Inwood, IA

Urban Forestry Management Plan

SUMMER 2021

JEO CONSULTING GROUP

Table of Contents

Table of Contents

Table of Contents

Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Inwood 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 42.5% of Inwood'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 258 trees inventoried.

- Inwood's trees provide $69,370 of benefits annually, an average of $268.88 per tree
- There are over 18 species of trees
- The top three genera are: Ash 42.5%, Maple 37%, and Basswood/Linden 5%
- 61% of trees need some type of management
- 37 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 37 trees needing removal, 25 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*
- All 110 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 42 years to remove ash. We suggest that city officials request a budget increase to $3,500 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

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

Assist Inwood 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 258 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. Inwood's trees reduce energy-related costs by approximately $16,967 annually (Appendix A, Table 1). These savings are both in electricity (80.6 MWh) and in natural gas ($11,069 Therms).

Annual Stormwater Benefits

Inwood's trees intercept about 1,017,887 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $27,585 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 Inwood, it is estimated that trees remove 1,092.0 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 $3,098 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Inwood, trees sequester about 235,386 lbs of carbon per year with an associated value of $1,765 (Appendix A, Table 5). In addition, the trees store 4,534,136 lbs of carbon, with a yearly benefit of $34,006 (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. Inwood receives $19,111 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, Inwood's trees provide $69,370 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 258 trees in Inwood provide approximately $268.88 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$16,967**	• Intercept **1,017,887 gallons** • Provides **$27,585** benefit	• Remove **1,092.0 lbs** of pollution • Net value of **$3,098**	• Sequester **235,386 lbs** • Value of **$1,765** • Store **4,534,136 lbs** • Value of **$34,006**	• **$19,111** in social benefits	• **$69,370** annual benefits • Each tree provides **$268.88** annually

FOREST STRUCTURE

Species Distribution

Inwood has over 18 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Ash	110	42.5%	Oak	4	1.5%
Maple	95	37%	Walnut	4	1.5%
Basswood/Linden	14	5%	Mountain ash	2	<1%
Honeylocust	10	4%	Apple (Crab)	2	<1%
Hackberry	8	3%	Cherry plum	1	<1%
Spruce	7	3%	Chokecherry	1	<1%

Age Class

Most of Inwood's trees (48.5%) 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. Inwood's size curve is on the larger side, indicating an 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 Inwood indicate that 86% of the trees are in good or fair health, with only 14% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 76% of Inwood's trees are in good or fair health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Twenty-four percent of the tree population's wood condition is in poor health, dead, or dying. This 24% 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	141	54.5%
Crown Reduction	11	4%
Tree Removal	37	14%
Crown Raising	6	2%
Tree Staking	0	0%

Canopy Cover

The total canopy with both private and public trees is 50.31 acres or 6% cover. The canopy cover included in the Inwood inventory includes approximately 10 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 20% in 30 years. To achieve this goal it is estimated that 20 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Inwood's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure 7). The following describes the land use and locations for the street and park trees.

Land Use	Percentage
Single Family Residential	58%
Industrial/Large Commercial	0%
Park/Vacant/Other	42%
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

Inwood has 37 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 25 trees 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 of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 158 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 37 removals, 28 are ash trees. There are a total of 110 ash trees, and 110 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 Schedule and Budget 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 Inwood.

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 (37%) and ash (42.5%) (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, black walnut, willows, evergreens, boxelder, and Siberian elm. All trees planted must meet the restrictions in city ordinance 3.09 (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 3.09 (Appendix C): "The Tree Board shall develop and maintain a list of desirable trees for planting along streets in three classes: small, medium and large. A list of tree species not suitable for planting as Street Trees will also be created and enforced by the Tree Board." We recommend species such as Kentucky coffeetree, ginkgo, swamp white oak, Honeylocust, 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.

