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Waucoma, IA

Urban Forestry Management Plan

SUMMER 2021

JEO CONSULTING GROUP

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Waucoma in managing its urban forest, including budgeting and future planning. Trees bring numerous benefits to a community, and sound management helps leaders take advantage of these benefits. Management is especially important now considering the serious threats posed by forest pests like 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 except mountain ash. There is a strong possibility that 35% of Waucoma's city-owned trees will die once EAB becomes established in the community, unless local leaders begin preventative treatment. 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 2021, JEO conducted a tree inventory 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 57 trees inventoried.

- Waucoma trees provide $11,621 of benefits annually, an average of $203.88 per tree
- There are over 14 species of trees
- The top three genera are: Ash 35%, Apple (Crab) 16%, and Maple 14%
- 40% of trees need some type of management
- 6 trees should be removed

Recommendations

We detail our core recommendations in the Recommendations Section. In the Emerald Ash Borer Plan, we include management recommendations. Below are some key recommendations.

- Out of the 6 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*
- 10 of the 20 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 yearly with a visual survey.
- With the current budget it could take 14 years to remove ash. We suggest that city officials request a budget increase to $2,500 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

This plan was developed to assist Waucoma with managing, budgeting, and future planning of their urban forest. Across the state, forestry budgets continue to decrease as a higher percentage of the budgets are devoted to 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, treatment, and replacement planting. With proper planning and management of the current canopy in Waucoma, these costs can be spread out over the years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important part of Waucoma's infrastructure and one of the city's greatest assets. The benefits of trees are immense. Trees improve air quality, intercept stormwater runoff, conserve energy, lower traffic speeds, increase property values, reduce crime, improve mental health, and create a desirable place to live, to name just a few. Good urban forestry management will maintain these important benefits for the people of Waucoma and future generations.

Urban forestry management sets goals and develops management strategies to achieve them. To develop management strategies, a comprehensive public tree inventory must be conducted. The inventory informs maintenance, removal schedules, tree planting, and budgeting. Aligning management actions with the tree inventory results will help meet Waucoma's urban forestry goals.

Assist Waucoma with Managing its Urban Forest

Inform on the Benefits of a Healthy Urban Forest

Establish Preventative Treatment for Emerald Ash Borer

Develop Efficient City Tree Management Techniques

Mitigate Public Safety Issues

Findings

INVENTORY

In 2021, JEO conducted a tree inventory that included 100% of the city-owned trees on both streets and parks. The team collected tree data 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 data collectors' programming 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, for all ash trees, the team notes signs and symptoms associated with EAB including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

INVENTORY RESULTS

JEO entered the data collected for the 57 city trees into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. Following are results from the i-Tree STREETS analysis.

ANNUAL BENEFITS

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Waucoma's trees reduce energy-related costs by approximately $1,083 annually (Appendix A, Table 1). These savings are both in electricity (14.3 MWh) and in natural gas (1,948.6 Therms).

Annual Stormwater Benefits

Waucoma's trees intercept about 168,302 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $4,561 in benefit 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 lessens emissions of volatile organic matter (ozone). In Waucoma, it is estimated that trees remove 182.2 lbs of air pollution (ozone (O3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and sulfur dioxide (SO2)) per year with a net value of $511 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Waucoma, trees sequester about 39,655 lbs of carbon per year with an associated value of $297 (Appendix A, Table 5). In addition, the trees store 700,763 lbs of carbon, with a yearly benefit of $5,256 (Appendix A, Table 4).

Annual Aesthetics Benefits

The social benefits of trees are hard to capture. The i-Tree 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. Waucoma receives $3,106 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, Waucoma's trees provide $11,621 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 57 trees in Waucoma provide approximately $203.88 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$1,083**	• Intercept **168,302 gallons** • Provides **$4,561** benefit	• Remove **182.2 lbs** of pollution • Net value of **$511**	• Sequester **39,655 lbs** • Value of **$297** • Store **700,763 lbs** • Value of **$5,256**	• **$3,106** in social benefits	• **$11,621** annual benefits • Each tree provides **$203.88** annually

FOREST STRUCTURE

Species Distribution

Waucoma has over 14 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Ash	20	35%
Apple (Crab)	9	16%
Maple	8	14%
Boxelder	7	12%
Elm	5	9%
Pine	2	3.5%

Oak	2	3.5%
Basswood/Linden	1	2%
Walnut	1	2%
Spruce	1	2%
Cedar	1	2%

Age Class

Most of Waucoma's trees (40%) are between 18 and 30 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Waucoma's size curve is on the larger side, indicating a middle-aged to older than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Waucoma indicate that 46% of the trees are in good health, with only 12% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 33% of Waucoma's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Sixteen percent of the tree population's wood condition is in poor health, dead, or dying. 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).

Action	Number of Trees	Percentage
Crown Cleaning	19	33%
Crown Reduction	0	0%
Tree Removal	6	10.5%
Crown Raising	3	5%
Tree Staking	1	2%

Canopy Cover

The total canopy with both private and public trees is 44.7 acres or nearly 16% cover. The canopy cover included in the Waucoma inventory includes approximately 2 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 2 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Waucoma'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	Percentage
Single Family Residential	61%
Industrial/Large Commercial	0%
Park/Vacant/Other	39%
Small Commercial	0%
Multifamily Residential	0%

Recommendations

RECOMMENDATIONS

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead, dying, or have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorists' vision of pedestrians, vehicles, traffic signs and signals should be removed.

HAZARDOUS TREES

Waucoma has 6 trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 5 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the Proposed Budget and Schedule 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 23 trees with maintenance needs.

POOR TREE SPECIES

After removing the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 6 removals, 5 are ash trees. There are a total of 20 ash trees, and 10 of those have signs and symptoms that have been associated with EAB. *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 removes lower branches that are two inches in diameter or larger to provide clearance for pedestrians or vehicles. Crown reduction removes individual limbs from structures or utility wires. We recommend that all trees be pruned on a routine schedule every five to seven years. Please refer to the Proposed Budget and Schedule for further information.

Planting

Most of the planting over the next five years will replace the trees that are removed. We recommend planting 1.2 trees for every tree removed, since survival rates will not be 100%. 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 Waucoma.

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 ash and crab apple (16%) (Appendix A, Figure 1). Also, ash trees have not been recommended since 2002, due to the threat of EAB. It is encouraged to avoid planting any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, boxelder, 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. We recommend 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.

EMERALD ASH BORER PLAN

Ash Tree Removal

Tree removal will be prioritized by first removing dead, dying, hazardous trees (Appendix B, Figure 4). Next will be all ash in poor condition that display EAB signs and symptoms (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 providing 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 normally disposed of 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). "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, evergreen, willow, or black walnut." Instead, we recommend planting species such as honey locust, Kentucky coffeetree, tulip tree, ginkgo, swamp white oak, and eastern redbud.

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.

