Epworth, 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 Epworth 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 4% of Epworth'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 289 trees inventoried.

- Epworth's trees provide $35,652 of benefits annually, an average of $123.36 per tree
- There are over 37 species of trees
- The top three genera are: Maple 29%, Oak 20%, and Spruce 14.5%
- 31% of trees need some type of management
- 16 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 16 trees needing removal, 1 tree is 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*
- 4 of the 12 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 2-3 years to remove ash. We suggest that city officials request a budget increase to $5,000 annually and apply for grants to match your budget to plant replacement trees.

Introduction

INTRODUCTION

This plan was developed to assist Epworth 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 Epworth, 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 Epworth'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 Epworth 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 Epworth's urban forestry goals.

Assist Epworth 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 289 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. Epworth's trees reduce energy-related costs by approximately $9,248 annually (Appendix A, Table 1). These savings are both in electricity (44.6 MWh) and in natural gas (5,979.9 Therms).

Annual Stormwater Benefits

Epworth's trees intercept about 462,585 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $12,536 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 Epworth, it is estimated that trees remove 499.6 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 $1,343 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Epworth, trees sequester about 96,469 lbs of carbon per year with an associated value of $1,236 (Appendix A, Table 5). In addition, the trees store 1,239,647 lbs of carbon, with a yearly benefit of $9,297 (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. Epworth receives $11,289 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, Epworth's trees provide $35,652 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 289 trees in Epworth provide approximately $123.36 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$9,248**	• Intercept **462,585 gallons** • Provides **$12,536** benefit	• Remove **499.6 lbs** of pollution • Net value of **$1,343**	• Sequester **96,469 lbs** • Value of **$1,236** • Store **1,239,647 lbs** • Value of **$9,297**	• **$11,289** in social benefits	• **$35,652** annual benefits • Each tree provides **$123.36** annually

FOREST STRUCTURE

Species Distribution

Epworth 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	83	29%
Oak	58	20%
Spruce	42	14.5%
Pine	29	10%
Cedar	14	5%
Ash	12	4%
Apple	9	3%
Honey locust	8	3%
Poplar	8	3%
Basswood/Linden	4	1%
Kentucky coffee	4	1%

Cottonwood	4	1%
Boxelder	3	1%
Hackberry	3	1%
Elm	1	<1%
Southern magnolia	1	<1%
Eastern redbud	1	<1%
Ginkgo	1	<1%
Amur maple	1	<1%
Birch	1	<1%
Sycamore	1	<1%
Other Deciduous	1	<1%

Age Class

Most of Epworth's trees (47%) are between 6 and 18 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. Epworth's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Epworth indicate that 67% of the trees are in good health, with only 4% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 69% of Epworth's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Six percent of the tree population's wood condition is in poor health, dead, or dying. This 6% 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	76	26%
Crown Reduction	5	2%
Tree Removal	16	5.5%
Crown Raising	5	2%
Tree Staking	1	<1%

Canopy Cover

The total canopy with both private and public trees is 153 acres or about 15% of total land in city limits. The canopy cover included in the Epworth inventory includes approximately 3 acres (Appendix A, Figure 5). The city's canopy goal is to increase canopy by 6% in 30 years. To achieve this goal it is estimated that at least 5 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Epworth'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	18%
Industrial/Large Commercial	0%
Park/Vacant/Other	93%
Small Commercial	1%
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

Epworth has 16 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 is 1 tree over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the Proposed Schedule and Budget at the end of this section. After all the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 87 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 16 removals, 5 are ash trees. There are a total of 12 ash trees, and 4 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 Epworth.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with maple (29%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood (unless cotton less), cotton-bearing poplar, or box-elder as outlined in section 8.12.040 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 8.12.040 (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 8.12.040 (Appendix C). "To not plant any of the following species: cottonwood (unless cotton less), cotton-bearing poplar, or box-elder." Instead, we recommend planting a diverse mix of species including Kentucky coffeetree, ginkgo, swamp white oak, northern hackberry, linden, 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 8.12.040 states:

1. To trim their trees or plantings so that they shall not cause a hazard to the public or block public walks or ways or interfere with proper lighting of public 2021 streets or places. The minimum clearance of any overhanging portion shall be eight feet over walks and fourteen feet above the surface of the traveled portion of the street;

2. To not plant any tree or other planting on private property which would cause a public danger or nuisance;

3. To not plant any tree nearer than four feet to the sidewalk line or alley right-of-way line;

4. To treat in an accepted manner or remove any tree or plant so diseased or insect-ridden as to constitute a hazard to other trees and especially those dangerous to trees or plants in public streets or places;

5. To not plant any of the following species: cottonwood (unless cotton less), cotton-bearing poplar, or box-elder. (Ord. 357 Sec. 4, 1973)

Schedule & Budget

PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $2,000/Year for removals paired with grant funds up to $5,000 for tree planting/management (Based off Reported Yearly Tree Budget)

YEAR 1	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

YEAR 2	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

YEAR 3	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

YEAR 4	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

YEAR 5	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

YEAR 6	Est. Cost
Remove 2 trees recommended for immediate removal	$1,600
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 3 trees in open locations	$450
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$2,800**

Estimated costs based on average costs of $800/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 $1,600 a year. If the budget were increased to $5,000 a year all ash could be removed in 2 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $5,000/Year for removals paired with grant funds up to $5,000 for tree planting/management – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 6 trees recommended for immediate removal	$4,800
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$8,550**

YEAR 2	Est. Cost
Remove 6 trees recommended for immediate removal	$4,800
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$8,550**

YEAR 3	Est. Cost
Remove 4 trees recommended for immediate removal	$3,200
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,950**

YEAR 4	Est. Cost
Remove 4 ash trees	$3,200
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,950**

YEAR 5	Est. Cost
Remove 3 remaining ash trees	$3,200
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$6,950**

YEAR 6	Est. Cost
Additional Removal Money	$4,800
Prune/Manage 1/6 of City Trees (about 50 trees/year)	$750
Plant 20 trees in open locations	$3,000
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$8,550**

Proposed Budget Increase

EAB could potentially kill all ash trees in Epworth within four years of its arrival. To remove all ash trees alone within six years, the budget would need to be increased to $1,600 a year. If the budget were increased to $5,000 per year all ash could be removed within 2 years. Additionally, we recommend that Epworth 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 6 trees could be treated per year (every other year treatment). Six trees would be selected for treatment, and Epworth would still need to find around $35,000 for removal. Alternatively, if there are 10 treatable trees, it would cost approximately $3,000 a year for treatment and leave no guaranteed funds for removal. 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 Epworth. We suggest considering an increased budget to plan for this.

WORKS CITED

Census Bureau. 2010. http://censtats.census.gov/data/IA/1601964290.pdf(April, 2013)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, DJ and JF Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J; McPherson, E Gregory; Simpson, James R; Vargas, Kelaine E; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