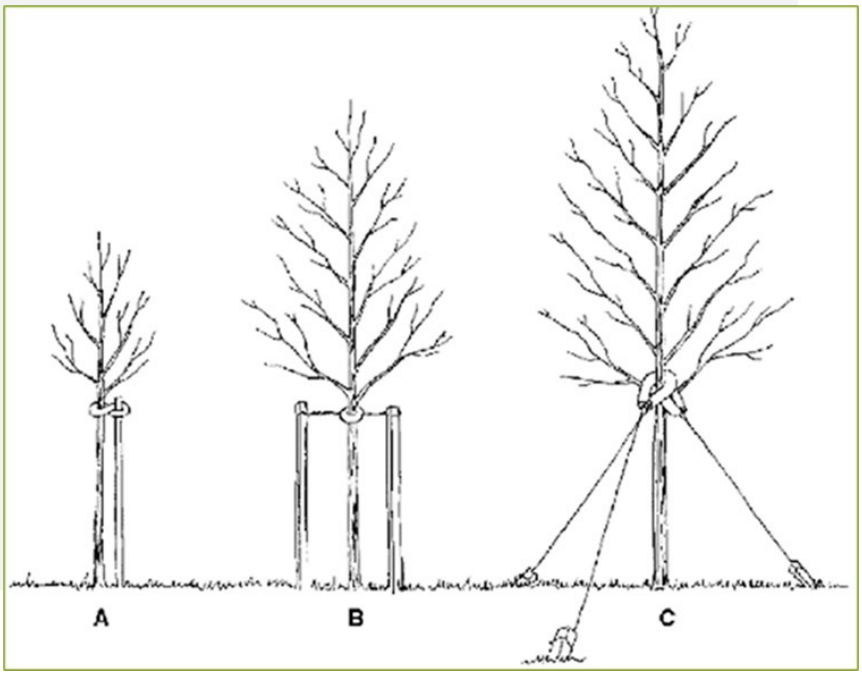
Monitoring

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 3.07 states “The City Tree Board shall recommend the removal of any dead or diseased trees on private property within the city, when such trees constitute a hazard to life and property, or harbor insects or disease which constitutes a potential threat to other trees within the City. Per Iowa Code 364.12(e), the property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. This City will be responsible TITLE VI 250 for the removal and cost of such diseased or dead wood on publicly owned property or right-of-way.”

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $1,850/Year – (Based off estimated $2 per capita calculation)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

YEAR 2	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

YEAR 4	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

YEAR 5	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

YEAR 6	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,795**

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 $12,850 a year. If the budget were increased to $3,500 a year all ash could be removed in 22 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $3,500/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

YEAR 2	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

YEAR 3	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

YEAR 4	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

YEAR 5	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

YEAR 6	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 5 trees in open locations	$750
Prune 1/6 of city owned trees	$645
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$3,495**

Proposed Budget Increase

EAB could potentially kill all ash trees in Inwood within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $12,850 a year. If the

budget were increased to $3,500 per year all ash could be removed within 22 years. Additionally, we recommend that Inwood 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 4 trees could be treated per year (every other year treatment). Four trees would be selected for treatment, and Inwood would still need to find $74,200 for removal of ash. Alternatively, if there are 8 treatable trees, it would cost approximately $2,400 a year for treatment and leave $71,400 for removal of all ash. 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 Inwood. 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

Inwood

Annual Energy Benefits of Public Trees

2/18/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	33.3	2,527	4,616.9	4,525	7,051	(N/A)	40.3	41.6	67.80
Silver maple	22.4	1,704	2,980.6	2,921	4,625	(N/A)	23.6	27.3	75.82
Norway maple	8.4	634	1,214.8	1,191	1,825	(N/A)	11.2	10.8	62.92
Honeylocust	3.0	224	406.2	398	623	(N/A)	3.9	3.7	62.25
Northern hackberry	3.2	247	455.2	446	693	(N/A)	3.1	4.1	86.58
American basswood	2.5	188	350.2	343	531	(N/A)	2.7	3.1	75.83
Littleleaf linden	1.2	88	144.6	142	230	(N/A)	2.7	1.4	32.86
Blue spruce	1.1	83	151.0	148	231	(N/A)	2.7	1.4	33.07
White ash	1.2	94	145.7	143	237	(N/A)	2.3	1.4	39.45
Black walnut	1.5	116	208.6	204	320	(N/A)	1.6	1.9	80.00
Sugar maple	0.9	70	128.0	125	196	(N/A)	1.6	1.2	48.91
Northern red oak	0.3	25	47.2	46	72	(N/A)	1.2	0.4	23.90
Mountain ash	0.4	29	56.3	55	84	(N/A)	0.8	0.5	42.14
Apple	0.2	16	28.5	28	44	(N/A)	0.8	0.3	21.77
Cherry plum	0.2	14	24.7	24	38	(N/A)	0.4	0.2	38.13
Pin oak	0.3	25	46.0	45	71	(N/A)	0.4	0.4	70.52
Common chokecherry	0.2	14	24.7	24	38	(N/A)	0.4	0.2	38.13
Red maple	0.3	22	39.9	39	61	(N/A)	0.4	0.4	60.68
Total	80.6	6,120	11,069.0	10,848	16,967	(N/A)	100.0	100.0	65.76