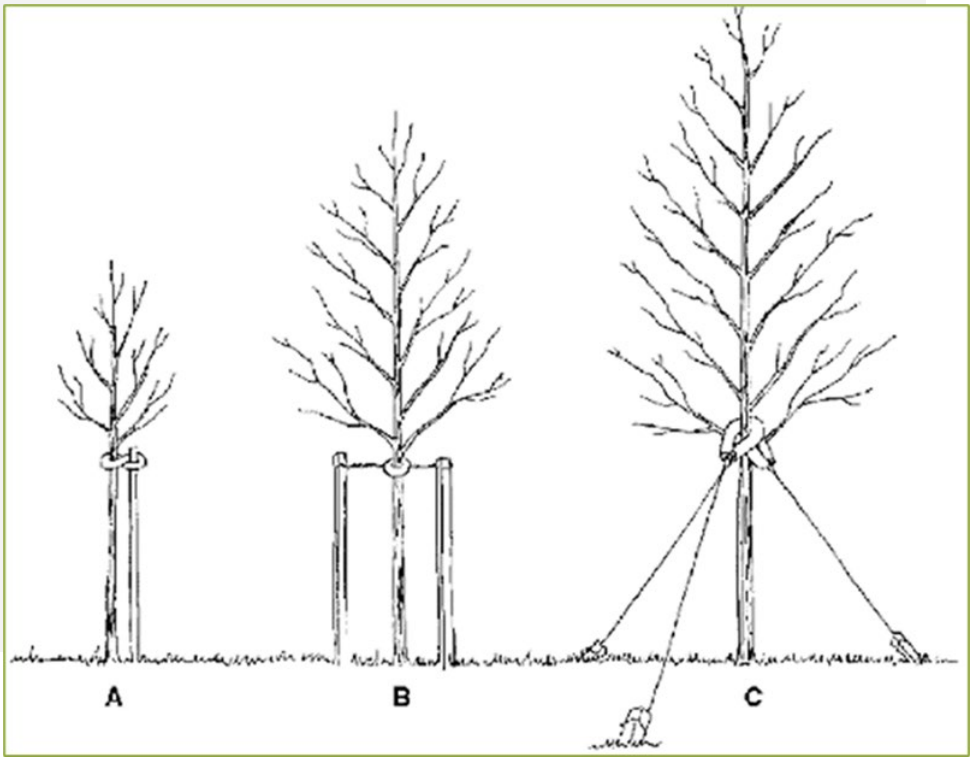
Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for EAB signs and symptoms including 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 150.06 states “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 pass 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 (14) fourteen 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 condition to be corrected and the cost assessed against the property.”

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $1,000/Year – (Based off Estimated Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

YEAR 2	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

YEAR 4	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

YEAR 5	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

YEAR 6	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 1 tree in open location	$150
Prune 1/6 of city owned trees	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,000**

Estimated costs based on average costs of $700/tree for removal, $150/tree for planting and maintenance, and $15/tree for pruning.

***To remove all ash trees within 6 years alone, the budget would need to be $2,500 a year. If the budget were increased to $1,500 a year all ash could be removed in 9 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $2,500/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,550**

YEAR 2	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Prune 1/3 of city owned trees	$285
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,385**

YEAR 3	Est. Cost
Remove 3 ash trees	$2,100
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,550**

YEAR 4	Est. Cost
Remove 3 ash trees	$2,100
Prune 1/3 of city owned trees	$285
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,385**

YEAR 5	Est. Cost
Remove 3 ash trees	$2,100
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,550**

YEAR 6	Est. Cost
Remove 3 ash trees	$2,100
Prune 1/3 of city owned trees	$285
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,385**

Proposed Budget Increase

EAB could potentially kill all ash trees in Waucoma within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $2,500 a year. If the budget were increased to $1,500 per year all ash could be removed within 9 years. Additionally, we recommend that Waucoma 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 considered by many communities is treating 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 removal all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at $15 per inch, about 3 trees could be treated per year (every other year treatment). Three trees would be selected for treatment, and Waucoma would still need to find nearly $12,000 for removal. Alternatively, if there are 6 treatable trees, it would cost approximately $1,800 a year for treatment and leave $11,000 for removal. These are alternatives to straight removal of ash trees. However, whether the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Waucoma. We suggest considering an increased budget to plan for this.

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Appendices

APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Waucoma

Annual Energy Benefits of Public Trees

2/1/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	5.7	431	780.7	765	1,196	(N/A)	33.3	40.0	62.97
Apple	0.7	51	115.5	113	164	(N/A)	15.8	5.5	18.19
Boxelder	1.5	112	194.9	191	303	(N/A)	12.3	10.1	43.27
Silver maple	2.8	210	367.6	360	570	(N/A)	12.3	19.1	81.45
Siberian elm	1.2	89	157.9	155	244	(N/A)	7.0	8.1	60.94
Eastern white pine	0.4	28	49.2	48	76	(N/A)	3.5	2.6	38.17
Bur oak	0.7	55	90.1	88	143	(N/A)	3.5	4.8	71.43
Black walnut	0.3	20	38.1	37	57	(N/A)	1.8	1.9	57.32
Norway spruce	0.1	10	14.6	14	24	(N/A)	1.8	0.8	24.14
American elm	0.0	0	0.1	0	0	(N/A)	1.8	0.0	0.23
American basswood	0.2	18	36.4	36	54	(N/A)	1.8	1.8	53.99
White ash	0.3	23	43.0	42	66	(N/A)	1.8	2.2	65.60
Eastern red cedar	0.0	1	2.5	2	4	(N/A)	1.8	0.1	3.62
Sugar maple	0.5	35	58.0	57	91	(N/A)	1.8	3.1	91.45
Total	14.3	1,083	1,948.6	1,910	2,993	(N/A)	100.0	100.0	52.50

Table 2: Annual Stormwater Benefits

Waucoma

Annual Stormwater Benefits of Public Trees

2/1/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	63,610	1,724	(N/A)	33.3	37.8	90.73
Apple	2,380	65	(N/A)	15.8	1.4	7.17
Boxelder	13,301	360	(N/A)	12.3	7.9	51.49
Silver maple	43,962	1,191	(N/A)	12.3	26.1	170.20
Siberian elm	10,379	281	(N/A)	7.0	6.2	70.32
Eastern white pine	9,209	250	(N/A)	3.5	5.5	124.79
Bur oak	8,704	236	(N/A)	3.5	5.2	117.95
Black walnut	2,591	70	(N/A)	1.8	1.5	70.21
Norway spruce	1,539	42	(N/A)	1.8	0.9	41.70
American elm	3	0	(N/A)	1.8	0.0	0.09
American basswood	2,133	58	(N/A)	1.8	1.3	57.80
White ash	3,225	87	(N/A)	1.8	1.9	87.40
Eastern red cedar	183	5	(N/A)	1.8	0.1	4.97
Sugar maple	7,083	192	(N/A)	1.8	4.2	191.94
Citywide total	168,302	4,561	(N/A)	100.0	100.0	80.02

