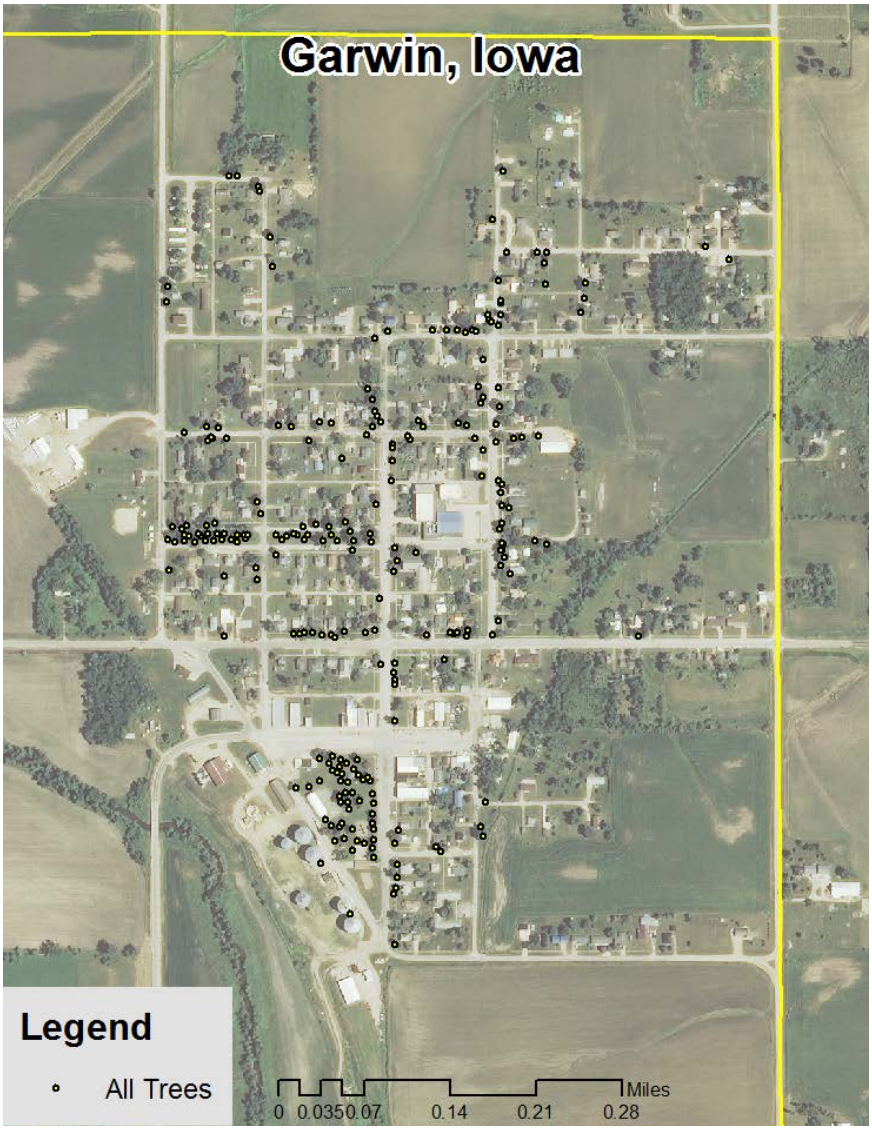
Garwin, IA



2016 Urban Forest Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Garwin 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 23% of Garwin'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 2015, a tree inventory was conducted by Matt Brewer, Iowa DNR, 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 239 trees inventoried.

- Garwin's trees provide $42,742 of benefits annually, an average of $179 a tree
- There are over 37 species of trees
- The top three genera are: Maple 38%, Ash 23%, and Hackberry 11%
- 15% of trees are in need of some type of management
- 7 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 7 trees needing removal, 5 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*
- 6 of the 55 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, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, or evergreens
- Check ash trees with a visual survey yearly
- Budget impacts from ash removal – Suggestion: request a budget increase to at least $3,850-$8,250 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Garwin 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 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 Garwin, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2015, a tree inventory was conducted by Matt Brewer, Iowa DNR, 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 239 city trees was entered into the USDA Forest Service program i-Tree Streets, 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. Garwin's trees reduce energy related costs by approximately $11,540 annually (Appendix A, Table 1). These savings are both in Electricity (54.6 MWh) and in Natural Gas (7,548.5 Therms).

Annual Stormwater Benefits

Garwin's trees intercept about 606,680 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $16,441 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 Garwin, it is estimated that trees remove 702.3 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 $1,982 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Garwin, trees sequester about 121,330 lbs of carbon a year with an associated value of $910 (Appendix A, Table 4). In addition, the trees store 2,088,988 lbs of carbon, with a yearly benefit of $15,667 (Appendix A, Table 5).

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. Garwin receives $11,261 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, Garwin's trees provide $42,742 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 239 trees in Garwin provides approximately $179 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Garwin has over 37 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	90	38%
Ash	55	23%
Hackberry	27	11%
Oak	11	5%
Spruce	8	3%
Black Walnut	7	3%
Aspen/Cottonwood	4	2%
Honeylocust	3	1%
Mulberry	3	1%
American Sycamore	3	1%
Cherry/Plum	3	1%
Linden/Basswood	3	1%
Elm	3	1%
Eastern Red Cedar	2	1%
Apple/Crabapple	2	1%
Mountain Ash	2	1%
Northern White Cedar	2	1%
Ohio Buckeye	1	<1%
Catalpa	1	<1%
Pine	1	<1%
Pear	1	<1%
Willow	1	<1%
Other Large Evergreen	4	2%
Other Large Deciduous	1	<1%
Other Small Deciduous	1	<1%

Age Class

Over half of Garwin's trees (51%) are between 18 and 36 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that a large number of trees are in the smallest size categories (a downward slope) to prepare for natural mortality and to maintain canopy cover. Garwin will have an aging tree population as this 51% matures, and should consider new plantings (currently only 16% are under 6 inches in diameter) to develop the next generation of trees.

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 Garwin indicate that 90% of the trees are in good health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Additionally, 64% of Garwin'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 9% of the population. This 9% 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	29	12%
Tree Removal	7	3%

Canopy Cover

The total canopy with both private and public trees is 19% (124 acres). The canopy cover included in the Garwin inventory includes approximately 6 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Garwin'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	62%
Park/vacant/other	35%
Small commercial	3%

Location	
Planting strip	45%
Front yard	41%
Other maintained locations	14%

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

Garwin has 1 critical concern tree which needs immediate removal. This tree 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. This tree is over 24 inches in diameter at 4.5 ft and 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 36 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 7 removals, 4 are ash trees. There are a total of 55 ash trees, and 6 of those have signs and symptoms that have been associated with EAB. In addition, there are 6 ash 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

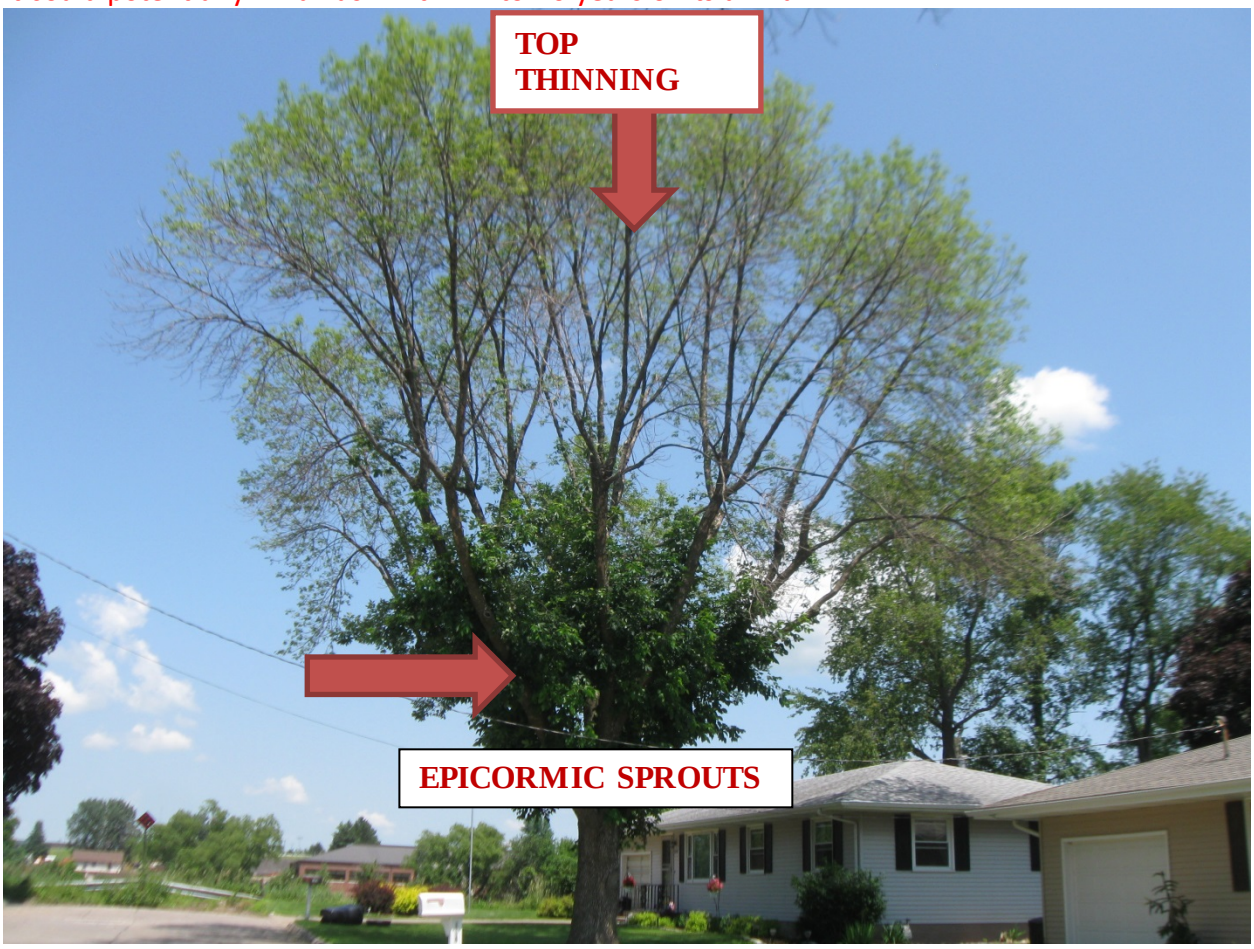
Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant at least 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees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