Appendices

APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Epworth

Annual Energy Benefits of Public Trees

2/3/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern red oak	3.8	288	517.1	507	795	(N/A)	11.8	8.6	23.39
Silver maple	6.8	513	874.6	857	1,370	(N/A)	10.4	14.8	45.68
Eastern white pine	3.0	228	395.4	388	615	(N/A)	8.7	6.7	24.61
Norway maple	3.3	248	483.3	474	722	(N/A)	7.6	7.8	32.80
Red maple	3.1	236	391.4	384	619	(N/A)	6.2	6.7	34.40
Pin oak	4.6	350	631.6	619	969	(N/A)	5.9	10.5	57.03
Blue spruce	1.6	123	209.7	206	328	(N/A)	5.5	3.5	20.51
Northern white cedar	1.6	125	214.6	210	335	(N/A)	4.8	3.6	23.93
Spruce	0.7	50	91.2	89	140	(N/A)	3.8	1.5	12.71
Sugar maple	2.1	161	284.6	279	440	(N/A)	3.8	4.8	39.96
Green ash	1.9	145	248.2	243	388	(N/A)	3.1	4.2	43.10
Apple	0.9	66	129.7	127	193	(N/A)	3.1	2.1	21.49
Black poplar	1.9	145	255.9	251	396	(N/A)	2.8	4.3	49.52
Norway spruce	1.0	77	127.2	125	202	(N/A)	2.8	2.2	25.19
Honeylocust	1.4	107	189.3	185	293	(N/A)	2.8	3.2	36.57
Black spruce	0.3	25	47.7	47	71	(N/A)	2.4	0.8	10.18
Bur oak	1.2	90	153.2	150	240	(N/A)	1.7	2.6	48.07
Scotch pine	0.6	42	68.7	67	109	(N/A)	1.4	1.2	27.30
Cottonwood	1.2	89	168.0	165	254	(N/A)	1.4	2.7	63.50
Kentucky coffeetree	0.4	30	54.7	54	83	(N/A)	1.4	0.9	20.80
Littleleaf linden	0.5	38	70.2	69	107	(N/A)	1.0	1.2	35.77
Northern hackberry	0.1	10	20.7	20	30	(N/A)	1.0	0.3	9.99
Boxelder	0.4	31	53.7	53	84	(N/A)	1.0	0.9	27.84
White ash	0.5	34	55.0	54	88	(N/A)	1.0	1.0	29.44
White oak	0.0	2	3.7	4	6	(N/A)	0.3	0.1	5.82
Ginkgo	0.0	0	0.4	0	1	(N/A)	0.3	0.0	0.57
Eastern redbud	0.0	2	3.8	4	5	(N/A)	0.3	0.1	5.40
American sycamore	0.1	7	13.7	13	21	(N/A)	0.3	0.2	20.64
Southern magnolia	0.3	20	36.3	36	56	(N/A)	0.3	0.6	55.99
Black maple	0.0	3	5.2	5	8	(N/A)	0.3	0.1	7.85
Siberian elm	0.3	20	37.9	37	57	(N/A)	0.3	0.6	57.41
Maple	0.3	19	30.1	29	49	(N/A)	0.3	0.5	48.95
Swamp white oak	0.2	18	29.5	29	47	(N/A)	0.3	0.5	46.78
Broadleaf Deciduous Mediu	0.1	8	16.9	17	24	(N/A)	0.3	0.3	24.47
Basswood	0.0	2	3.7	4	6	(N/A)	0.3	0.1	5.82
Amur maple	0.2	14	24.7	24	38	(N/A)	0.3	0.4	38.13
Paper birch	0.3	20	38.1	37	57	(N/A)	0.3	0.6	57.32
Total	44.6	3,387	5,979.9	5,860	9,248	(N/A)	100.0	100.0	32.00

Table 2: Annual Stormwater Benefits

Epworth

Annual Stormwater Benefits of Public Trees

2/3/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern red oak	25,602	694	(N/A)	11.8	5.5	20.41
Silver maple	79,987	2,168	(N/A)	10.4	17.3	72.25
Eastern white pine	56,046	1,519	(N/A)	8.7	12.1	60.75
Norway maple	25,438	689	(N/A)	7.6	5.5	31.33
Red maple	21,002	569	(N/A)	6.2	4.5	31.62
Pin oak	42,393	1,149	(N/A)	5.9	9.2	67.58
Blue spruce	21,467	582	(N/A)	5.5	4.6	36.36
Northern white cedar	26,557	720	(N/A)	4.8	5.7	51.41
Spruce	7,521	204	(N/A)	3.8	1.6	18.53
Sugar maple	19,892	539	(N/A)	3.8	4.3	49.01
Green ash	18,051	489	(N/A)	3.1	3.9	54.35
Apple	3,134	85	(N/A)	3.1	0.7	9.44
Black poplar	16,720	453	(N/A)	2.8	3.6	56.64
Norway spruce	15,658	424	(N/A)	2.8	3.4	53.04
Honeylocust	12,738	345	(N/A)	2.8	2.8	43.15
Black spruce	3,644	99	(N/A)	2.4	0.8	14.11
Bur oak	16,133	437	(N/A)	1.7	3.5	87.44
Scotch pine	9,016	244	(N/A)	1.4	1.9	61.08
Cottonwood	13,263	359	(N/A)	1.4	2.9	89.85
Kentucky coffeetree	4,304	117	(N/A)	1.4	0.9	29.16
Littleleaf linden	4,087	111	(N/A)	1.0	0.9	36.92
Northern hackberry	653	18	(N/A)	1.0	0.1	5.90
Boxelder	2,896	78	(N/A)	1.0	0.6	26.16
White ash	2,890	78	(N/A)	1.0	0.6	26.11
White oak	172	5	(N/A)	0.3	0.0	4.65
Ginkgo	7	0	(N/A)	0.3	0.0	0.19
Eastern redbud	69	2	(N/A)	0.3	0.0	1.86
American sycamore	608	16	(N/A)	0.3	0.1	16.47
Southern magnolia	3,187	86	(N/A)	0.3	0.7	86.37
Black maple	137	4	(N/A)	0.3	0.0	3.72
Siberian elm	2,290	62	(N/A)	0.3	0.5	62.07
Maple	1,604	43	(N/A)	0.3	0.3	43.46
Swamp white oak	1,409	38	(N/A)	0.3	0.3	38.19
Broadleaf Deciduous Medium	586	16	(N/A)	0.3	0.1	15.88
Basswood	172	5	(N/A)	0.3	0.0	4.65
Amur maple	667	18	(N/A)	0.3	0.1	18.06
Paper birch	2,591	70	(N/A)	0.3	0.6	70.21
Citywide total	462,585	12,536	(N/A)	100.0	100.0	43.38

Table 3: Annual Air Quality Benefits

Epworth

Annual Air Quality Benefits of Public Trees

2/3/2022

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								
Northern red oak	4.4	0.8	2.3	0.2	24	18.1	2.6	2.5	17.2	113	-6.1	-23	42.0	114	(N/A)	11.8	3.35
Silver maple	11.6	2.0	6.0	0.5	63	31.8	4.7	4.5	30.6	199	-6.6	-25	84.9	238	(N/A)	10.4	7.92
Eastern white pine	6.5	1.3	5.3	0.8	43	14.2	2.1	2.0	13.6	89	-27.0	-101	18.7	30	(N/A)	8.7	1.20
Norway maple	4.4	0.8	2.3	0.2	24	16.0	2.3	2.2	14.8	99	-1.1	-4	41.9	119	(N/A)	7.6	5.40
Red maple	4.3	0.7	2.1	0.2	23	14.5	2.1	2.0	14.1	91	-1.6	-6	38.6	109	(N/A)	6.2	6.04
Pin oak	6.5	1.1	3.5	0.3	36	22.0	3.2	3.1	20.9	137	-12.5	-47	48.1	126	(N/A)	5.9	7.43
Blue spruce	2.9	0.6	2.4	0.4	19	7.6	1.1	1.1	7.3	48	-7.8	-29	15.5	37	(N/A)	5.5	2.34
Northern white cedar	3.0	0.6	2.5	0.4	20	7.7	1.1	1.1	7.4	48	-11.8	-44	12.1	24	(N/A)	4.8	1.73
Spruce	0.7	0.1	0.7	0.1	5	3.2	0.5	0.4	3.0	20	-2.5	-9	6.3	16	(N/A)	3.8	1.42
Sugar maple	2.4	0.4	1.2	0.1	13	10.0	1.5	1.4	9.6	63	-1.9	-7	24.7	69	(N/A)	3.8	6.24
Green ash	2.5	0.4	1.2	0.1	13	9.0	1.3	1.3	8.6	56	0.0	0	24.4	70	(N/A)	3.1	7.73
Apple	0.8	0.1	0.4	0.0	4	4.3	0.6	0.6	4.0	26	0.0	0	10.8	31	(N/A)	3.1	3.41
Black poplar	1.6	0.3	0.9	0.1	9	9.1	1.3	1.3	8.7	57	0.0	0	23.2	66	(N/A)	2.8	8.22
Norway spruce	1.8	0.3	1.5	0.2	12	4.7	0.7	0.7	4.6	30	-6.5	-24	8.0	17	(N/A)	2.8	2.14
Honeylocust	2.4	0.4	1.1	0.1	13	6.7	1.0	0.9	6.4	42	-1.7	-6	17.2	48	(N/A)	2.8	5.99
Black spruce	0.4	0.1	0.3	0.0	2	1.6	0.2	0.2	1.5	10	-1.2	-4	3.1	8	(N/A)	2.4	1.12
Bur oak	2.9	0.5	1.3	0.1	15	5.6	0.8	0.8	5.4	35	0.0	0	17.3	50	(N/A)	1.7	9.99
Scotch pine	1.0	0.2	0.9	0.1	7	2.6	0.4	0.4	2.5	16	-3.8	-14	4.2	9	(N/A)	1.4	2.13
Cottonwood	1.6	0.3	0.8	0.1	8	5.7	0.8	0.8	5.3	35	0.0	0	15.3	44	(N/A)	1.4	10.93
Kentucky coffeetree	0.5	0.1	0.2	0.0	3	1.9	0.3	0.3	1.8	12	0.0	0	5.0	14	(N/A)	1.4	3.57
Littleleaf linden	0.6	0.1	0.3	0.0	3	2.4	0.4	0.3	2.3	15	-0.3	-1	6.1	17	(N/A)	1.0	5.73
Northern hackberry	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.5	4	(N/A)	1.0	1.38
Boxelder	0.2	0.0	0.1	0.0	1	1.9	0.3	0.3	1.8	12	-0.1	0	4.6	13	(N/A)	1.0	4.30
White ash	0.1	0.0	0.1	0.0	1	2.1	0.3	0.3	2.1	13	0.0	0	5.0	14	(N/A)	1.0	4.71
White oak	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.3	0.87
Ginkgo	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)	0.3	0.07
Eastern redbud	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.3	0.71
American sycamore	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.3	2.99
Southern magnolia	0.3	0.1	0.3	0.0	2	1.3	0.2	0.2	1.2	8	-0.9	-3	2.6	7	(N/A)	0.3	6.63
Black maple	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)	0.3	1.12
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)	0.3	9.47
Maple	0.3	0.1	0.2	0.0	2	1.2	0.2	0.2	1.2	7	-0.1	0	3.1	9	(N/A)	0.3	8.75
Swamp white oak	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)	0.3	7.92
Broadleaf Deciduous Medium	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	0.3	3.47
Basswood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.3	0.87