Table 3: Annual Air Quality Benefits

Waucoma

Annual Air Quality Benefits of Public Trees

2/1/2022

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	7.8	1.3	3.7	0.4	42	27.2	4.0	3.8	25.8	169	0.0	0	73.8	211	(N/A)	33.3	11.09
Apple	0.4	0.1	0.2	0.0	2	3.4	0.5	0.5	3.0	21	0.0	0	8.1	23	(N/A)	15.8	2.55
Boxelder	1.5	0.2	0.8	0.1	8	7.0	1.0	1.0	6.7	44	-0.7	-3	17.6	49	(N/A)	12.3	7.04
Silver maple	8.6	1.5	4.2	0.4	46	13.1	1.9	1.8	12.5	82	-4.6	-17	39.4	111	(N/A)	12.3	15.85
Siberian elm	1.4	0.2	0.7	0.1	8	5.6	0.8	0.8	5.3	35	0.0	0	14.9	42	(N/A)	7.0	10.60
Eastern white pine	1.1	0.2	0.9	0.1	7	1.8	0.3	0.2	1.7	11	-5.7	-21	0.6	-3	(N/A)	3.5	-1.58
Bur oak	1.7	0.3	0.8	0.1	9	3.4	0.5	0.5	3.3	21	0.0	0	10.4	30	(N/A)	3.5	14.99
Black walnut	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)	1.8	9.34
Norway spruce	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	1.8	2.82
American elm	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)	1.8	0.03
American basswood	0.2	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	7	-0.2	-1	2.8	8	(N/A)	1.8	7.78
White ash	0.4	0.1	0.2	0.0	2	1.5	0.2	0.2	1.4	9	0.0	0	3.9	11	(N/A)	1.8	11.18
Eastern red cedar	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	-0.1	0	0.1	0	(N/A)	1.8	0.20
Sugar maple	1.5	0.3	0.7	0.1	8	2.1	0.3	0.3	2.1	13	-1.1	-4	6.2	17	(N/A)	1.8	16.99
Citywide total	25.2	4.2	12.5	1.2	136	68.0	9.9	9.4	64.6	424	-13.0	-49	182.2	511	(N/A)	100.0	8.97

Table 4: Annual Carbon Stored

Waucoma

Stored CO2 Benefits of Public Trees

2/1/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	252,422	1,893	(N/A)	33.3	36.0	99.64
Apple	8,171	61	(N/A)	15.8	1.2	6.81
Boxelder	42,654	320	(N/A)	12.3	6.1	45.70
Silver maple	215,232	1,614	(N/A)	12.3	30.7	230.61
Siberian elm	34,270	257	(N/A)	7.0	4.9	64.26
Eastern white pine	14,981	112	(N/A)	3.5	2.1	56.18
Bur oak	59,654	447	(N/A)	3.5	8.5	223.70
Black walnut	8,458	63	(N/A)	1.8	1.2	63.43
Norway spruce	1,170	9	(N/A)	1.8	0.2	8.78
American elm	14	0	(N/A)	1.8	0.0	0.10
American basswood	8,218	62	(N/A)	1.8	1.2	61.63
White ash	8,458	63	(N/A)	1.8	1.2	63.43
Eastern red cedar	43	0	(N/A)	1.8	0.0	0.32
Sugar maple	47,020	353	(N/A)	1.8	6.7	352.65
Citywide total	700,763	5,256	(N/A)	100.0	100.0	92.21

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Table 5: Annual Carbon Sequestered

Waucoma

Annual CO $_2$ Benefits of Public Trees

2/1/2022

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	13,900	104	-1,212	-59	-10	9,533	72	22,163	166 (N/A)	33.3	36.9	8.75
Apple	1,025	8	-39	-11	0	1,117	8	2,092	16 (N/A)	15.8	3.5	1.74
Boxelder	4,033	30	-205	-17	-2	2,473	19	6,284	47 (N/A)	12.3	10.5	6.73
Silver maple	13,889	104	-1,033	-33	-8	4,638	35	17,460	131 (N/A)	12.3	29.1	18.71
Siberian elm	2,078	16	-164	-12	-1	1,967	15	3,869	29 (N/A)	7.0	6.4	7.25
Eastern white pine	0	0	-72	-9	-1	622	5	541	4 (N/A)	3.5	0.9	2.03
Bur oak	924	7	-286	-8	-2	1,206	9	1,836	14 (N/A)	3.5	3.1	6.88
Black walnut	660	5	-41	-3	0	441	3	1,058	8 (N/A)	1.8	1.8	7.93
Norway spruce	116	1	-6	-2	0	216	2	324	2 (N/A)	1.8	0.5	2.43
American elm	7	0	0	0	0	2	0	9	0 (N/A)	1.8	0.0	0.07
American basswood	597	4	-39	-3	0	405	3	960	7 (N/A)	1.8	1.6	7.20
White ash	845	6	-41	-3	0	518	4	1,320	10 (N/A)	1.8	2.2	9.90
Eastern red cedar	13	0	0	-1	0	26	0	39	0 (N/A)	1.8	0.1	0.29
Sugar maple	1,569	12	-226	-6	-2	764	6	2,102	16 (N/A)	1.8	3.5	15.76
Citywide total	39,655	297	-3,364	-164	-26	23,931	179	60,058	450 (N/A)	100.0	100.0	7.90

Table 6: Annual Social and Aesthetic Benefits

Waucoma

Annual Aesthetic/Other Benefits of Public Trees

2/1/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,117	(N/A)	33.3	36.0	58.81
Apple	58	(N/A)	15.8	1.9	6.40
Boxelder	325	(N/A)	12.3	10.5	46.37
Silver maple	977	(N/A)	12.3	31.5	139.63
Siberian elm	164	(N/A)	7.0	5.3	40.99
Eastern white pine	0	(N/A)	3.5	0.0	0.00
Bur oak	74	(N/A)	3.5	2.4	37.21
Black walnut	58	(N/A)	1.8	1.9	57.69
Norway spruce	32	(N/A)	1.8	1.0	32.32
American elm	2	(N/A)	1.8	0.1	1.91
American basswood	48	(N/A)	1.8	1.5	47.53
White ash	101	(N/A)	1.8	3.3	101.35
Eastern red cedar	13	(N/A)	1.8	0.4	13.37
Sugar maple	136	(N/A)	1.8	4.4	136.28
Citywide total	3,106	(N/A)	100.0	100.0	54.49

