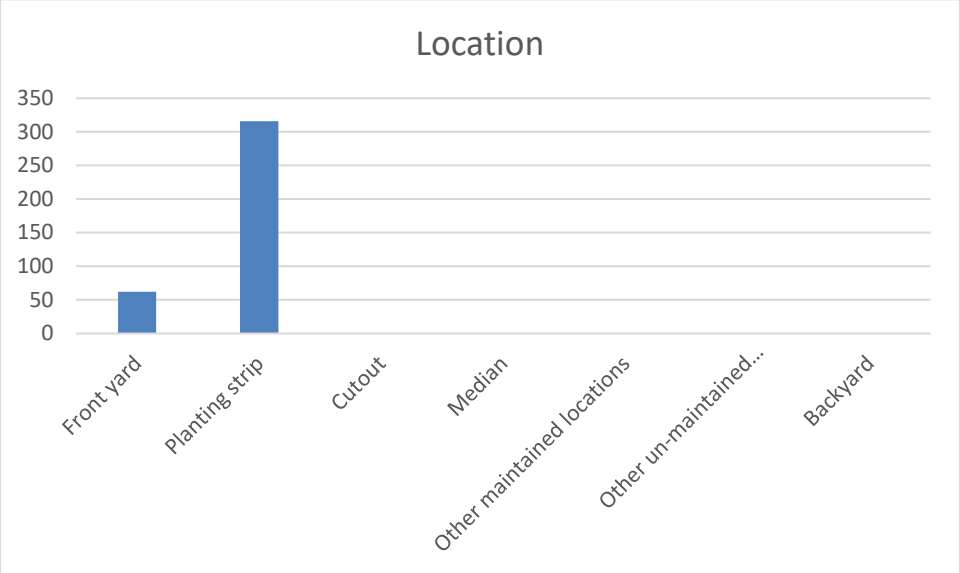

Figure 7: Location of city/park trees

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***

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means 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.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.

2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow, or black walnut.

151.03 DUTY TO TRIM 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 fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased, or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant, or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

(Code of Iowa, Sec. 364.12[3b & h])

The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

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.