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 10% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 5-10% of the total urban forest. Presently, the forest is heavily planted with maple (38%) (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: any fruit-bearing tree

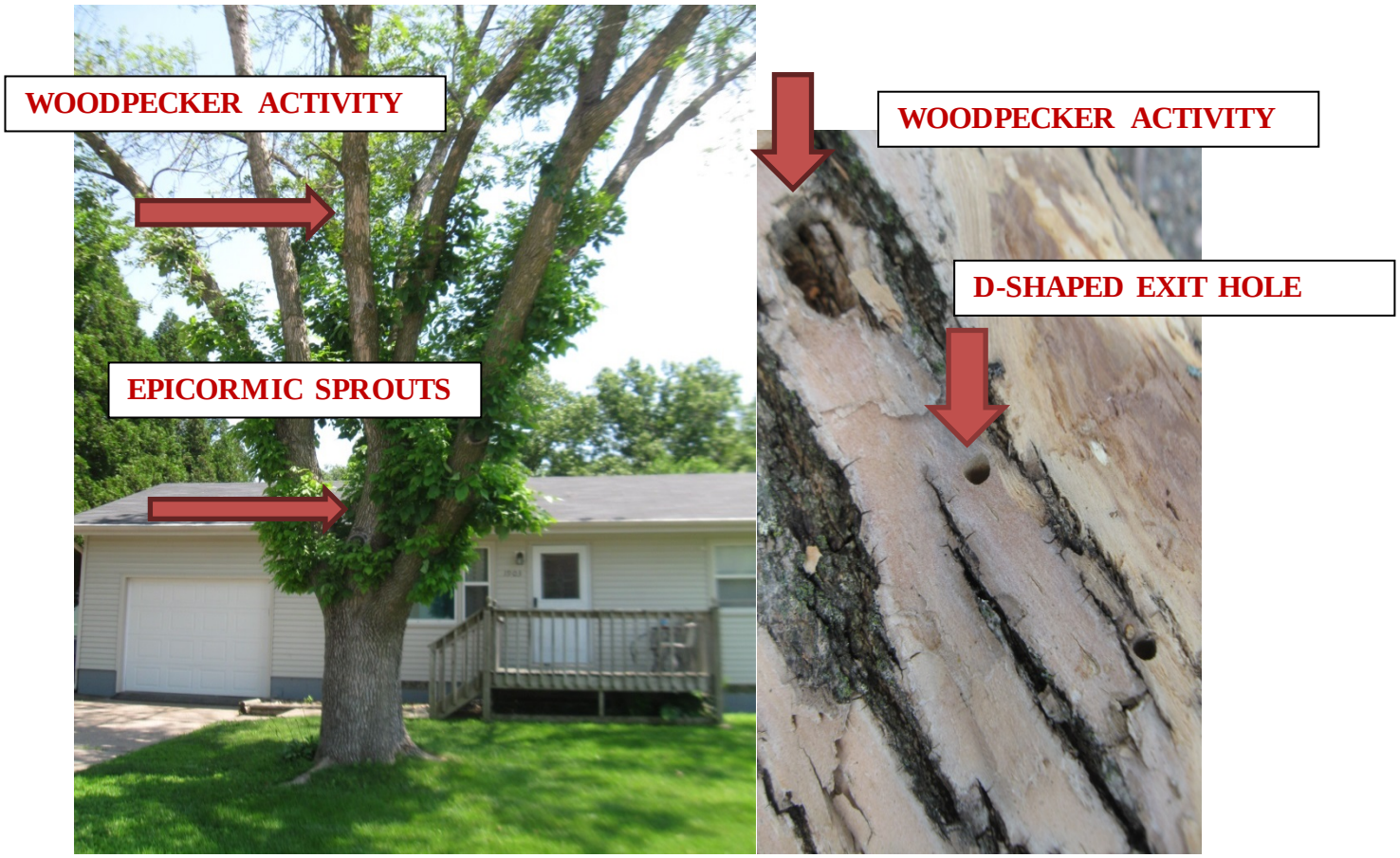
or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, or evergreens, as outlined in section 140.03 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 140.03 (Appendix C).

Continual Monitoring For EAB

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 (See examples below). Once EAB arrives in Garwin, it could potentially kill all ash within 4 to 10 years of its arrival.



EAB infested tree in Muscatine with top thinning and many new green epicormic sprouts



EAB infested tree in Muscatine with sprouting, wood pecker activity, and D-shaped exit holes

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 an 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.

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? The entire state of Iowa is under quarantine, so regulated articles may not be moved into non-quarantined states. For more information, please visit http://www.emeraldashborer.info/.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 140.03 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, or evergreens.

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. City Code 141.05 states "If the superintendent, upon inspection or examination, shall determine with reasonable certainty that any condition as herein defined exists in or on private premises and that the danger to other elm trees within the City is imminent, the superintendent shall immediately notify by certified mail the owner, occupant or person in charge of such property to correct such condition within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt of notice, Council may cause the nuisance to be removed and the cost assessed against the property as provided in Chapter 56.".

Six Year Maintenance Plan and Cost Estimates

Year 1 (FY 2016)

Remove 1 critical concern tree that needs immediate attention	$900
Remove 3 trees (marked for removal)	$2,700
Plant and Maintain 10 trees in open locations (pursue grants)	$1,000
Ash tree treatment (if elected), 27 trees in good condition, average 24–30"	avg. $405/tree
-$15 per inch, treated every two years, see note	
*Or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 2 (FY 2017)

Remove 3 trees (marked for removal)	$2,700
Plant and Maintain 10 trees in open locations (pursue grants)	$1,000
Ash tree treatment (if elected) or saving for future ash removal	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 3 (FY 2018)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 4 (FY 2019)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

Year 5 (FY 2020)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Visual Survey for signs and symptoms of EAB	

Year 6 (FY 2021)

Remove any new critical concern trees and ash in poor health	$900/tree
Plant and Maintain 20 trees in open locations (pursue grants)	$2,000
Ash tree treatment (if elected) or saving for future ash removal	
Routine trimming: Contract to trim 1/3 of the city trees (~$300 per tree)	
Visual Survey for signs and symptoms of EAB	

*****Reduction of ash in poor health will reduce exposure to Emerald Ash Borer over time. EAB could potentially kill all ash within 4-15 years of its arrival.
******Assuming a cost of $900 per tree for removal, the budget would need to be increased to $8,250 a year to remove all ash trees within 6 years.
*******Suggest a future (post ash removal and replacement) budget of at least $2 per capita (population 527). Currently, this amount would cover about 13% of what would be needed to remove EAB infested trees over a six year period. Suggest setting aside additional funds to prepare for the expected arrival of EAB. Planting would be at least partially dependent on receiving grant funds annually.

Proposed Budget Increase

EAB could potentially kill all ash trees in Garwin within 4-15 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $8,250 a year. If the budget were increased to $3,850 a year all ash could be removed within 13 years. Additionally, it is recommended that Garwin 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. For an example, if the average ash diameter is 20 inches and treatment costs $15 per inch, then treating 10 trees would cost about $3,000 (every other year treatment). This would be 10 trees selected for treatment, and Garwin would still need to find $900 per tree for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 every two years for treatment and leave five less trees for removal (for at least two more years). These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Garwin. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees

1/15/2016

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	16.0	1,215	2,207.3	2,163	3,378	(N/A)	21.8	29.3	64.97
Norway maple	5.3	400	758.0	743	1,143	(N/A)	12.1	9.9	39.40
Northern hackberry	8.9	673	1,252.0	1,227	1,900	(N/A)	11.3	16.5	70.38
Silver maple	7.4	564	972.7	953	1,517	(N/A)	9.6	13.1	65.98
Sugar maple	2.0	150	278.6	273	423	(N/A)	6.3	3.7	28.22
Maple	0.6	44	78.7	77	121	(N/A)	5.0	1.0	10.08
Red maple	0.8	64	121.0	119	182	(N/A)	3.8	1.6	20.28
Spruce	0.8	65	111.8	110	174	(N/A)	3.3	1.5	21.76
Black walnut	1.7	130	240.0	235	365	(N/A)	2.9	3.2	52.15
Conifer Evergreen Large	0.6	49	83.5	82	131	(N/A)	1.7	1.1	32.74
Cottonwood	1.5	114	198.6	195	308	(N/A)	1.7	2.7	77.07
Bur oak	1.1	82	154.3	151	233	(N/A)	1.7	2.0	58.34
Black cherry	0.5	36	76.1	75	110	(N/A)	1.3	1.0	36.82
American sycamore	0.0	3	4.6	5	7	(N/A)	1.3	0.1	2.38
Honeylocust	0.7	55	95.9	94	149	(N/A)	1.3	1.3	49.50
Littleleaf linden	0.2	18	34.6	34	51	(N/A)	1.3	0.4	17.16
Mulberry	0.3	21	45.1	44	65	(N/A)	1.3	0.6	21.73
Oak	0.6	45	85.0	83	128	(N/A)	0.8	1.1	64.12
Pin oak	0.6	46	84.4	83	129	(N/A)	0.8	1.1	64.44
White ash	0.4	30	56.3	55	86	(N/A)	0.8	0.7	42.85
Elm	0.8	63	112.7	110	173	(N/A)	0.8	1.5	86.52
Eastern red cedar	0.2	17	32.9	32	49	(N/A)	0.8	0.4	24.57
Apple	0.0	3	7.6	7	11	(N/A)	0.8	0.1	5.40
White oak	0.3	25	47.3	46	72	(N/A)	0.8	0.6	35.78
Northern white cedar	0.3	20	29.3	29	48	(N/A)	0.8	0.4	24.14
Mountain ash	0.2	14	25.3	25	39	(N/A)	0.8	0.3	19.50
Boxelder	0.5	35	60.2	59	94	(N/A)	0.8	0.8	46.88
Catalpa	0.3	25	46.9	46	71	(N/A)	0.4	0.6	70.91
Broadleaf Deciduous Small	0.0	0	0.6	1	1	(N/A)	0.4	0.0	0.87
Eastern white pine	0.2	14	24.6	24	38	(N/A)	0.4	0.3	38.17
Northern red oak	0.2	15	23.3	23	38	(N/A)	0.4	0.3	37.72
Willow	0.3	24	47.4	46	71	(N/A)	0.4	0.6	70.84
Broadleaf Deciduous Large	0.4	29	53.7	53	82	(N/A)	0.4	0.7	82.02
Pear	0.2	14	24.7	24	38	(N/A)	0.4	0.3	38.13
Siberian elm	0.3	20	37.9	37	57	(N/A)	0.4	0.5	57.41
Ohio buckeye	0.2	18	29.5	29	47	(N/A)	0.4	0.4	46.78
Black ash	0.0	3	6.2	6	9	(N/A)	0.4	0.1	8.99
Total	54.6	4,143	7,548.5	7,398	11,540	(N/A)	100.0	100.0	48.29