Table 7: Summary of Benefits in Dollars

Waucoma

Total Annual Benefits, Net Benefits, and Costs for Public Trees

2/1/2022

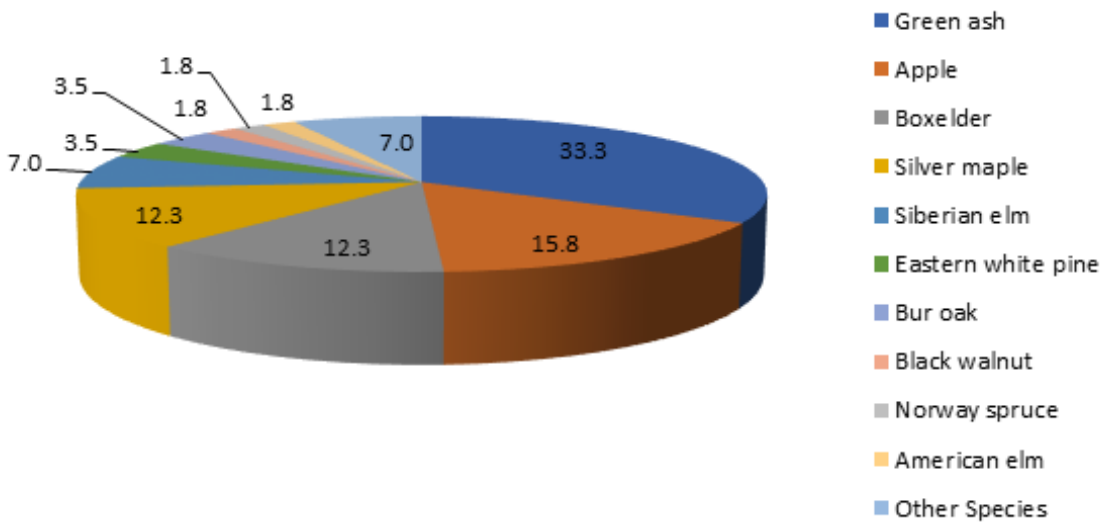
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	2,993	(N/A)	52.50	(N/A)	0.00	(N/A)
CO2	450	(N/A)	7.90	(N/A)	0.00	(N/A)
Air Quality	511	(N/A)	8.97	(N/A)	0.00	(N/A)
Stormwater	4,561	(N/A)	80.02	(N/A)	0.00	(N/A)
Aesthetic/Other	3,106	(N/A)	54.49	(N/A)	0.00	(N/A)
Total Benefits	11,621	(N/A)	203.88	(N/A)	0.00	(N/A)
Costs						
Planting	0		0.00		0.00	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	0		0.00		0.00	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	0		0.00		0.00	
Total Costs	0		0.00		0.00	
Net Benefits	11,621	(N/A)	203.88	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Waucoma

Species Distribution of Public Trees

2/1/2022



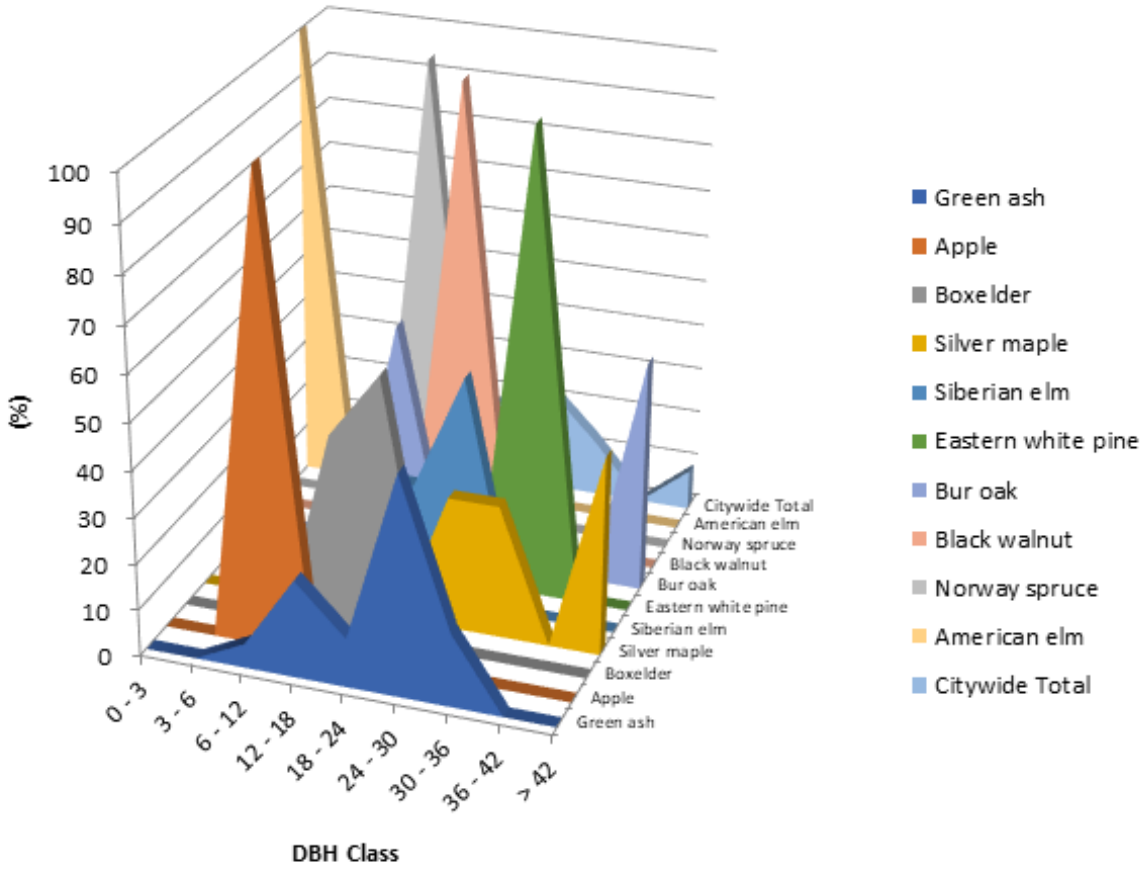
Species	Percent
Green ash	33.3
Apple	15.8
Boxelder	12.3
Silver maple	12.3
Siberian elm	7.0
Eastern white pine	3.5
Bur oak	3.5
Black walnut	1.8
Norway spruce	1.8
American elm	1.8
Other Species	7.0
Total	100.0

Figure 2: Relative Age Class

Waucoma

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

2/1/2022



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Green ash	0.00	0.00	5.26	21.05	10.53	47.37	15.79	0.00	0.00
Apple	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Boxelder	0.00	0.00	0.00	42.86	57.14	0.00	0.00	0.00	0.00
Silver maple	0.00	0.00	0.00	0.00	0.00	28.57	28.57	0.00	42.86
Siberian elm	0.00	0.00	0.00	25.00	25.00	50.00	0.00	0.00	0.00
Eastern white pine	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00
Bur oak	0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	50.00
Black walnut	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00
Norway spruce	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00
American elm	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Citywide Total	1.75	1.75	17.54	17.54	17.54	22.81	12.28	0.00	8.77