Epworth

Annual Air Quality Benefits of Public Trees

2/3/2022

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								
Amur maple	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)	0.3	6.56
Paper birch	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)	0.3	9.34
Citywide total	64.8	11.4	38.5	4.2	372	211.7	30.9	29.5	202.2	1,322	-93.5	-351	499.6	1,343	(N/A)	100.0	4.65

Table 4: Annual Carbon Stored

Epworth

Stored CO2 Benefits of Public Trees

2/3/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern red oak	79,722	598	(N/A)	11.8	6.4	17.59
Silver maple	258,774	1,941	(N/A)	10.4	20.9	64.69
Eastern white pine	65,723	493	(N/A)	8.7	5.3	19.72
Norway maple	74,172	556	(N/A)	7.6	6.0	25.29
Red maple	49,077	368	(N/A)	6.2	4.0	20.45
Pin oak	160,891	1,207	(N/A)	5.9	13.0	70.98
Blue spruce	19,577	147	(N/A)	5.5	1.6	9.18
Northern white cedar	27,739	208	(N/A)	4.8	2.2	14.86
Spruce	4,619	35	(N/A)	3.8	0.4	3.15
Sugar maple	67,534	507	(N/A)	3.8	5.4	46.05
Green ash	85,994	645	(N/A)	3.1	6.9	71.66
Apple	12,935	97	(N/A)	3.1	1.0	10.78
Black poplar	53,196	399	(N/A)	2.8	4.3	49.87
Norway spruce	14,966	112	(N/A)	2.8	1.2	14.03
Honeylocust	29,717	223	(N/A)	2.8	2.4	27.86
Black spruce	1,777	13	(N/A)	2.4	0.1	1.90
Bur oak	99,110	743	(N/A)	1.7	8.0	148.66
Scotch pine	9,026	68	(N/A)	1.4	0.7	16.92
Cottonwood	51,316	385	(N/A)	1.4	4.1	96.22
Kentucky coffeetree	16,156	121	(N/A)	1.4	1.3	30.29
Littleleaf linden	12,838	96	(N/A)	1.0	1.0	32.09
Northern hackberry	435	3	(N/A)	1.0	0.0	1.09
Boxelder	5,825	44	(N/A)	1.0	0.5	14.56
White ash	5,741	43	(N/A)	1.0	0.5	14.35
White oak	185	1	(N/A)	0.3	0.0	1.39
Ginkgo	5	0	(N/A)	0.3	0.0	0.03
Eastern redbud	178	1	(N/A)	0.3	0.0	1.33
American sycamore	1,035	8	(N/A)	0.3	0.1	7.76
Southern magnolia	4,397	33	(N/A)	0.3	0.4	32.98
Black maple	218	2	(N/A)	0.3	0.0	1.64
Siberian elm	6,743	51	(N/A)	0.3	0.5	50.57
Maple	3,624	27	(N/A)	0.3	0.3	27.18
Swamp white oak	3,624	27	(N/A)	0.3	0.3	27.18
Broadleaf Deciduous	1,101	8	(N/A)	0.3	0.1	8.26
Basswood	185	1	(N/A)	0.3	0.0	1.39
Amur maple	3,037	23	(N/A)	0.3	0.2	22.78
Paper birch	8,458	63	(N/A)	0.3	0.7	63.43
Citywide total	1,239,647	9,297	(N/A)	100.0	100.0	32.17

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

Epworth

Annual CO $_2$ Benefits of Public Trees

2/3/2022

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
Northern red oak	5,801	44	-383	-45	-3	6,376	48	11,749	88 (N/A)	11.8	7.1	2.59
Silver maple	22,970	172	-1,245	-70	-10	11,344	85	32,998	247 (N/A)	10.4	20.0	8.25
Eastern white pine	3,570	27	-315	-55	-3	5,034	38	8,234	62 (N/A)	8.7	5.0	2.47
Norway maple	5,877	44	-358	-34	-3	5,481	41	10,966	82 (N/A)	7.6	6.7	3.74
Red maple	6,366	48	-236	-27	-2	5,206	39	11,309	85 (N/A)	6.2	6.9	4.71
Pin oak	16,475	124	-772	-46	-6	7,744	58	23,401	176 (N/A)	5.9	14.2	10.32
Blue spruce	1,285	10	-94	-28	-1	2,709	20	3,873	29 (N/A)	5.5	2.3	1.82
Northern white cedar	1,794	13	-133	-29	-1	2,757	21	4,388	33 (N/A)	4.8	2.7	2.35
Spruce	600	5	-22	-12	0	1,115	8	1,681	13 (N/A)	3.8	1.0	1.15
Sugar maple	4,237	32	-326	-22	-3	3,550	27	7,439	56 (N/A)	3.8	4.5	5.07
Green ash	3,554	27	-413	-20	-3	3,196	24	6,318	47 (N/A)	3.1	3.8	5.27
Apple	1,305	10	-62	-11	-1	1,465	11	2,696	20 (N/A)	3.1	1.6	2.25
Black poplar	4,381	33	-255	-19	-2	3,214	24	7,320	55 (N/A)	2.8	4.4	6.86
Norway spruce	1,077	8	-72	-17	-1	1,700	13	2,687	20 (N/A)	2.8	1.6	2.52
Honeylocust	4,066	30	-143	-12	-1	2,367	18	6,279	47 (N/A)	2.8	3.8	5.89
Black spruce	195	1	-9	-6	0	543	4	724	5 (N/A)	2.4	0.4	0.78
Bur oak	1,913	14	-476	-14	-4	1,993	15	3,417	26 (N/A)	1.7	2.1	5.13
Scotch pine	606	5	-43	-9	0	926	7	1,479	11 (N/A)	1.4	0.9	2.77
Cottonwood	2,939	22	-246	-12	-2	1,974	15	4,654	35 (N/A)	1.4	2.8	8.73
Kentucky coffeetree	1,008	8	-78	-5	-1	654	5	1,579	12 (N/A)	1.4	1.0	2.96
Littleleaf linden	1,527	11	-62	-6	-1	850	6	2,310	17 (N/A)	1.0	1.4	5.77
Northern hackberry	85	1	-2	-2	0	214	2	296	2 (N/A)	1.0	0.2	0.74
Boxelder	780	6	-28	-4	0	682	5	1,430	11 (N/A)	1.0	0.9	3.57
White ash	858	6	-28	-4	0	760	6	1,586	12 (N/A)	1.0	1.0	3.96
White oak	74	1	-1	-1	0	49	0	121	1 (N/A)	0.3	0.1	0.91
Ginkgo	2	0	0	0	0	4	0	6	0 (N/A)	0.3	0.0	0.04
Eastern redbud	38	0	-1	-1	0	37	0	74	1 (N/A)	0.3	0.0	0.55
American sycamore	209	2	-5	-1	0	159	1	361	3 (N/A)	0.3	0.2	2.71
Southern magnolia	260	2	-21	-3	0	451	3	687	5 (N/A)	0.3	0.4	5.15
Black maple	39	0	-1	-1	0	60	0	97	1 (N/A)	0.3	0.1	0.73
Siberian elm	485	4	-32	-3	0	447	3	897	7 (N/A)	0.3	0.5	6.73
Maple	483	4	-17	-2	0	431	3	895	7 (N/A)	0.3	0.5	6.71