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees

1/15/2016

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	185,999	5,041	(N/A)	21.8	30.7	96.93
Norway maple	43,768	1,186	(N/A)	12.1	7.2	40.90
Northern hackberry	92,254	2,500	(N/A)	11.3	15.2	92.60
Silver maple	98,272	2,663	(N/A)	9.6	16.2	115.79
Sugar maple	19,679	533	(N/A)	6.3	3.2	35.55
Maple	3,211	87	(N/A)	5.0	0.5	7.25
Red maple	7,169	194	(N/A)	3.8	1.2	21.59
Spruce	12,341	334	(N/A)	3.3	2.0	41.80
Black walnut	16,379	444	(N/A)	2.9	2.7	63.41
Conifer Evergreen Large	13,717	372	(N/A)	1.7	2.3	92.93
Cottonwood	21,434	581	(N/A)	1.7	3.5	145.21
Bur oak	12,437	337	(N/A)	1.7	2.0	84.26
Black cherry	2,613	71	(N/A)	1.3	0.4	23.60
American sycamore	207	6	(N/A)	1.3	0.0	1.87
Honeylocust	5,089	138	(N/A)	1.3	0.8	45.97
Littleleaf linden	2,380	64	(N/A)	1.3	0.4	21.50
Mulberry	1,446	39	(N/A)	1.3	0.2	13.06
Oak	6,534	177	(N/A)	0.8	1.1	88.53
Pin oak	5,987	162	(N/A)	0.8	1.0	81.13
White ash	3,839	104	(N/A)	0.8	0.6	52.02
Elm	12,729	345	(N/A)	0.8	2.1	172.48
Eastern red cedar	3,269	89	(N/A)	0.8	0.5	44.30
Apple	137	4	(N/A)	0.8	0.0	1.86
White oak	3,961	107	(N/A)	0.8	0.7	53.67
Northern white cedar	3,077	83	(N/A)	0.8	0.5	41.70
Mountain ash	674	18	(N/A)	0.8	0.1	9.13
Boxelder	4,546	123	(N/A)	0.8	0.7	61.59
Catalpa	3,943	107	(N/A)	0.4	0.6	106.85
Broadleaf Deciduous Small	7	0	(N/A)	0.4	0.0	0.20
Eastern white pine	4,605	125	(N/A)	0.4	0.8	124.79
Northern red oak	1,193	32	(N/A)	0.4	0.2	32.34
Willow	3,764	102	(N/A)	0.4	0.6	102.01
Broadleaf Deciduous Large	5,491	149	(N/A)	0.4	0.9	148.79
Pear	667	18	(N/A)	0.4	0.1	18.06
Siberian elm	2,290	62	(N/A)	0.4	0.4	62.07
Ohio buckeye	1,409	38	(N/A)	0.4	0.2	38.19
Black ash	163	4	(N/A)	0.4	0.0	4.41
Citywide total	606,680	16,441	(N/A)	100.0	100.0	68.79

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees

1/15/2016

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								
Green ash	23.6	3.8	11.1	1.1	125	76.6	11.1	10.6	72.6	477	0.0	0	210.4	602	(N/A)	21.8	11.57
Norway maple	8.3	1.4	4.2	0.4	45	25.5	3.7	3.5	23.9	158	-2.0	-8	68.9	196	(N/A)	12.1	6.75
Northern hackberry	15.1	2.6	7.6	0.7	82	42.8	6.2	5.9	40.2	265	0.0	0	121.0	347	(N/A)	11.3	12.87
Silver maple	15.8	2.7	7.9	0.7	86	35.0	5.1	4.9	33.6	219	-8.2	-31	97.6	274	(N/A)	9.6	11.92
Sugar maple	2.4	0.4	1.3	0.1	13	9.5	1.4	1.3	9.0	59	-2.0	-7	23.4	65	(N/A)	6.3	4.33
Maple	0.5	0.1	0.3	0.0	3	2.8	0.4	0.4	2.6	17	-0.2	-1	6.8	19	(N/A)	5.0	1.60
Red maple	1.7	0.3	0.8	0.1	9	4.1	0.6	0.6	3.8	25	-0.6	-2	11.3	32	(N/A)	3.8	3.56
Spruce	1.4	0.3	1.2	0.2	9	4.0	0.6	0.6	3.8	25	-4.9	-18	7.1	16	(N/A)	3.3	1.97
Black walnut	1.7	0.3	0.9	0.1	9	8.2	1.2	1.1	7.8	51	0.0	0	21.2	60	(N/A)	2.9	8.61
Conifer Evergreen Large	1.7	0.3	1.3	0.2	11	3.0	0.4	0.4	2.9	19	-7.7	-29	2.7	1	(N/A)	1.7	0.28
Cottonwood	3.2	0.5	1.4	0.1	17	7.1	1.0	1.0	6.8	44	0.0	0	21.2	61	(N/A)	1.7	15.30
Bur oak	1.5	0.2	0.7	0.1	8	5.2	0.8	0.7	4.9	32	0.0	0	14.1	40	(N/A)	1.7	10.11
Black cherry	0.9	0.2	0.4	0.0	5	2.4	0.3	0.3	2.1	14	0.0	0	6.7	19	(N/A)	1.3	6.41
American sycamore	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)	1.3	0.35
Honeylocust	0.9	0.1	0.4	0.0	5	3.4	0.5	0.5	3.3	21	-0.6	-2	8.5	24	(N/A)	1.3	7.93
Littleleaf linden	0.4	0.1	0.2	0.0	2	1.1	0.2	0.2	1.0	7	-0.2	-1	3.0	8	(N/A)	1.3	2.79
Mulberry	0.5	0.1	0.2	0.0	3	1.4	0.2	0.2	1.3	8	0.0	0	3.8	11	(N/A)	1.3	3.67
Oak	0.8	0.1	0.4	0.0	4	2.9	0.4	0.4	2.7	18	0.0	0	7.6	22	(N/A)	0.8	10.91
Pin oak	0.9	0.2	0.5	0.0	5	2.9	0.4	0.4	2.8	18	-1.8	-7	6.3	17	(N/A)	0.8	8.29
White ash	0.4	0.1	0.2	0.0	2	1.9	0.3	0.3	1.8	12	0.0	0	5.0	14	(N/A)	0.8	7.04
Elm	2.0	0.3	0.9	0.1	10	3.9	0.6	0.5	3.7	25	0.0	0	12.0	35	(N/A)	0.8	17.37
Eastern red cedar	0.7	0.1	0.5	0.1	4	1.1	0.2	0.1	1.0	7	-1.8	-7	2.0	4	(N/A)	0.8	2.19
Apple	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.5	1	(N/A)	0.8	0.71
White oak	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	13	(N/A)	0.8	6.28
Northern white cedar	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.2	7	-1.1	-4	2.3	6	(N/A)	0.8	2.82
Mountain ash	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	6	0.0	0	2.3	7	(N/A)	0.8	3.33
Boxelder	0.6	0.1	0.3	0.0	3	2.2	0.3	0.3	2.1	14	-0.2	-1	5.6	16	(N/A)	0.8	7.84
Catalpa	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12	(N/A)	0.4	12.48
Broadleaf Deciduous Small	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.4	0.11
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)	0.4	-1.58
Northern red oak	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.9	6	-0.3	-1	2.1	6	(N/A)	0.4	5.79
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)	0.4	13.58
Broadleaf Deciduous Large	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	0.4	15.71
Pear	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7	(N/A)	0.4	6.56
Siberian elm	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	0.4	9.47
Ohio buckeye	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)	0.4	7.92
Black ash	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)	0.4	1.21
Citywide total	89.4	15.0	45.2	4.4	486	261.3	38.0	36.2	247.4	1,626	-34.5	-130	702.3	1,982	(N/A)	100.0	8.29