Figure 3: Foliage Condition

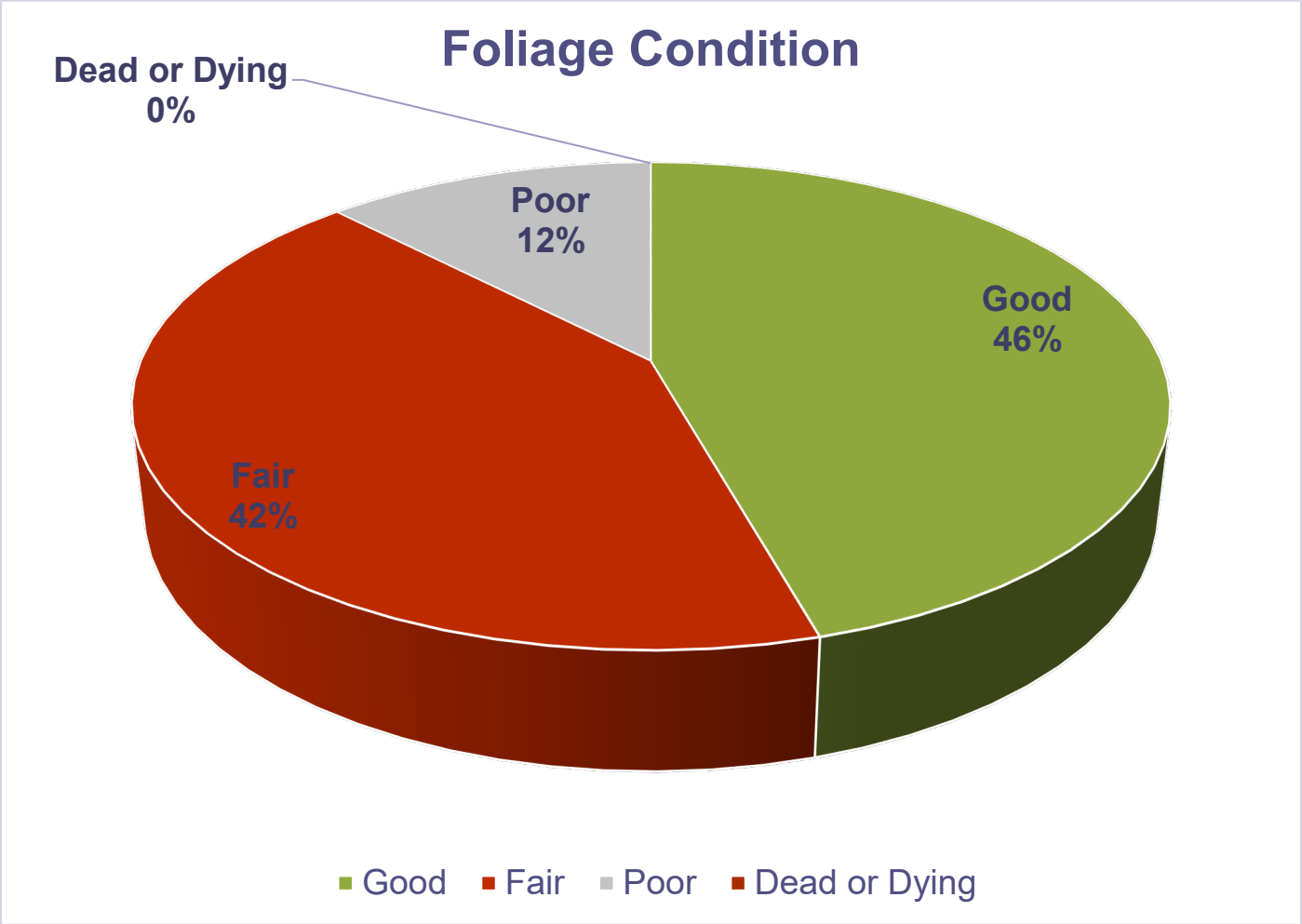


Figure 4: Wood Condition

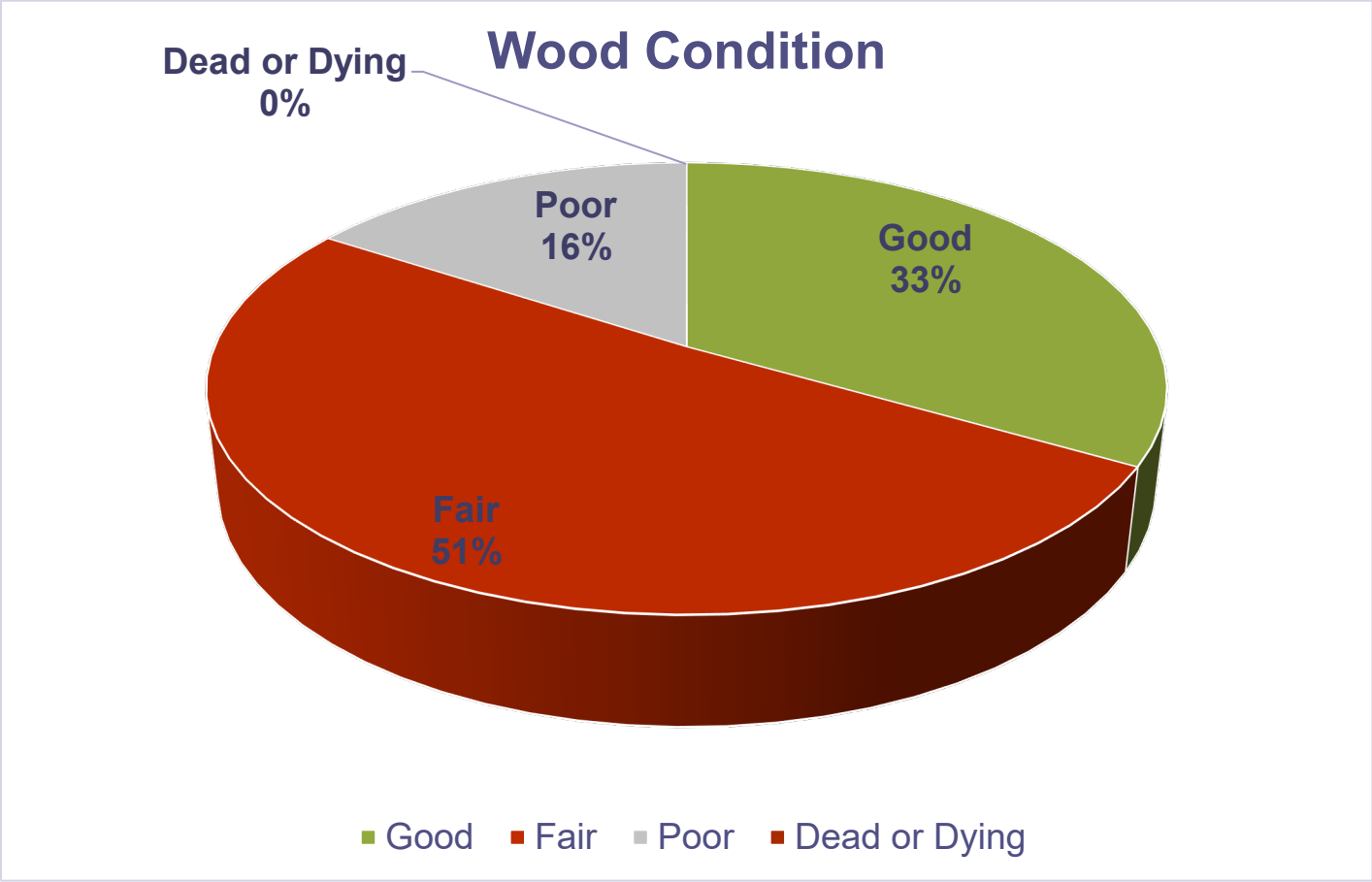
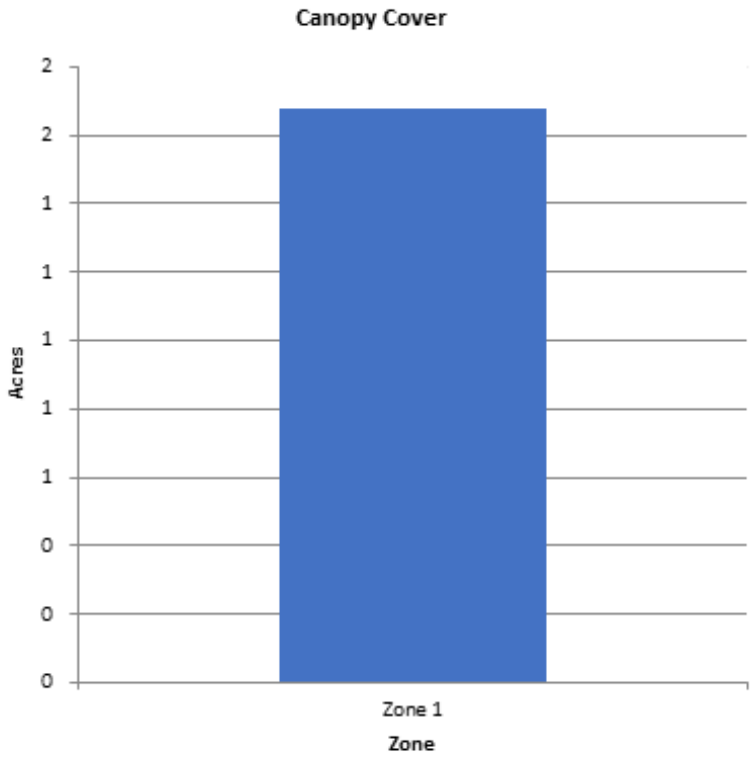