Table 2: Annual Stormwater Benefits

Inwood

Annual Stormwater Benefits of Public Trees

2/18/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	407,588	11,046	(N/A)	40.3	40.0	106.21
Silver maple	343,176	9,300	(N/A)	23.6	33.7	152.46
Norway maple	85,824	2,326	(N/A)	11.2	8.4	80.20
Honeylocust	28,554	774	(N/A)	3.9	2.8	77.38
Northern hackberry	35,377	959	(N/A)	3.1	3.5	119.84
American basswood	37,735	1,023	(N/A)	2.7	3.7	146.09
Littleleaf linden	7,219	196	(N/A)	2.7	0.7	27.95
Blue spruce	18,480	501	(N/A)	2.7	1.8	71.54
White ash	8,990	244	(N/A)	2.3	0.9	40.60
Black walnut	20,811	564	(N/A)	1.6	2.0	140.99
Sugar maple	10,403	282	(N/A)	1.6	1.0	70.48
Northern red oak	3,365	91	(N/A)	1.2	0.3	30.40
Mountain ash	1,841	50	(N/A)	0.8	0.2	24.94
Apple	735	20	(N/A)	0.8	0.1	9.96
Cherry plum	667	18	(N/A)	0.4	0.1	18.06
Pin oak	3,591	97	(N/A)	0.4	0.4	97.30
Common chokecherry	667	18	(N/A)	0.4	0.1	18.06
Red maple	2,867	78	(N/A)	0.4	0.3	77.70
Citywide total	1,017,887	27,585	(N/A)	100.0	100.0	106.92

Table 3: Annual Air Quality Benefits

Inwood

Annual Air Quality Benefits of Public Trees

2/18/2022

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	56.9	9.1	26.4	2.5	300	159.5	23.2	22.1	150.9	992	0.0	0	450.5	1,293	(N/A)	40.3	12.43
Silver maple	65.4	11.1	31.6	2.9	351	106.1	15.5	14.8	101.5	663	-35.3	-132	313.6	882	(N/A)	23.6	14.46
Norway maple	18.5	3.2	8.9	0.8	99	40.6	5.9	5.6	37.9	251	-4.2	-16	117.1	335	(N/A)	11.2	11.54
Honeylocust	5.4	0.9	2.5	0.2	29	14.1	2.1	2.0	13.4	88	-3.8	-14	36.7	102	(N/A)	3.9	10.20
Northern hackberry	6.9	1.2	3.4	0.3	37	15.6	2.3	2.2	14.7	97	0.0	0	46.6	134	(N/A)	3.1	16.79
American basswood	6.1	1.0	2.8	0.3	33	11.9	1.7	1.6	11.2	74	-4.9	-18	31.8	88	(N/A)	2.7	12.57
Littleleaf linden	0.9	0.1	0.5	0.0	5	5.4	0.8	0.8	5.3	34	-0.5	-2	13.3	37	(N/A)	2.7	5.32
Blue spruce	3.2	0.6	2.6	0.4	21	5.2	0.8	0.7	5.0	33	-7.1	-27	11.4	27	(N/A)	2.7	3.83
White ash	0.7	0.1	0.4	0.0	4	5.7	0.8	0.8	5.6	36	0.0	0	14.2	40	(N/A)	2.3	6.67
Black walnut	3.4	0.5	1.5	0.2	18	7.3	1.1	1.0	6.9	45	0.0	0	21.9	63	(N/A)	1.6	15.83
Sugar maple	1.4	0.2	0.7	0.1	7	4.4	0.6	0.6	4.2	28	-1.1	-4	11.1	31	(N/A)	1.6	7.73
Northern red oak	0.7	0.1	0.3	0.0	4	1.6	0.2	0.2	1.5	10	-1.0	-4	3.8	10	(N/A)	1.2	3.32
Mountain ash	0.6	0.1	0.3	0.0	3	1.9	0.3	0.3	1.7	12	0.0	0	5.2	15	(N/A)	0.8	7.45
Apple	0.2	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	0.0	0	2.6	7	(N/A)	0.8	3.63
Cherry plum	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
Pin oak	0.6	0.1	0.3	0.0	3	1.6	0.2	0.2	1.5	10	-1.1	-4	3.5	9	(N/A)	0.4	9.04
Common chokecherry	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
Red maple	0.7	0.1	0.3	0.0	4	1.4	0.2	0.2	1.3	8	-0.2	-1	4.0	12	(N/A)	0.4	11.54
Citywide total	172.0	28.7	82.9	7.9	922	385.1	56.0	53.4	365.3	2,398	-59.4	-223	1,092.0	3,098	(N/A)	100.0	12.01