Table 4: Annual Carbon Stored

Stored CO2 Benefits of Public Trees

1/15/2016

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	763,435	5,726	(N/A)	21.8	36.5	110.11
Norway maple	138,619	1,040	(N/A)	12.1	6.6	35.85
Northern hackberry	230,718	1,730	(N/A)	11.3	11.0	64.09
Silver maple	332,649	2,495	(N/A)	9.6	15.9	108.47
Sugar maple	71,617	537	(N/A)	6.3	3.4	35.81
Maple	6,380	48	(N/A)	5.0	0.3	3.99
Red maple	18,378	138	(N/A)	3.8	0.9	15.31
Spruce	10,966	82	(N/A)	3.3	0.5	10.28
Black walnut	54,310	407	(N/A)	2.9	2.6	58.19
Conifer Evergreen La	19,494	146	(N/A)	1.7	0.9	36.55
Cottonwood	108,132	811	(N/A)	1.7	5.2	202.75
Bur oak	48,353	363	(N/A)	1.7	2.3	90.66
Black cherry	14,393	108	(N/A)	1.3	0.7	35.98
American sycamore	210	2	(N/A)	1.3	0.0	0.52
Honeylocust	10,688	80	(N/A)	1.3	0.5	26.72
Littleleaf linden	8,243	62	(N/A)	1.3	0.4	20.61
Mulberry	7,664	57	(N/A)	1.3	0.4	19.16
Oak	24,230	182	(N/A)	0.8	1.2	90.86
Pin oak	23,457	176	(N/A)	0.8	1.1	87.96
White ash	9,492	71	(N/A)	0.8	0.5	35.60
Elm	65,202	489	(N/A)	0.8	3.1	244.51
Eastern red cedar	2,204	17	(N/A)	0.8	0.1	8.27
Apple	356	3	(N/A)	0.8	0.0	1.33
White oak	15,785	118	(N/A)	0.8	0.8	59.19
Northern white cedar	2,340	18	(N/A)	0.8	0.1	8.78
Mountain ash	3,051	23	(N/A)	0.8	0.1	11.44
Boxelder	17,904	134	(N/A)	0.8	0.9	67.14
Catalpa	15,773	118	(N/A)	0.4	0.8	118.30
Broadleaf Deciduous	14	0	(N/A)	0.4	0.0	0.10
Eastern white pine	7,490	56	(N/A)	0.4	0.4	56.18
Northern red oak	3,595	27	(N/A)	0.4	0.2	26.96
Willow	14,280	107	(N/A)	0.4	0.7	107.10
Broadleaf Deciduous	25,943	195	(N/A)	0.4	1.2	194.57
Pear	3,037	23	(N/A)	0.4	0.1	22.78
Siberian elm	6,743	51	(N/A)	0.4	0.3	50.57
Ohio buckeye	3,624	27	(N/A)	0.4	0.2	27.18
Black ash	218	2	(N/A)	0.4	0.0	1.64
Citywide total	2,088,988	15,667	(N/A)	100.0	100.0	65.55

Table 5: Annual Carbon Sequestered

Annual CO Benefits of Public Trees

1/15/2016

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
Green ash	39,024	293	-3,665	-168	-29	26,858	201	62,049	465 (N/A)	21.8	30.7	8.95
Norway maple	7,653	57	-668	-55	-5	8,836	66	15,766	118 (N/A)	12.1	7.8	4.08
Northern hackberry	11,806	89	-1,108	-85	-9	14,881	112	25,494	191 (N/A)	11.3	12.6	7.08
Silver maple	27,535	207	-1,597	-78	-13	12,470	94	38,331	287 (N/A)	9.6	19.0	12.50
Sugar maple	4,209	32	-344	-23	-3	3,322	25	7,163	54 (N/A)	6.3	3.5	3.58
Maple	911	7	-31	-7	0	970	7	1,843	14 (N/A)	5.0	0.9	1.15
Red maple	1,304	10	-88	-9	-1	1,413	11	2,619	20 (N/A)	3.8	1.3	2.18
Spruce	879	7	-53	-15	-1	1,425	11	2,237	17 (N/A)	3.3	1.1	2.10
Black walnut	4,150	31	-261	-18	-2	2,869	22	6,741	51 (N/A)	2.9	3.3	7.22
Conifer Evergreen Large	815	6	-94	-12	-1	1,085	8	1,795	13 (N/A)	1.7	0.9	3.36
Cottonwood	3,229	24	-519	-16	-4	2,512	19	5,205	39 (N/A)	1.7	2.6	9.76
Bur oak	2,779	21	-232	-12	-2	1,816	14	4,351	33 (N/A)	1.7	2.2	8.16
Black cherry	592	4	-69	-7	-1	794	6	1,310	10 (N/A)	1.3	0.6	3.27
American sycamore	79	1	-1	-1	0	57	0	135	1 (N/A)	1.3	0.1	0.34
Honeylocust	1,612	12	-51	-6	0	1,204	9	2,759	21 (N/A)	1.3	1.4	6.90
Littleleaf linden	826	6	-40	-3	0	387	3	1,170	9 (N/A)	1.3	0.6	2.93
Mulberry	601	5	-37	-4	0	465	3	1,025	8 (N/A)	1.3	0.5	2.56
Oak	1,517	11	-116	-6	-1	994	7	2,388	18 (N/A)	0.8	1.2	8.95
Pin oak	2,371	18	-113	-6	-1	1,020	8	3,272	25 (N/A)	0.8	1.6	12.27
White ash	1,027	8	-46	-4	0	674	5	1,651	12 (N/A)	0.8	0.8	6.19
Elm	1,872	14	-313	-9	-2	1,384	10	2,934	22 (N/A)	0.8	1.5	11.00
Eastern red cedar	43	0	-11	-4	0	374	3	402	3 (N/A)	0.8	0.2	1.51
Apple	76	1	-2	-1	0	74	1	147	1 (N/A)	0.8	0.1	0.55
White oak	859	6	-76	-4	-1	557	4	1,337	10 (N/A)	0.8	0.7	5.01
Northern white cedar	231	2	-11	-4	0	433	3	649	5 (N/A)	0.8	0.3	2.43
Mountain ash	276	2	-15	-2	0	314	2	574	4 (N/A)	0.8	0.3	2.15
Boxelder	1,456	11	-86	-5	-1	769	6	2,134	16 (N/A)	0.8	1.1	8.00
Catalpa	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.4	0.7	9.97
Broadleaf Deciduous Smal	9	0	0	0	0	6	0	14	0 (N/A)	0.4	0.0	0.10
Eastern white pine	256	2	-36	-4	0	311	2	528	4 (N/A)	0.4	0.3	3.96
Northern red oak	281	2	-17	-2	0	329	2	591	4 (N/A)	0.4	0.3	4.43
Willow	0	0	-69	-4	-1	539	4	466	3 (N/A)	0.4	0.2	3.49
Broadleaf Deciduous Larg	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.4	0.7	11.11
Pear	268	2	-15	-2	0	308	2	560	4 (N/A)	0.4	0.3	4.20
Siberian elm	485	4	-32	-3	0	447	3	897	7 (N/A)	0.4	0.4	6.73
Ohio buckeye	386	3	-17	-2	0	395	3	762	6 (N/A)	0.4	0.4	5.71
Black ash	96	1	-2	-1	0	65	0	158	1 (N/A)	0.4	0.1	1.18
Citywide total	121,330	910	-10,031	-589	-80	91,558	687	202,267	1,517 (N/A)	100.0	100.0	6.35

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees

1/15/2016

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	3,084	(N/A)	21.8	27.4	59.30
Norway maple	790	(N/A)	12.1	7.0	27.23
Northern hackberry	1,497	(N/A)	11.3	13.3	55.45
Silver maple	2,261	(N/A)	9.6	20.1	98.31
Sugar maple	461	(N/A)	6.3	4.1	30.74
Maple	140	(N/A)	5.0	1.2	11.70
Red maple	176	(N/A)	3.8	1.6	19.58
Spruce	237	(N/A)	3.3	2.1	29.67
Black walnut	371	(N/A)	2.9	3.3	52.96
Conifer Evergreen Large	132	(N/A)	1.7	1.2	32.98
Cottonwood	229	(N/A)	1.7	2.0	57.28
Bur oak	225	(N/A)	1.7	2.0	56.33
Black cherry	35	(N/A)	1.3	0.3	11.73
American sycamore	25	(N/A)	1.3	0.2	8.42
Honeylocust	329	(N/A)	1.3	2.9	109.60
Littleleaf linden	87	(N/A)	1.3	0.8	28.98
Mulberry	35	(N/A)	1.3	0.3	11.75
Oak	123	(N/A)	0.8	1.1	61.64
Pin oak	199	(N/A)	0.8	1.8	99.74
White ash	135	(N/A)	0.8	1.2	67.39
Elm	125	(N/A)	0.8	1.1	62.47
Eastern red cedar	14	(N/A)	0.8	0.1	6.84
Apple	4	(N/A)	0.8	0.0	2.06
White oak	71	(N/A)	0.8	0.6	35.43
Northern white cedar	65	(N/A)	0.8	0.6	32.32
Mountain ash	16	(N/A)	0.8	0.1	7.76
Boxelder	105	(N/A)	0.8	0.9	52.39
Catalpa	66	(N/A)	0.4	0.6	65.59
Broadleaf Deciduous Small	0	(N/A)	0.4	0.0	0.03
Eastern white pine	26	(N/A)	0.4	0.2	26.25
Northern red oak	24	(N/A)	0.4	0.2	24.08
Willow	0	(N/A)	0.4	0.0	0.00
Broadleaf Deciduous Large	67	(N/A)	0.4	0.6	66.60
Pear	15	(N/A)	0.4	0.1	15.48
Siberian elm	40	(N/A)	0.4	0.4	39.94
Ohio buckeye	39	(N/A)	0.4	0.3	39.16
Black ash	13	(N/A)	0.4	0.1	12.89
Citywide total	11,261	(N/A)	100.0	100.0	47.12

Table 7: Summary of Benefits in Dollars

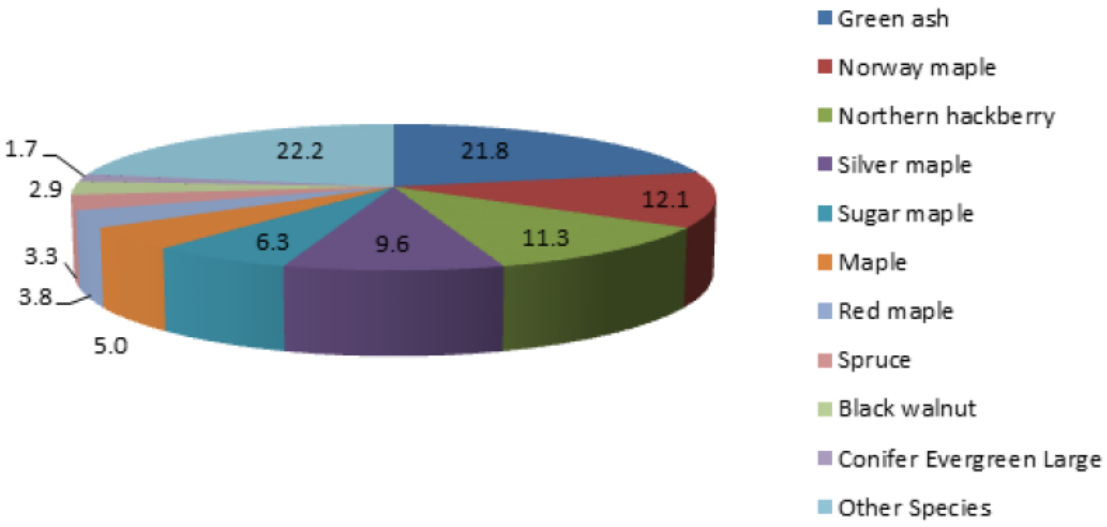
Total Annual Benefits of Public Trees by Species ($)