Figure 5: Canopy Cover in Acres

Waucoma

Canopy Cover of Public Trees (Acres)

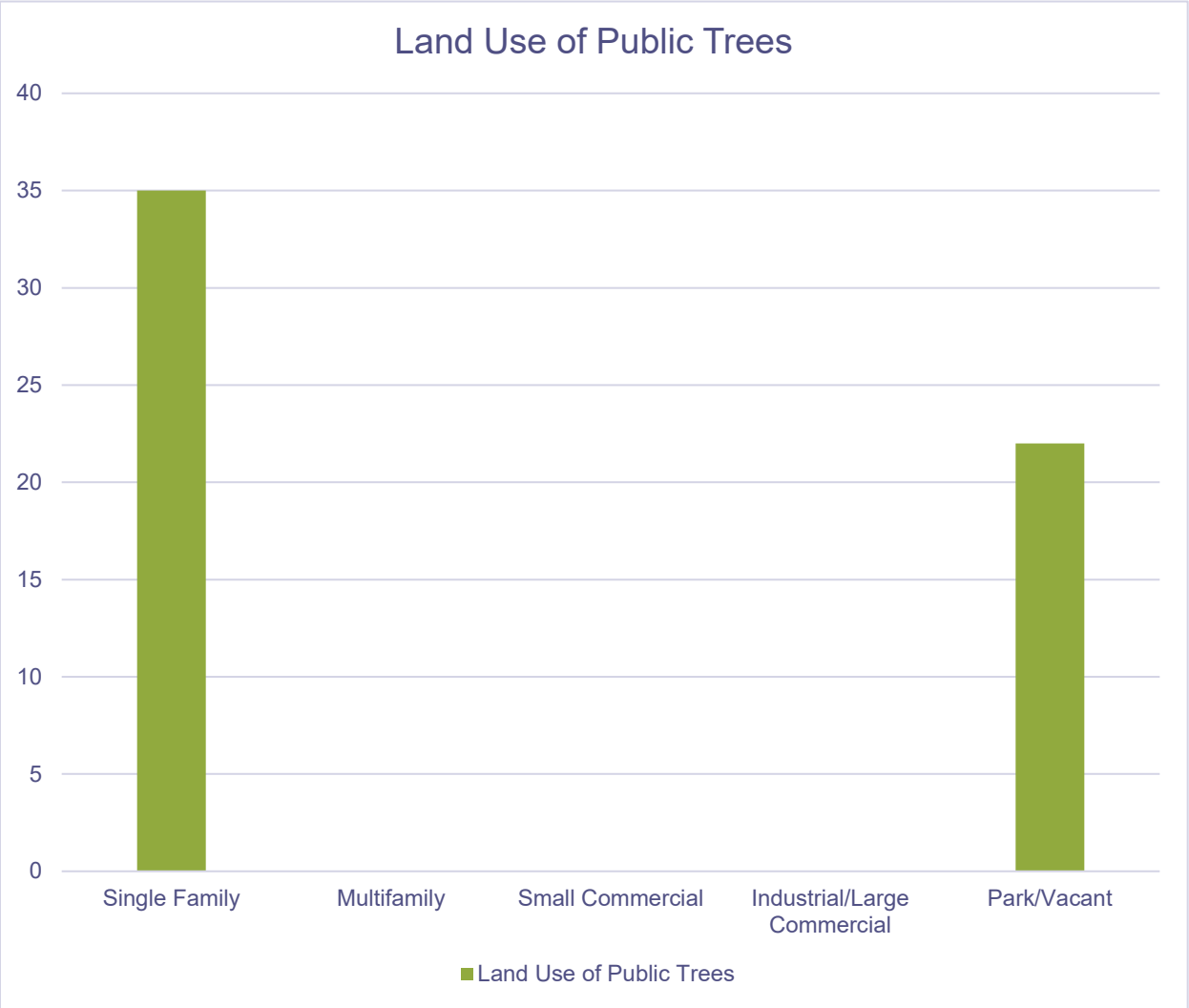
2/1/2022



Zone	Acres	% of Total Canopy Cover
Zone 1	2	100.0
Citywide total	2	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide Total	0	0	2	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