Annual CO $_2$ Benefits of Public Trees

2/3/2022

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
Swamp white oak	386	3	-17	-2	0	395	3	762	6 (N/A)	0.3	0.5	5.71
Broadleaf Deciduous Medi	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.2	2.95
Basswood	74	1	-1	-1	0	49	0	121	1 (N/A)	0.3	0.1	0.91
Amur maple	268	2	-15	-2	0	308	2	560	4 (N/A)	0.3	0.3	4.20
Paper birch	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.3	0.6	7.93
Citywide total	96,469	724	-5,957	-528	-49	74,861	561	164,845	1,236 (N/A)	100.0	100.0	4.28

Table 6: Annual Social and Aesthetic Benefits

Epworth

Annual Aesthetic/Other Benefits of Public Trees

2/3/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern red oak	541	(N/A)	11.8	4.8	15.91
Silver maple	2,078	(N/A)	10.4	18.4	69.25
Eastern white pine	815	(N/A)	8.7	7.2	32.61
Norway maple	608	(N/A)	7.6	5.4	27.63
Red maple	864	(N/A)	6.2	7.7	48.00
Pin oak	1,429	(N/A)	5.9	12.7	84.04
Blue spruce	318	(N/A)	5.5	2.8	19.85
Northern white cedar	438	(N/A)	4.8	3.9	31.27
Spruce	184	(N/A)	3.8	1.6	16.71
Sugar maple	462	(N/A)	3.8	4.1	41.99
Green ash	344	(N/A)	3.1	3.0	38.21
Apple	74	(N/A)	3.1	0.7	8.24
Black poplar	405	(N/A)	2.8	3.6	50.60
Norway spruce	286	(N/A)	2.8	2.5	35.74
Honeylocust	913	(N/A)	2.8	8.1	114.18
Black spruce	102	(N/A)	2.4	0.9	14.58
Bur oak	153	(N/A)	1.7	1.4	30.55
Scotch pine	159	(N/A)	1.4	1.4	39.70
Cottonwood	240	(N/A)	1.4	2.1	59.92
Kentucky coffeetree	100	(N/A)	1.4	0.9	25.08
Littleleaf linden	168	(N/A)	1.0	1.5	55.92
Northern hackberry	32	(N/A)	1.0	0.3	10.54
Boxelder	94	(N/A)	1.0	0.8	31.19
White ash	131	(N/A)	1.0	1.2	43.53
White oak	15	(N/A)	0.3	0.1	14.73
Ginkgo	0	(N/A)	0.3	0.0	0.37
Eastern redbud	2	(N/A)	0.3	0.0	2.06
American sycamore	29	(N/A)	0.3	0.3	28.56
Southern magnolia	41	(N/A)	0.3	0.4	41.22
Black maple	7	(N/A)	0.3	0.1	7.28
Siberian elm	40	(N/A)	0.3	0.4	39.94
Maple	66	(N/A)	0.3	0.6	65.89
Swamp white oak	39	(N/A)	0.3	0.3	39.16
Broadleaf Deciduous Medium	26	(N/A)	0.3	0.2	26.22
Basswood	15	(N/A)	0.3	0.1	14.73
Amur maple	15	(N/A)	0.3	0.1	15.48
Paper birch	58	(N/A)	0.3	0.5	57.69
Citywide total	11,289	(N/A)	100.0	100.0	39.06

Table 7: Summary of Benefits in Dollars

Epworth

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

2/3/2022

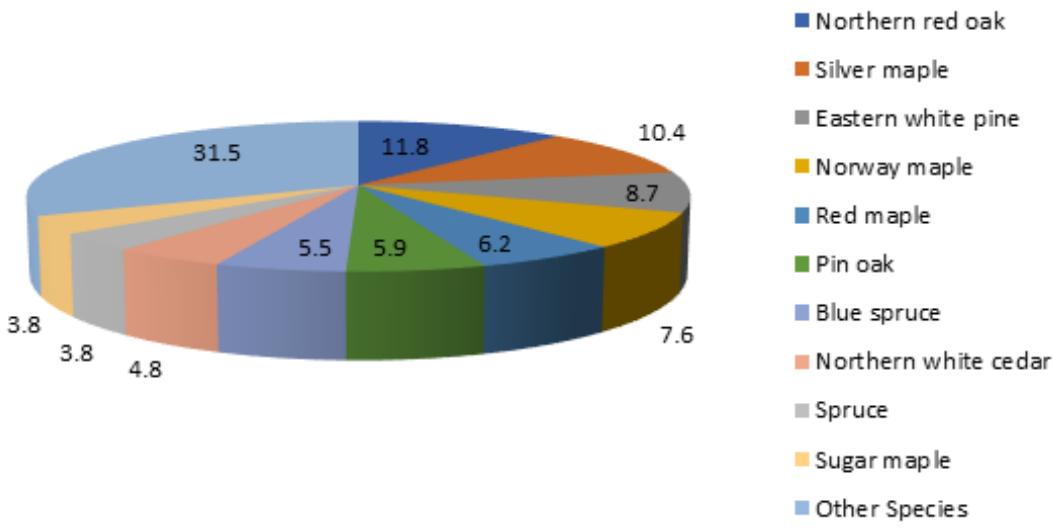
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	9,248	(N/A)	32.00	(N/A)	0.00	(N/A)
CO2	1,236	(N/A)	4.28	(N/A)	0.00	(N/A)
Air Quality	1,343	(N/A)	4.65	(N/A)	0.00	(N/A)
Stormwater	12,536	(N/A)	43.38	(N/A)	0.00	(N/A)
Aesthetic/Other	11,289	(N/A)	39.06	(N/A)	0.00	(N/A)
Total Benefits	35,652	(N/A)	123.36	(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	35,652	(N/A)	123.36	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Epworth

Species Distribution of Public Trees

2/3/2022



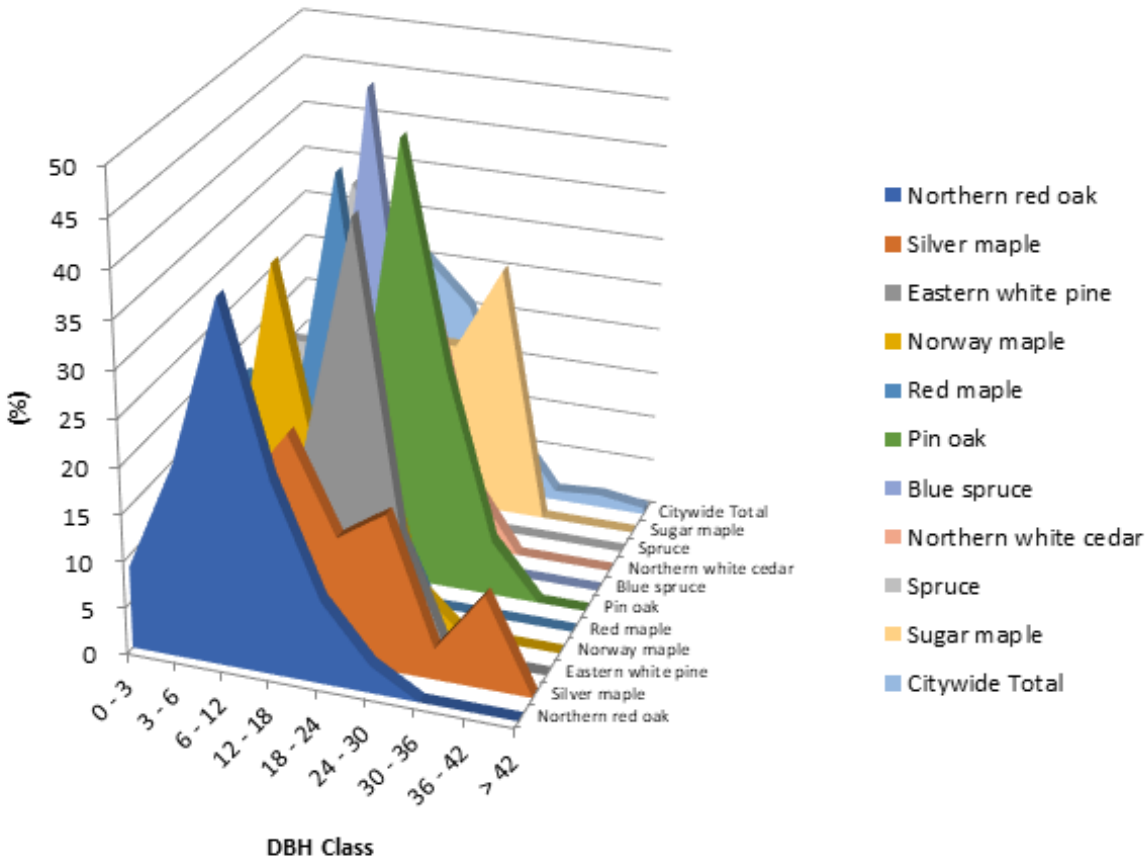
Species	Percent
Northern red oak	11.8
Silver maple	10.4
Eastern white pine	8.7
Norway maple	7.6
Red maple	6.2
Pin oak	5.9
Blue spruce	5.5
Northern white cedar	4.8
Spruce	3.8
Sugar maple	3.8
Other Species	31.5
Total	100.0