1/15/2016

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	3,378	465	602	5,041	3,084	12,570	(N/A)	29.4
Norway maple	1,143	118	196	1,186	790	3,432	(N/A)	8.0
Northern hackberry	1,900	191	347	2,500	1,497	6,436	(N/A)	15.1
Silver maple	1,517	287	274	2,663	2,261	7,003	(N/A)	16.4
Sugar maple	423	54	65	533	461	1,536	(N/A)	3.6
Maple	121	14	19	87	140	381	(N/A)	0.9
Red maple	182	20	32	194	176	605	(N/A)	1.4
Spruce	174	17	16	334	237	778	(N/A)	1.8
Black walnut	365	51	60	444	371	1,290	(N/A)	3.0
Conifer Evergreen Large	131	13	1	372	132	649	(N/A)	1.5
Cottonwood	308	39	61	581	229	1,219	(N/A)	2.9
Bur oak	233	33	40	337	225	869	(N/A)	2.0
Black cherry	110	10	19	71	35	246	(N/A)	0.6
American sycamore	7	1	1	6	25	40	(N/A)	0.1
Honeylocust	149	21	24	138	329	660	(N/A)	1.5
Littleleaf linden	51	9	8	64	87	220	(N/A)	0.5
Mulberry	65	8	11	39	35	158	(N/A)	0.4
Oak	128	18	22	177	123	468	(N/A)	1.1
Pin oak	129	25	17	162	199	532	(N/A)	1.2
White ash	86	12	14	104	135	351	(N/A)	0.8
Elm	173	22	35	345	125	700	(N/A)	1.6
Eastern red cedar	49	3	4	89	14	159	(N/A)	0.4
Apple	11	1	1	4	4	21	(N/A)	0.0
White oak	72	10	13	107	71	272	(N/A)	0.6
Northern white cedar	48	5	6	83	65	207	(N/A)	0.5
Mountain ash	39	4	7	18	16	84	(N/A)	0.2
Boxelder	94	16	16	123	105	353	(N/A)	0.8
Catalpa	71	10	12	107	66	266	(N/A)	0.6
Broadleaf Deciduous Sn	1	0	0	0	0	1	(N/A)	0.0
Eastern white pine	38	4	-2	125	26	192	(N/A)	0.4
Northern red oak	38	4	6	32	24	104	(N/A)	0.2
Willow	71	3	14	102	0	190	(N/A)	0.4
Broadleaf Deciduous La	82	11	16	149	67	324	(N/A)	0.8
Pear	38	4	7	18	15	82	(N/A)	0.2
Siberian elm	57	7	9	62	40	176	(N/A)	0.4
Ohio buckeye	47	6	8	38	39	138	(N/A)	0.3
Black ash	9	1	1	4	13	29	(N/A)	0.1
Citywide Total	11,540	1,517	1,982	16,441	11,261	42,742	(N/A)	100.0

Species Distribution of Public Trees

1/15/2016

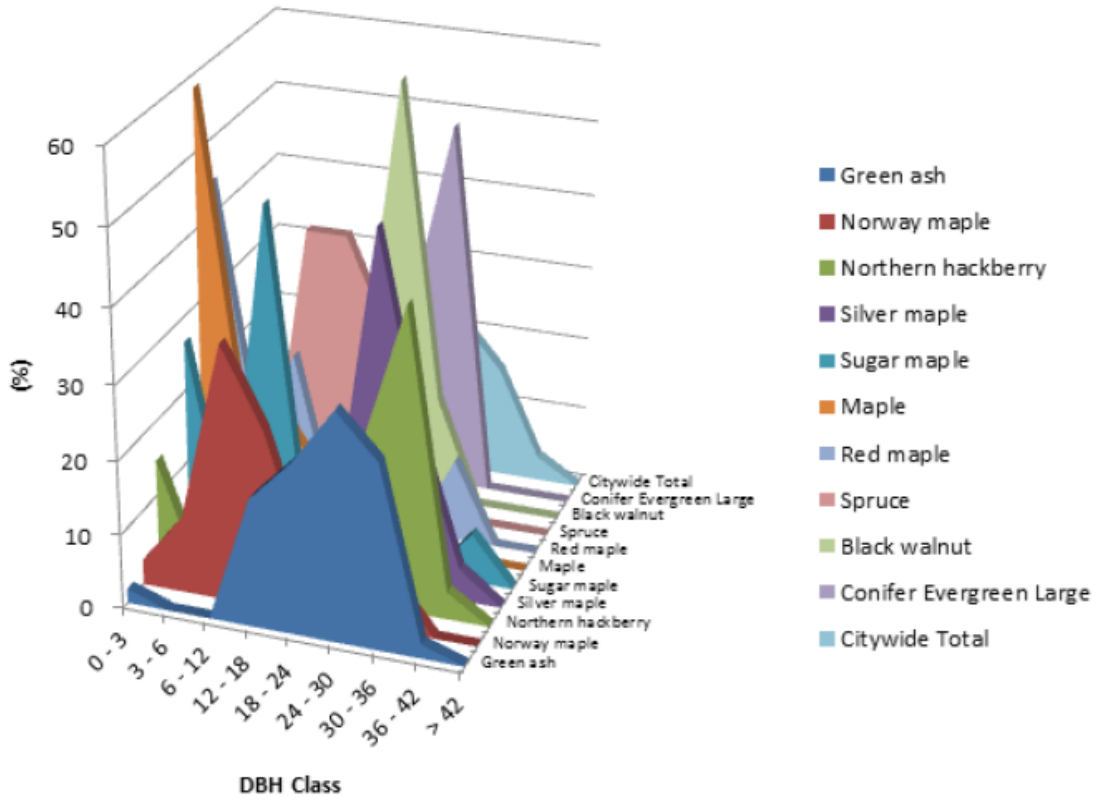


Species	Percent
Green ash	21.8
Norway maple	12.1
Northern hackberry	11.3
Silver maple	9.6
Sugar maple	6.3
Maple	5.0
Red maple	3.8
Spruce	3.3
Black walnut	2.9
Conifer Evergreen Large	1.7
Other Species	22.2
Total	100.0

Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species for All Zones (%)

1/15/2016



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Green ash	1.92	0.00	0.00	17.31	23.08	30.77	25.00	1.92	0.00
Norway maple	3.45	10.34	34.48	24.14	6.90	13.79	6.90	0.00	0.00
Northern hackberry	14.81	0.00	0.00	11.11	7.41	22.22	40.74	3.70	0.00
Silver maple	0.00	0.00	4.35	13.04	8.70	47.83	21.74	4.35	0.00
Sugar maple	26.67	0.00	46.67	0.00	13.33	6.67	0.00	6.67	0.00
Maple	58.33	16.67	16.67	8.33	0.00	0.00	0.00	0.00	0.00
Red maple	44.44	11.11	22.22	0.00	11.11	0.00	11.11	0.00	0.00
Spruce	0.00	0.00	37.50	37.50	25.00	0.00	0.00	0.00	0.00
Black walnut	0.00	0.00	14.29	14.29	57.14	14.29	0.00	0.00	0.00
Conifer Evergreen Large	0.00	0.00	0.00	25.00	25.00	50.00	0.00	0.00	0.00
Citywide Total	12.13	4.18	12.97	15.90	15.06	21.34	15.06	3.35	0.00