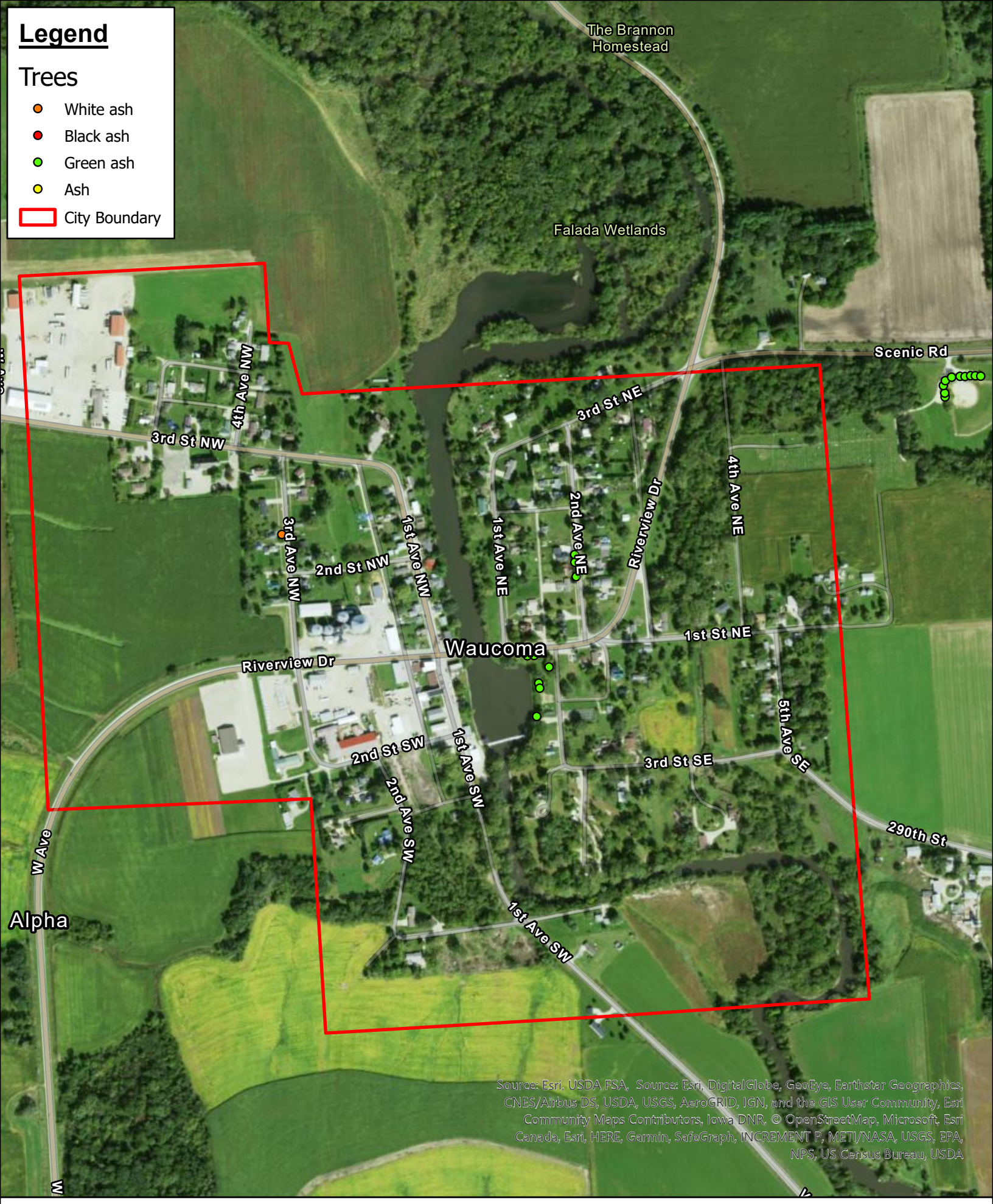
Figure 1: Location of Ash Trees

Figure 2: Location of EAB Symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

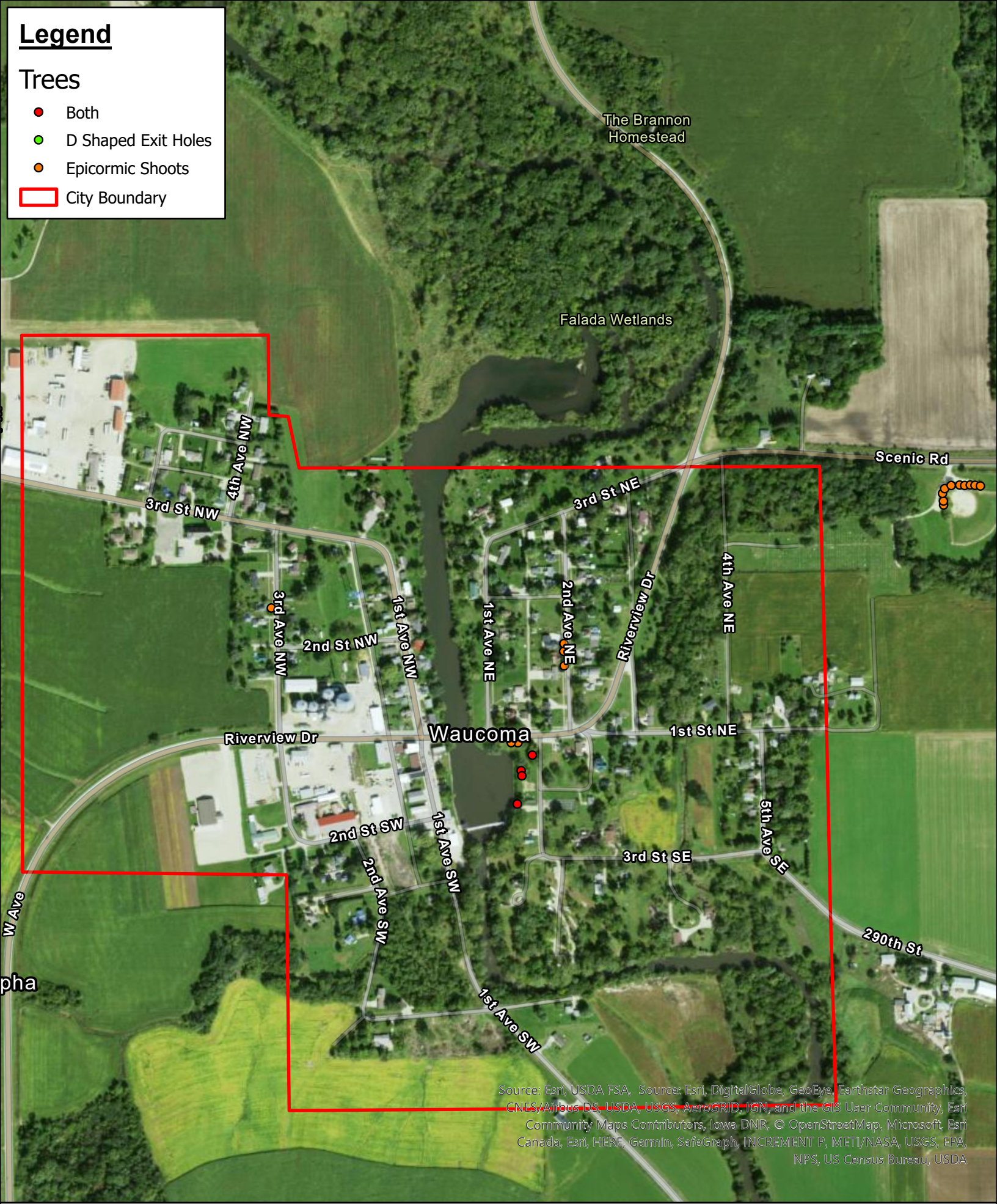
City ownership of the trees recommended for removal should be verified prior to any removal