Figure 2: Relative Age Class

Epworth

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

2/3/2022



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Northern red oak	8.82	20.59	38.24	20.59	8.82	2.94	0.00	0.00	0.00
Silver maple	3.33	13.33	16.67	23.33	13.33	16.67	3.33	10.00	0.00
Eastern white pine	4.00	12.00	8.00	20.00	44.00	12.00	0.00	0.00	0.00
Norway maple	13.64	9.09	36.36	13.64	22.73	4.55	0.00	0.00	0.00
Red maple	5.56	22.22	16.67	44.44	11.11	0.00	0.00	0.00	0.00
Pin oak	0.00	0.00	11.76	11.76	47.06	23.53	5.88	0.00	0.00
Blue spruce	6.25	18.75	6.25	50.00	12.50	6.25	0.00	0.00	0.00
Northern white cedar	0.00	0.00	28.57	35.71	28.57	7.14	0.00	0.00	0.00
Spruce	18.18	18.18	36.36	27.27	0.00	0.00	0.00	0.00	0.00
Sugar maple	9.09	18.18	9.09	18.18	18.18	27.27	0.00	0.00	0.00
Citywide Total	8.65	12.80	21.45	25.61	20.76	7.61	1.04	1.38	0.69

Figure 3: Foliage Condition

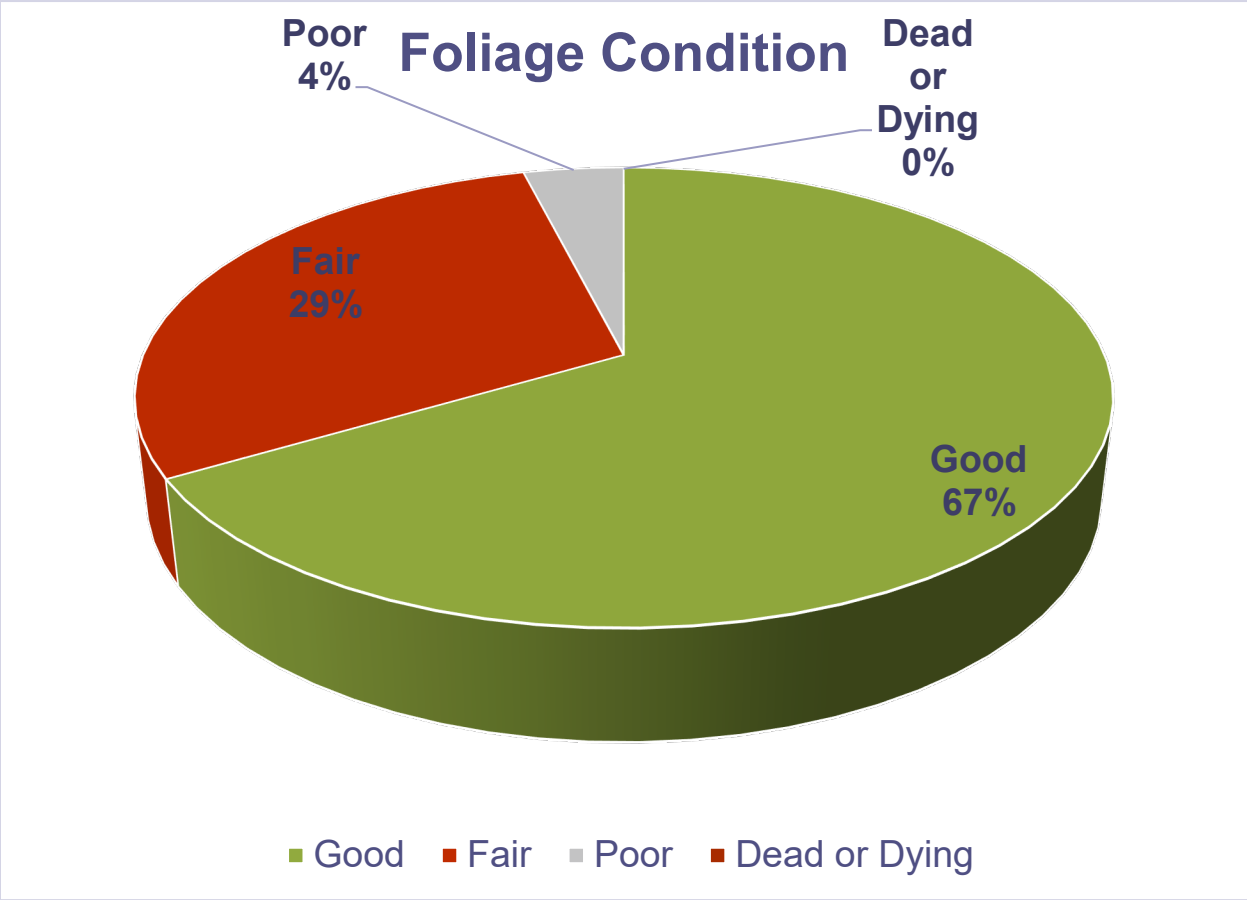


Figure 4: Wood Condition

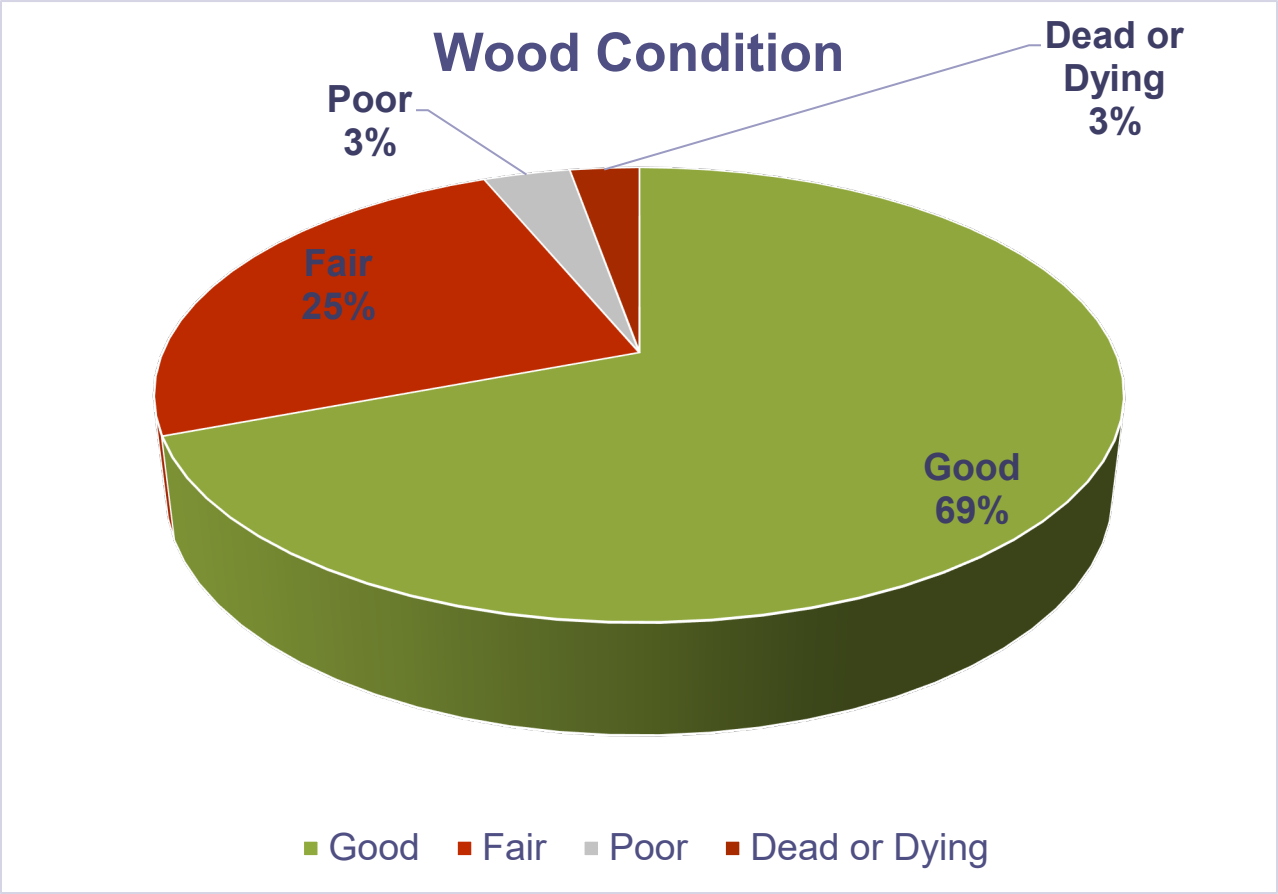
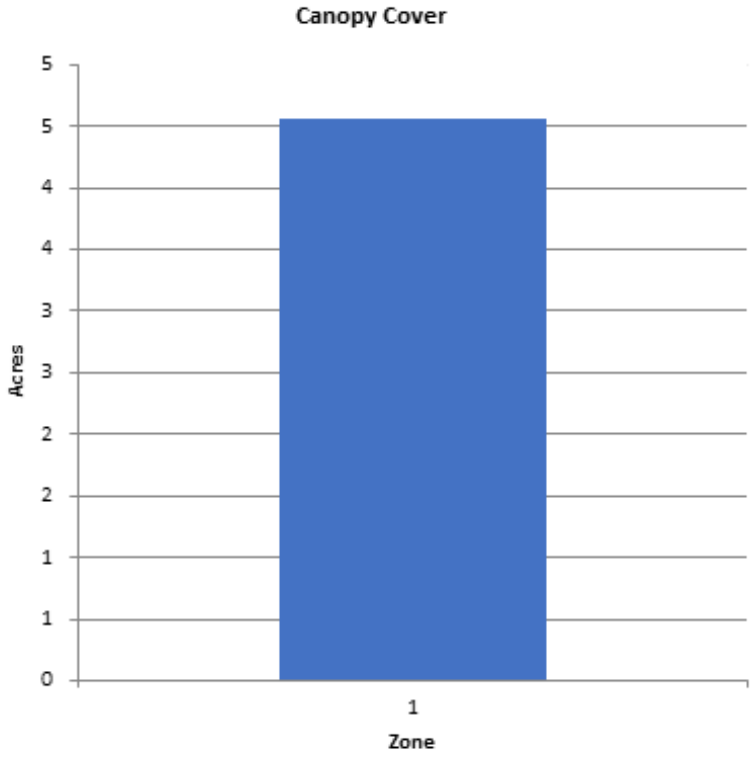