Figure 2: Relative Age Class

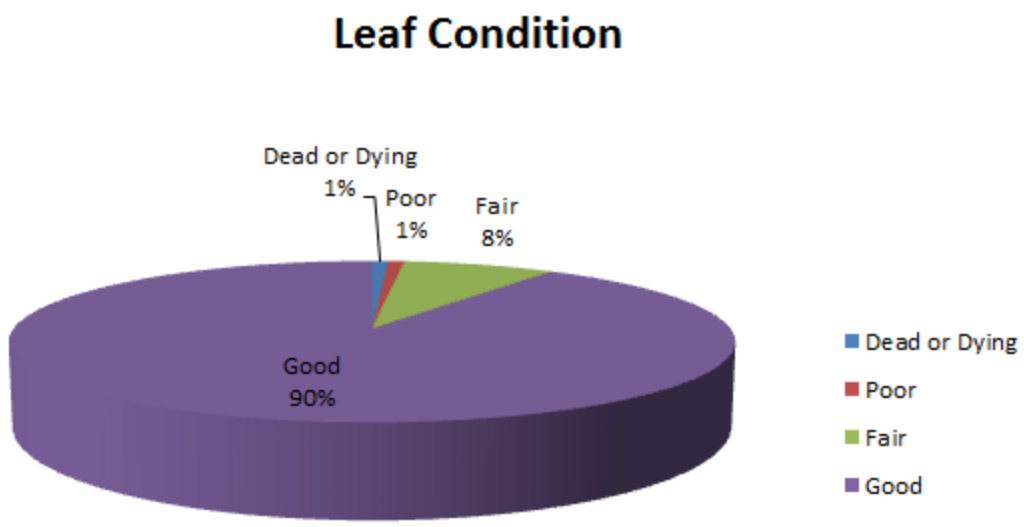


Figure 3: Foliage Condition

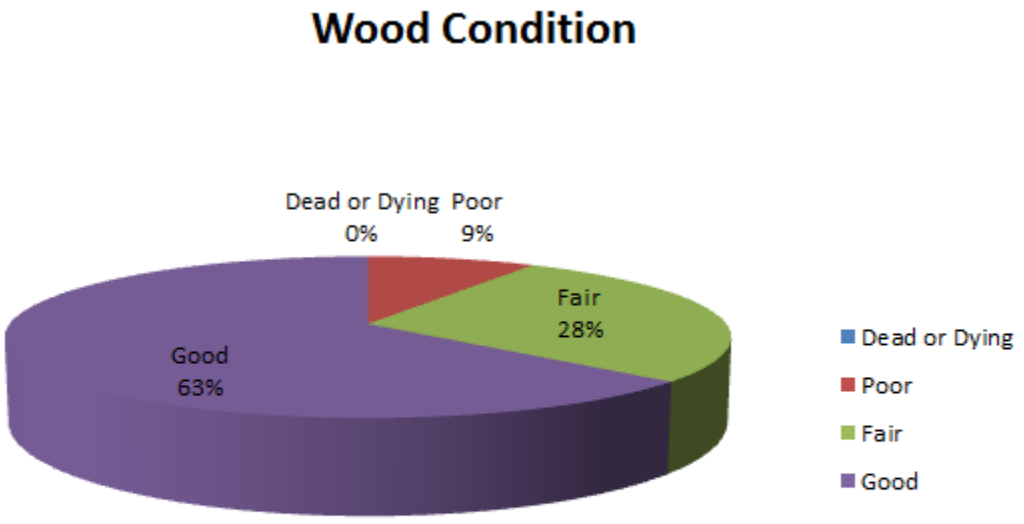
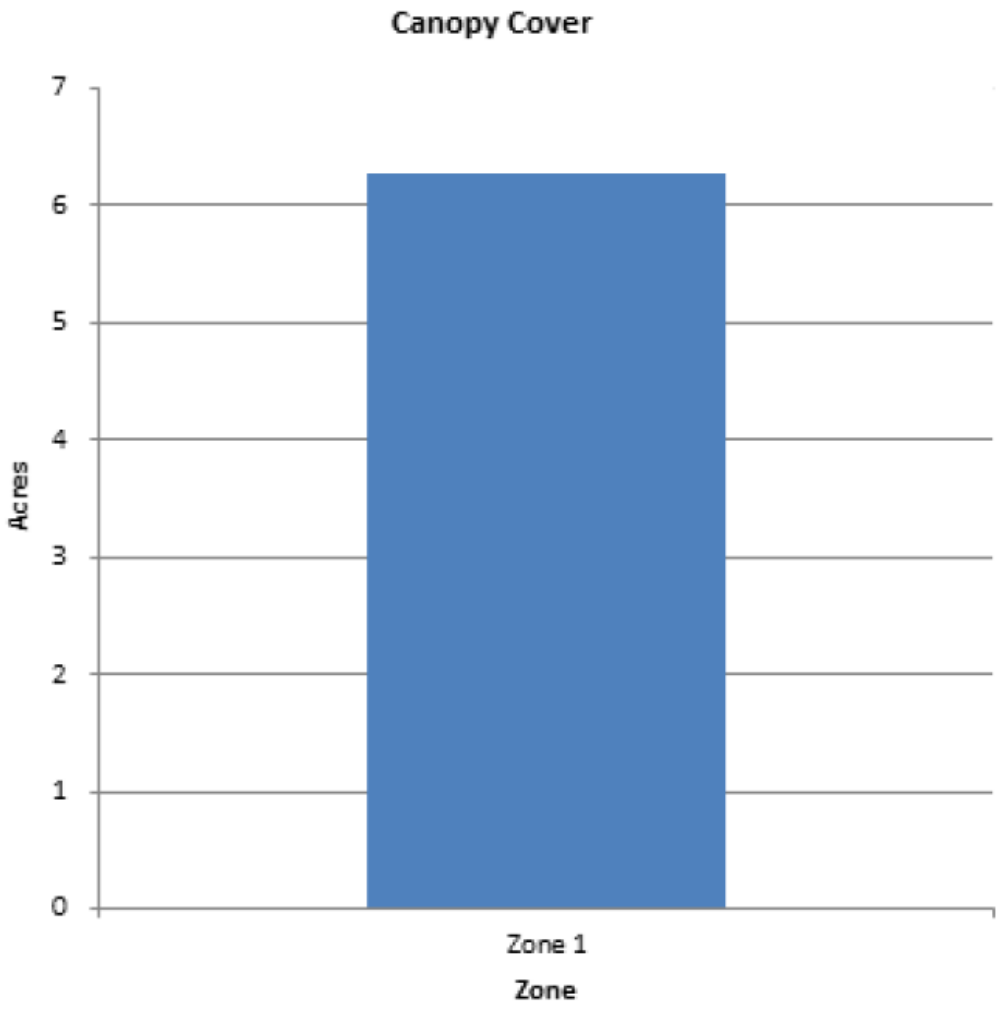


Figure 4: Wood Condition

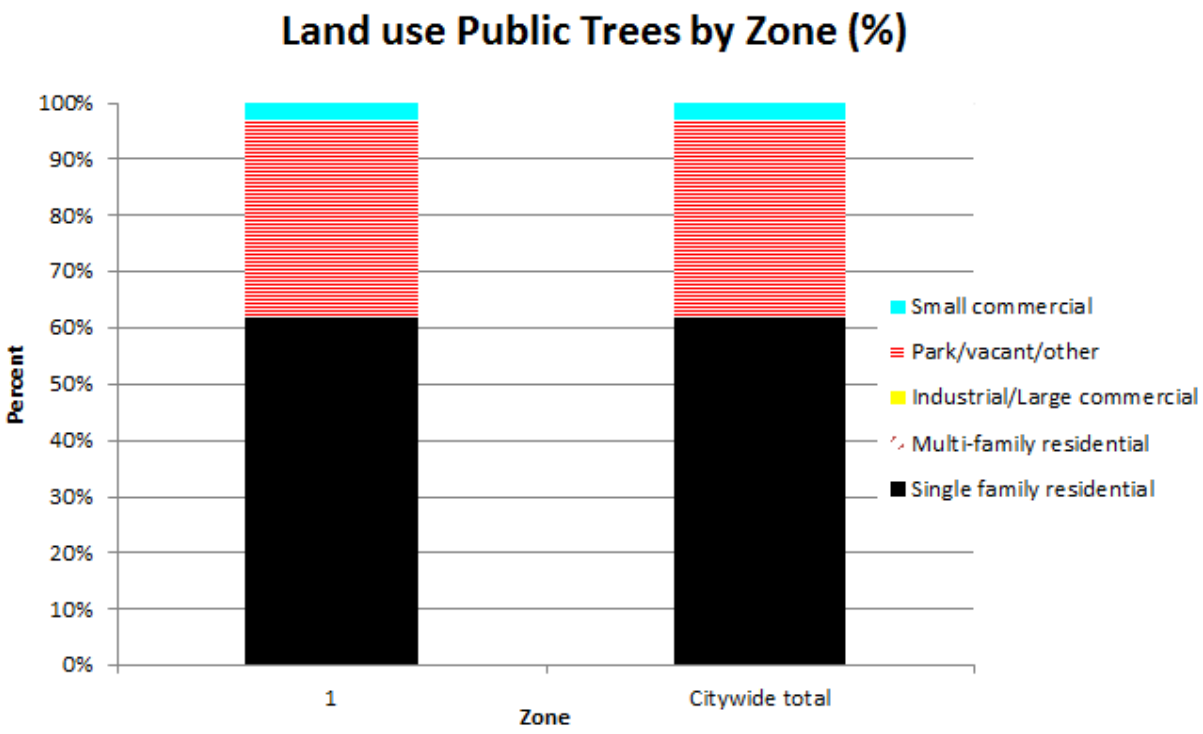
Canopy Cover of Public Trees (Acres)

1/15/2016



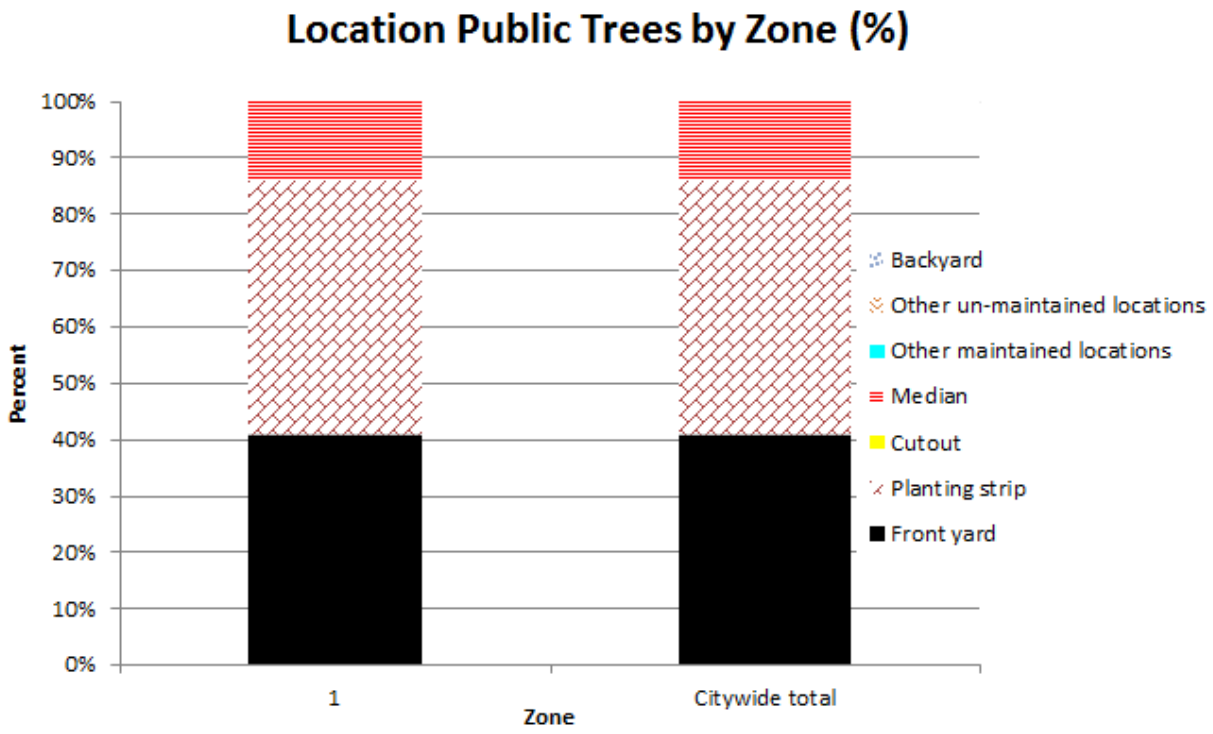
Zone	Acres	% of Total Canopy Cover
Zone 1	6	100.0
Citywide total	6	100.0