Ash Tree Location

0 290 580 1,160 Feet

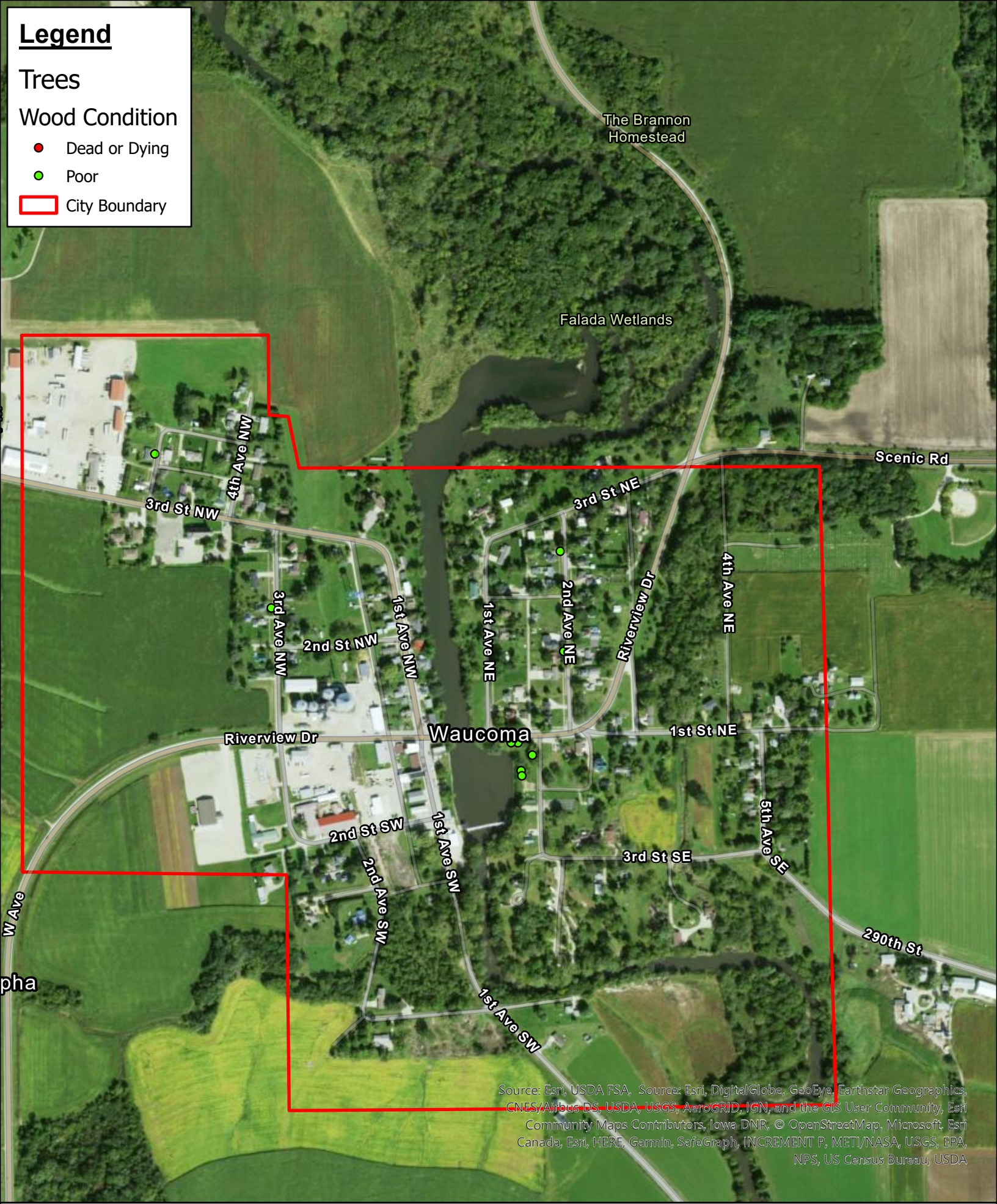
N



EAB Signs/Symptoms

0 290 580 1,160 Feet

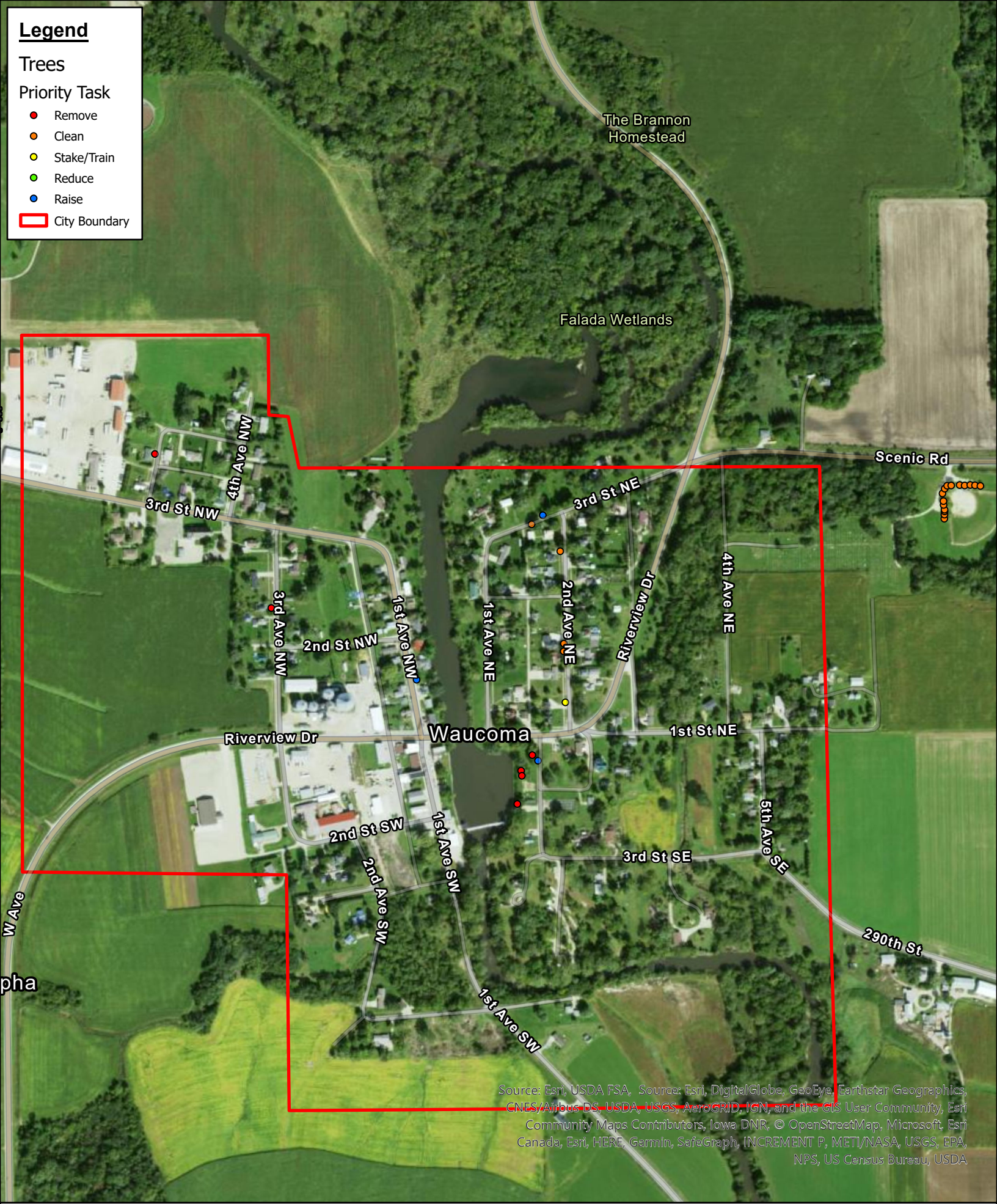
N



Poor Condition Trees

0 290 580 1,160 Feet

N



Priority Task

0 290 580 1,160 Feet

N

APPENDIX C: WAUCOMA TREE ORDINANCES

CHAPTER 150

TREES

150.01 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.

150.02 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 that 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.

150.03 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])

150.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 150.03, 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.

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

150.06 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.