Figure 5: Canopy Cover in Acres

Epworth

Canopy Cover of Public Trees (Acres)

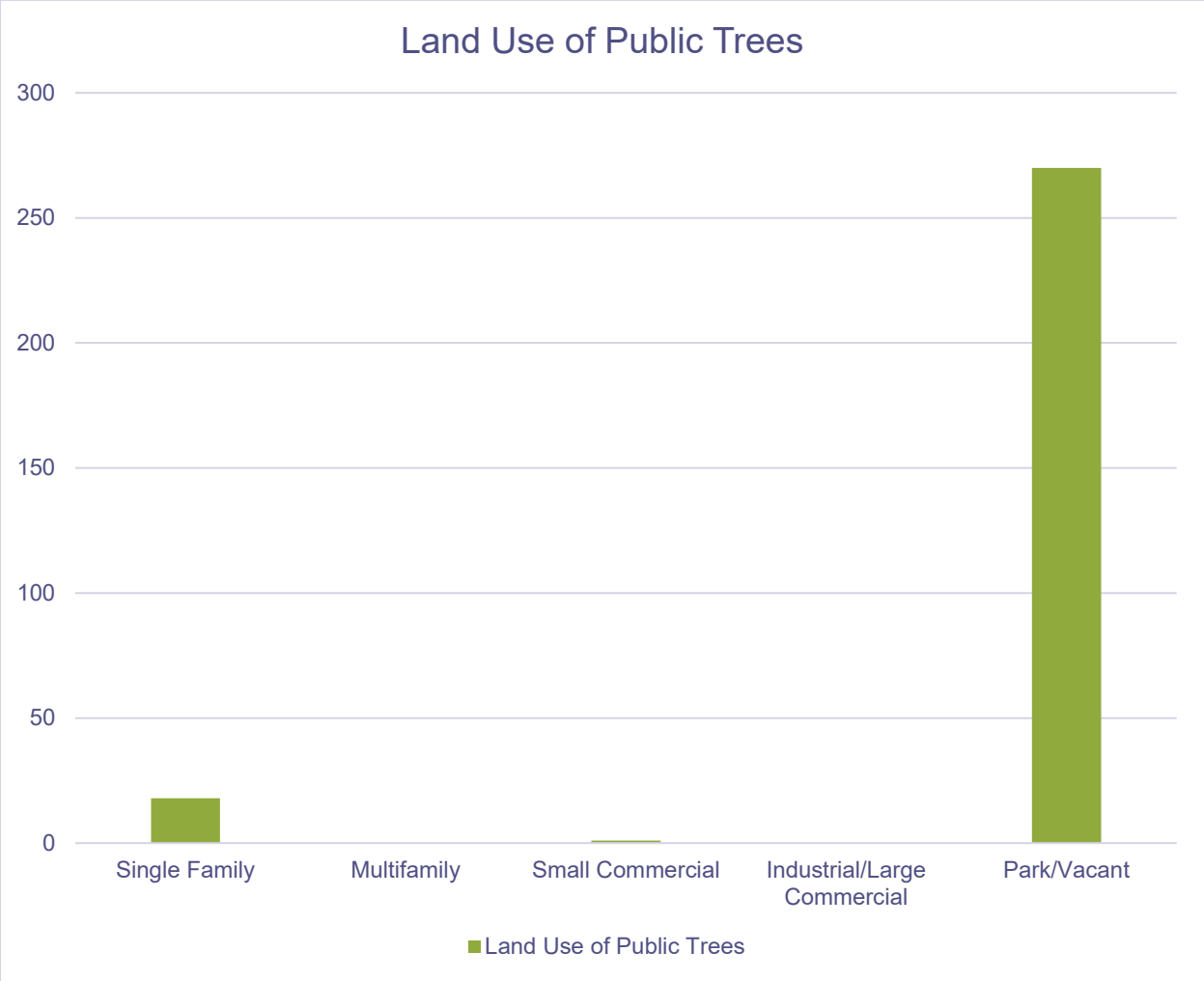
2/3/2022



Zone	Acres	% of Total Canopy Cover
1	5	100.0
Citywide total	5	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	5	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