Figure 5: Canopy Cover in Acres



Zone	Single family residential	Multi-family residential	Industrial/Large commercial	Park/vacant /other	Small commercial
1	61.92	0.00	0.00	35.15	2.93
Citywide total	61.92	0.00	0.00	35.15	2.93

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	40.59	45.19	0.00	14.23	0.00	0.00	0.00
Citywide total	40.59	45.19	0.00	14.23	0.00	0.00	0.00

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

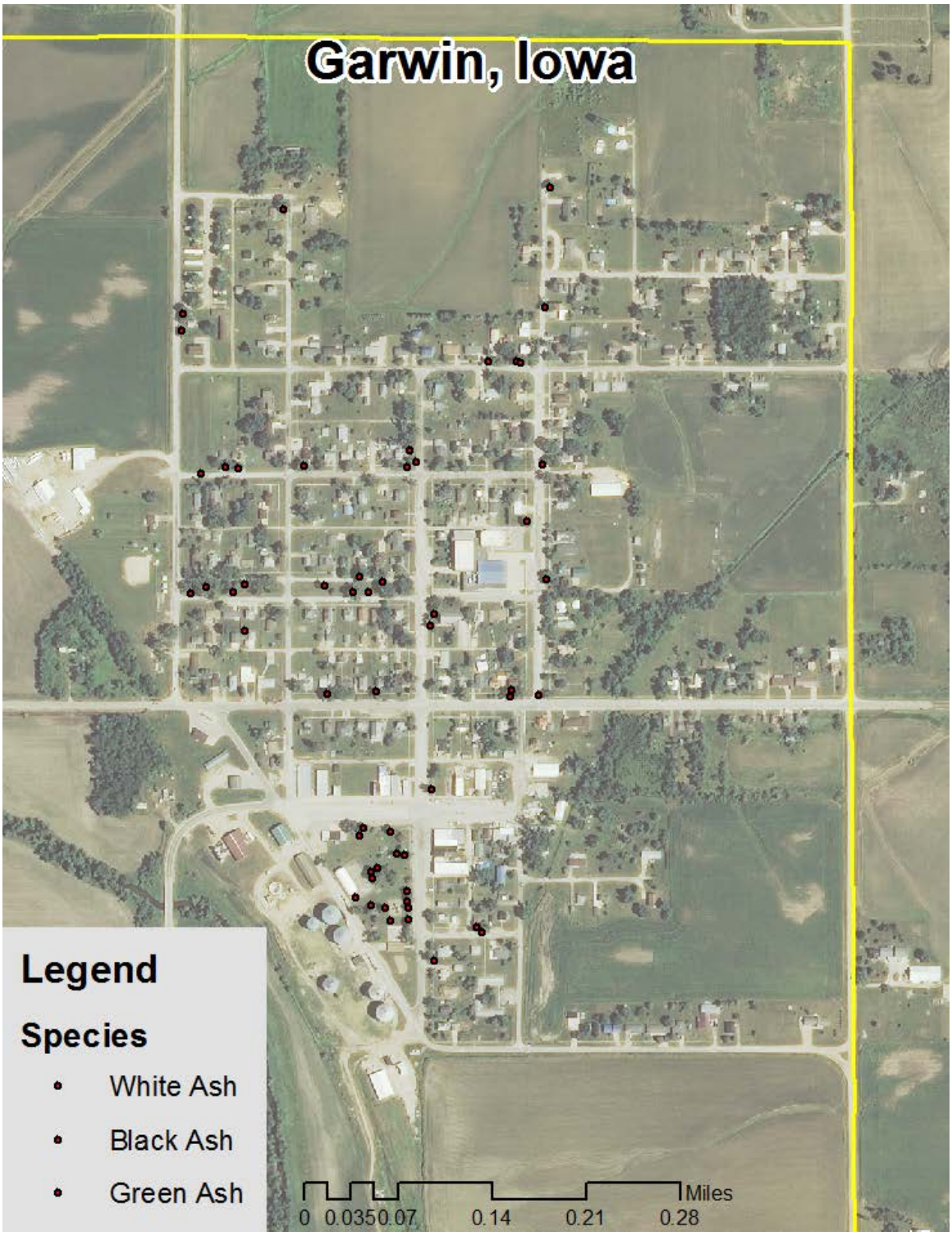


Figure 1: Location of Ash Trees

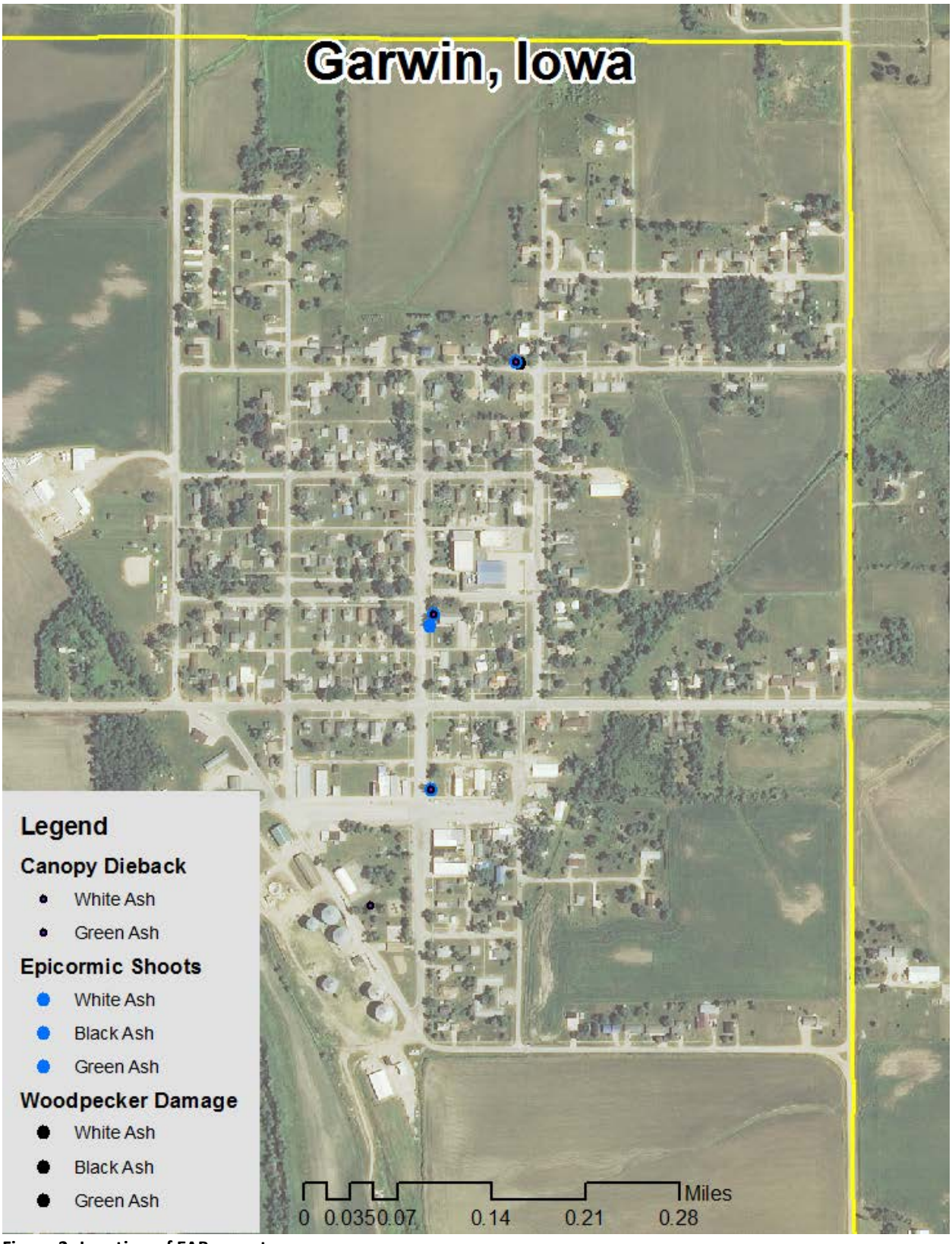


Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

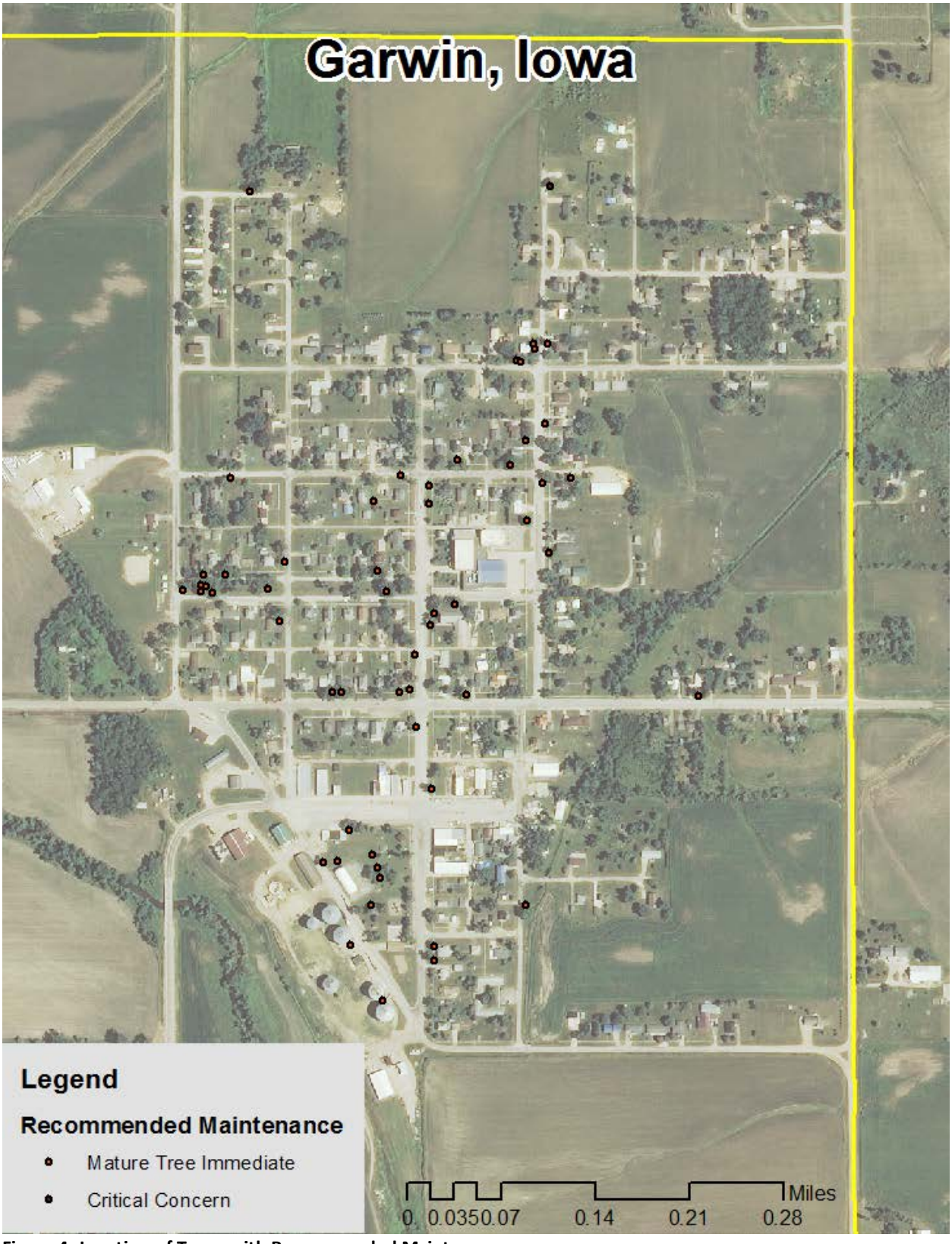


Figure 4: Location of Trees with Recommended Maintenance

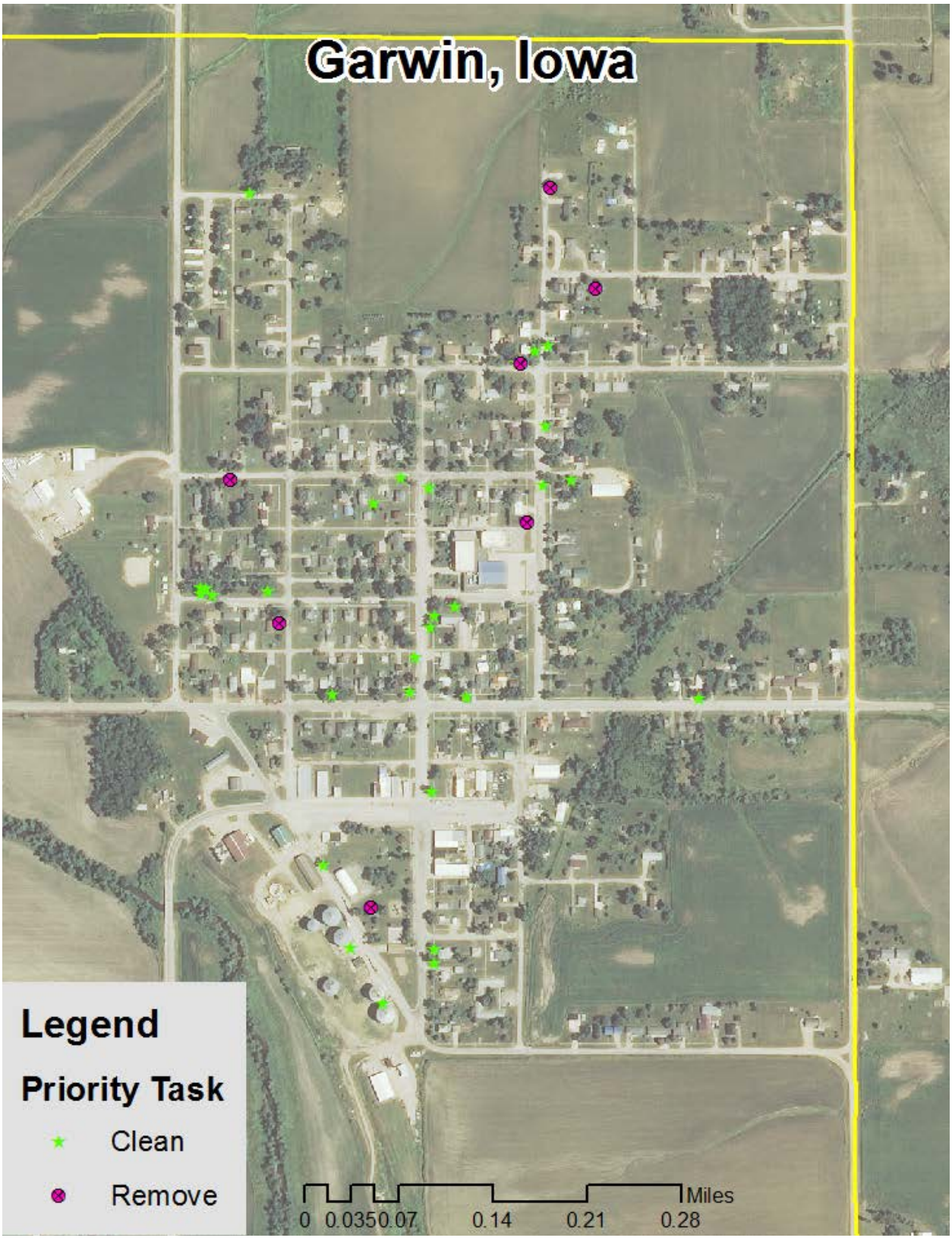


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Garwin Tree Ordinances

GARWIN, IOWA CHAPTER 140

TITLE V - BUILDING AND PROPERTY REGULATIONS

CHAPTER 140
TREES – GENERAL PROVISIONS

140.01 PURPOSE. The purpose of the chapters in this Code of Ordinances pertaining Trees is to beautify and preserve the appearance of the City by regulating and providing for the planting, care and removal of trees.

140.02 DEFINITIONS. For use in these chapters, the following terms are defined:

1. "Parking" means that part of the street, avenue or highway is 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 th lot line and that portion of the street usually traveled by vehicular traffic.

2. "Superintendent" means the superintendent of streets or such other person as may be designated by the Council.

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

1. Alignment. All trees hereafter 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 in 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.

-283-

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, boxelder, Chinese elm, or evergreens.

140.04 DUTY TO TRIM TREES. The owner of 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.

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

140.05 ASSESSMENT. If the abutting property owner fails to trim the trees as required in this chapter, the City may serve notice on the abutting property owner requiring that such action be taken within (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[2d&e])

140.06 TRIMMING TREES TO BE SUPERVISED. It shall be 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.

140.07 REMOVAL OF TREES. The superintendent shall remove, on order of the Council, any tree on the streets of the City which interferes with the making of improvements or with the travel thereon. The superintendent shall additionally remove any trees on the street, not on private property, which are dead of have become diseased, or which constitute a danger to the public, or which may otherwise be declared a nuisance.