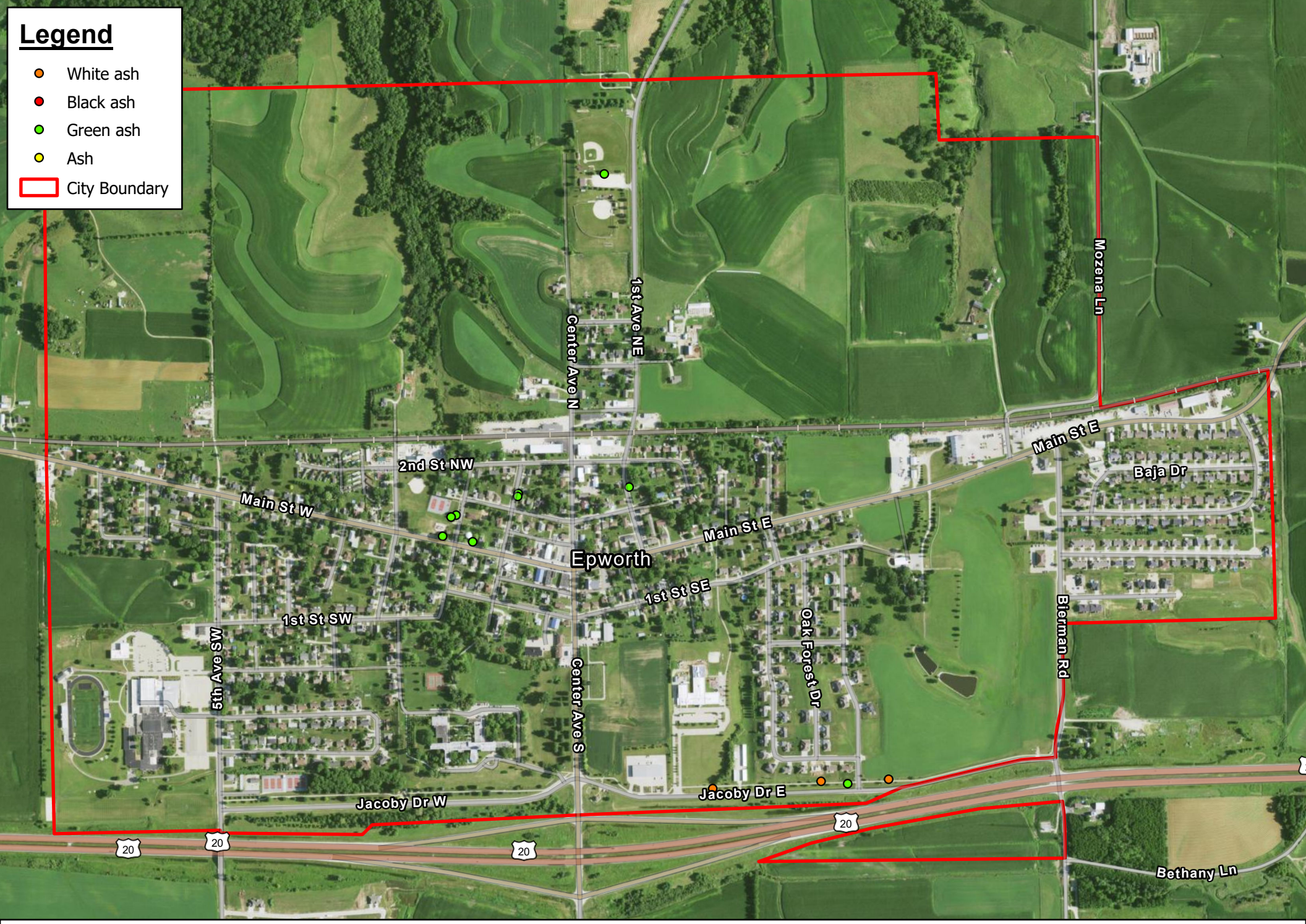
Figure 1: Location of Ash Trees

Figure 2: Location of EAB Symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

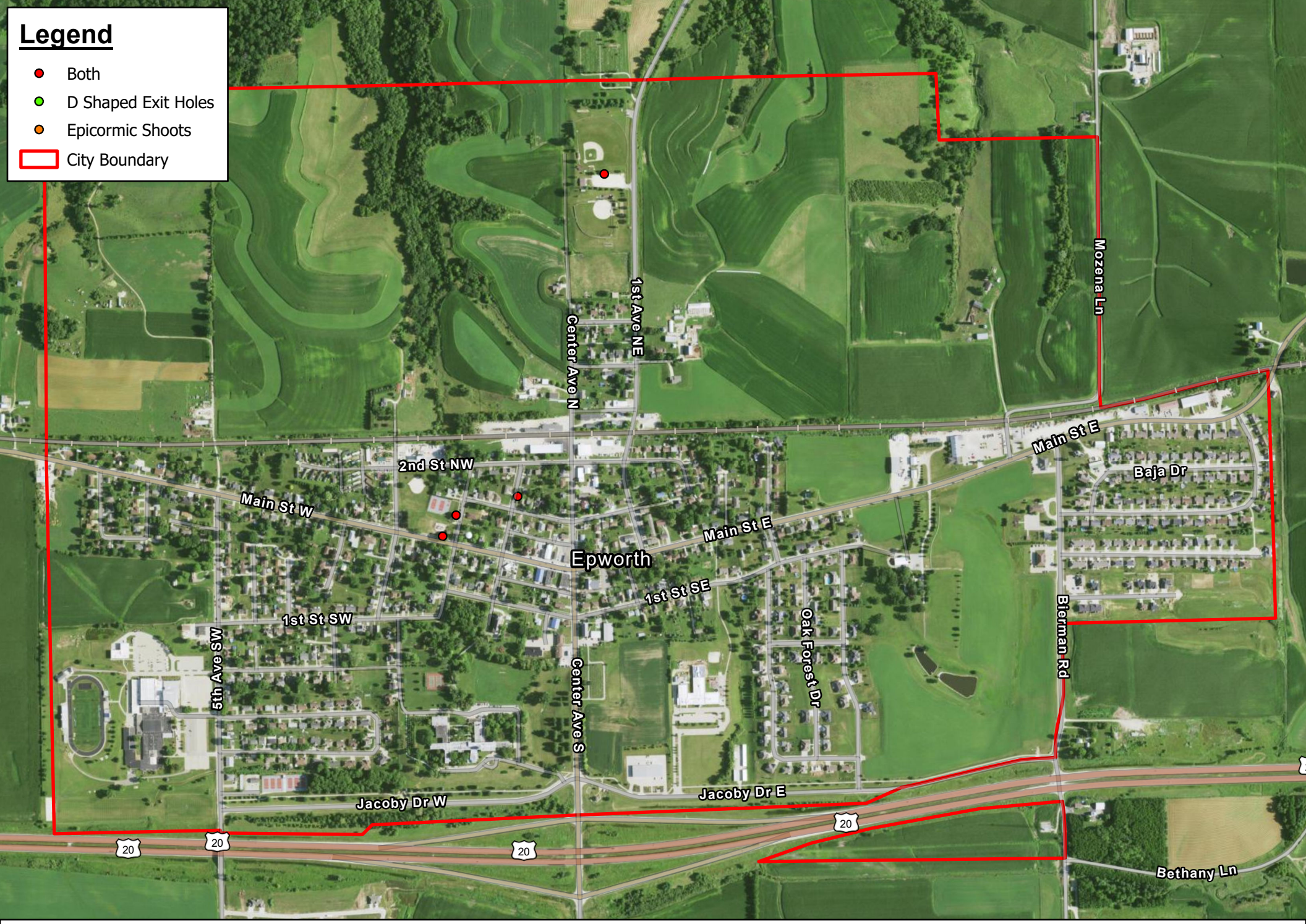
City ownership of the trees recommended for removal should be verified prior to any removal