(Code of Iowa, Sec. 364.12[2c] & 372.13[4])

TITLE V - BUILDING AND PROPERTY REGULATIONS

CHAPTER 141
TREES – DUTCH ELM DISEASE CONTROL

141.01 TREES SUBJECT TO REMOVAL. The Council, having determined that the health of the elm trees within the City is threatened by a fatal disease known as the Dutch Elm Disease, hereby declares the following shall be removed:

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

1. Living or Standing Trees. Any living or standing elm tree or part thereof infected with the Dutch Elm Disease fungus or which harbors any e elm bark beetles, that is scolytus multistriatus (eichb.) or hylurgopinus rufipes (marsh.).

2. Dead Trees. Any dead elm tree or part thereof including logs, branches, stumps, firewood or other elm material from which the bark has not been removed and burned or sprayed with an effective elm bark beetle destroying insecticide.

141.02 DUTY TO REMOVE. No person of entity shall permit any tree or material as defined in Section 141.01 to remain on the premises owned, controlled or occupied by such person or entity within the City.

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

141.03 INSPECTION. The superintendent shall inspect or cause to be inspected premises and places within the City to determine whether any condition as defined in Section 141.01 exists thereon, and also shall inspect or cause to be ed 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 the elm bark beetles.

141.04 REMOVAL FROM CITY PROPERTY. If the superintendent, upon inspection or examination, determined 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 danger to other elm trees within the City is imminent, the superintendent shall immediately cause such condition to be corrected so as to destroy or prevent as fully as possible the spread of Dutch Elm Disease or the insect pests or vectors know to carry such disease fungus.

141.05 REMOVAL FROM PRIVATE PROPERTY. If the superintendent, upon inspection or examination, 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 superintendent shall immediately notify by certified mail the owner, occupant or person in charge of such property to correct such condition within fourteen (14) days of said notification. If such owner, occupant or in charge of said property fails to comply within fourteen (14) days of receipt of notice, Council may cause the nuisance to be removed and the cost assessed against the property as provided in Chapter 56.

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

If the superintendent is unable to determine with reasonable certainty whether or not a tree in our upon private premises is infected with Dutch Elm Disease, the superintendent is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens.

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.