Ash Tree Location

0 437.5 875 1,750 Feet

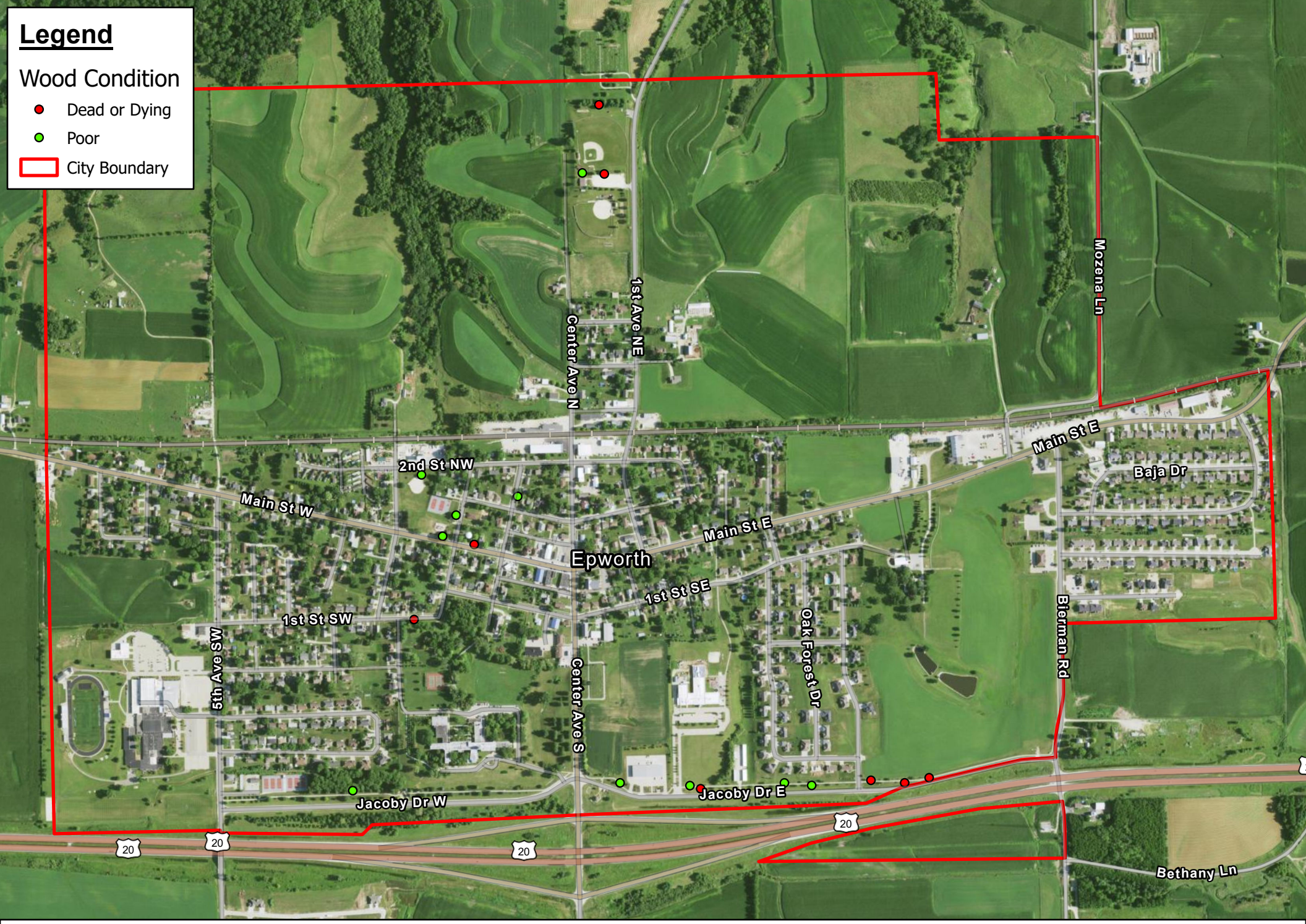
N



EAB Signs/Symptoms

0 437.5 875 1,750 Feet

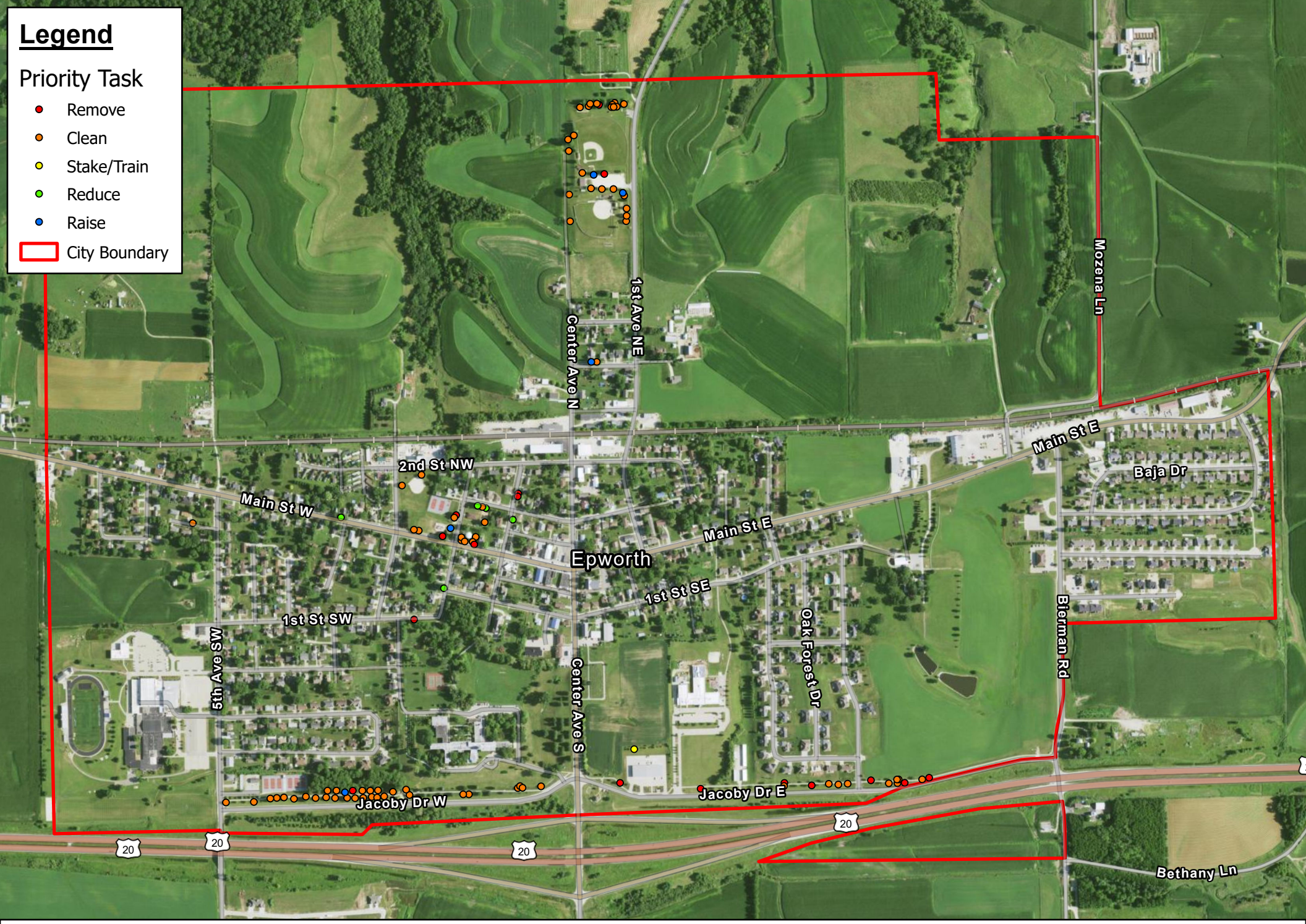
N



Poor Condition Trees

0 437.5 875 1,750 Feet

N



Priority Task

0 437.5 875 1,750 Feet

N

APPENDIX C: EPWORTH TREE ORDINANCES

8.12.010 Short Title.

This chapter shall be known and may be cited as the "Epworth Tree Ordinance". (Ord. 357 Sec.1, 1973)

8.12.010 City Forester--Appointment--Authority.

1. The Council shall designate the Supervisor of Public Works to act as City Forester.

2. The City Forester shall have jurisdiction over all trees and other plantings on the streets within the City in order to provide orderly tree planting, to protect the health of all trees from disease, and to require trees and plantings to be maintained in a manner not dangerous to public safety. (Ord. 357 Sec.2, 1973, amended 1988 codification)

8.12.030 City Forester--Powers and Duties.

The City Forester shall have the authority and it shall be their duty to prevent the indiscriminate trimming or removal of trees or plants within streets. They shall have the authority to regulate new planting of trees or other plantings in streets in accordance with street tree planting regulations approved by the Council and on file in the office of the Clerk. The City Forester shall have the authority to order private persons to comply with duties placed upon them by this chapter. The City Forester shall have supervision of all work by City employees or contractors in the trimming, preservation, planting, or removal of trees or other plantings in the streets. (Ord. 357 Sec.3, 1973)

8.12.040 Duties of Private Owners--Planting of Certain Trees Discouraged.

It shall be the duty of any person growing a tree or other plantings on private property abutting on streets or public places:

1. To trim their trees or plantings so that they shall not cause a hazard to the public or block public walks or ways or interfere with proper lighting of public 2021 streets or places. The minimum clearance of any overhanging portion shall be eight feet over walks and fourteen feet above the surface of the traveled portion of the street;

2. To not plant any tree or other planting on private property which would cause a public danger or nuisance;

3. To not plant any tree nearer than four feet to the sidewalk line or alley right-of-way line;

4. To treat in an accepted manner or remove any tree or plant so diseased or insect-ridden as to constitute a hazard to other trees and especially those dangerous to trees or plants in public streets or places;

5. To not plant any of the following species: cottonwood (unless cotton less), cotton-bearing poplar, or box-elder. (Ord. 357 Sec. 4, 1973)

8.12.050 Trees Infected with Dutch Elm Disease--Removal--Hearing

City to do work when. The owner, occupant, or person in charge of any private property shall remove at their own expense any tree, brush, wood, or debris infected with Dutch elm disease found thereon when so notified by the City Forester. The City Forester shall cause to be mailed such owner, occupant or person written notice that they may appear before the City Council at an appointed time not less than fourteen days from the date of mailing to show cause why said tree, brush, wood, or debris should not be declared a public nuisance. At said meeting the City Council may resolve and declare the same to be a public nuisance and may order its removal by said owner, occupant, or person. In the event said owner, occupant, or person fails to comply with the resolution and order of the City Council to so remove said public nuisance, the City Forester shall cause said public nuisance to be removed and shall submit the costs incident to said service and removal to the City Council, which shall certify the same to the County Auditor for collection with and in the same manner as general property taxes. (Ord. 357 Sec.5, 1973)

8.12.060 Trees Infected with Dutch Elm Disease--Removal from parkway.

If such infected or diseased trees are located in the parkway of any private property between the street or curb line and property line, then in that event, the Council shall immediately cause such infected or diseased trees to be removed and burned at its own cost in such a manner as to prevent as fully as possible the spread of such disease. (Ord. 357 Sec.6,'73)

8.12.080 Abuse of Trees Prohibited--Trimming Restrictions.

No person shall willfully damage, cut, carve, pick the seed of, or injure the bark of any tree or plant on the streets or public places of the City. Tree trimming shall be done in accordance with good practice and the regulations of the City. (Ord. 357 Sec.8, 1973)

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

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