Table 4: Annual Carbon Stored

Inwood

Stored CO2 Benefits of Public Trees

2/18/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,880,721	14,105	(N/A)	40.3	41.5	135.63
Silver maple	1,648,831	12,366	(N/A)	23.6	36.4	202.73
Norway maple	303,831	2,279	(N/A)	11.2	6.7	78.58
Honeylocust	67,094	503	(N/A)	3.9	1.5	50.32
Northern hackberry	112,357	843	(N/A)	3.1	2.5	105.34
American basswood	239,231	1,794	(N/A)	2.7	5.3	256.32
Littleleaf linden	20,024	150	(N/A)	2.7	0.4	21.45
Blue spruce	28,247	212	(N/A)	2.7	0.6	30.26
White ash	20,693	155	(N/A)	2.3	0.5	25.87
Black walnut	116,326	872	(N/A)	1.6	2.6	218.11
Sugar maple	38,915	292	(N/A)	1.6	0.9	72.97
Northern red oak	15,612	117	(N/A)	1.2	0.3	39.03
Mountain ash	9,780	73	(N/A)	0.8	0.2	36.67
Apple	3,215	24	(N/A)	0.8	0.1	12.06
Cherry plum	3,037	23	(N/A)	0.4	0.1	22.78
Pin oak	15,239	114	(N/A)	0.4	0.3	114.29
Common chokecherry	3,037	23	(N/A)	0.4	0.1	22.78
Red maple	7,945	60	(N/A)	0.4	0.2	59.59
Citywide total	4,534,136	34,006	(N/A)	100.0	100.0	131.81

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

Inwood

Annual CO $_2$ Benefits of Public Trees

2/18/2022

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	76,400	573	-9,027	-359	-70	55,835	419	122,849	921 (N/A)	40.3	35.3	8.86
Silver maple	108,579	814	-7,914	-264	-61	37,654	282	138,054	1,035 (N/A)	23.6	39.7	16.97
Norway maple	10,229	77	-1,458	-90	-12	14,014	105	22,695	170 (N/A)	11.2	6.5	5.87
Honeylocust	7,693	58	-322	-26	-3	4,960	37	12,305	92 (N/A)	3.9	3.5	9.23
Northern hackberry	4,378	33	-539	-33	-4	5,449	41	9,254	69 (N/A)	3.1	2.7	8.68
American basswood	12,070	91	-1,148	-32	-9	4,145	31	15,036	113 (N/A)	2.7	4.3	16.11
Littleleaf linden	3,018	23	-96	-12	-1	1,951	15	4,861	36 (N/A)	2.7	1.4	5.21
Blue spruce	1,180	9	-136	-22	-1	1,845	14	2,868	22 (N/A)	2.7	0.8	3.07
White ash	2,573	19	-100	-10	-1	2,076	16	4,539	34 (N/A)	2.3	1.3	5.67
Black walnut	3,058	23	-558	-17	-4	2,554	19	5,037	38 (N/A)	1.6	1.4	9.44
Sugar maple	2,096	16	-187	-10	-1	1,552	12	3,450	26 (N/A)	1.6	1.0	6.47
Northern red oak	110	1	-75	-5	-1	562	4	593	4 (N/A)	1.2	0.2	1.48
Mountain ash	746	6	-47	-5	0	643	5	1,338	10 (N/A)	0.8	0.4	5.02
Apple	306	2	-15	-3	0	346	3	633	5 (N/A)	0.8	0.2	2.37
Cherry plum	268	2	-15	-2	0	308	2	560	4 (N/A)	0.4	0.2	4.20
Pin oak	1,491	11	-73	-4	-1	562	4	1,976	15 (N/A)	0.4	0.6	14.82
Common chokecherry	268	2	-15	-2	0	308	2	560	4 (N/A)	0.4	0.2	4.20
Red maple	923	7	-38	-3	0	477	4	1,359	10 (N/A)	0.4	0.4	10.20
Citywide total	235,386	1,765	-21,765	-898	-170	135,241	1,014	347,965	2,610 (N/A)	100.0	100.0	10.12

Table 6: Annual Social and Aesthetic Benefits

Inwood

Annual Aesthetic/Other Benefits of Public Trees

2/18/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	5,957	(N/A)	40.3	31.2	57.28
Silver maple	7,786	(N/A)	23.6	40.7	127.64
Norway maple	929	(N/A)	11.2	4.9	32.05
Honeylocust	1,588	(N/A)	3.9	8.3	158.83
Northern hackberry	534	(N/A)	3.1	2.8	66.74
American basswood	756	(N/A)	2.7	4.0	108.01
Littleleaf linden	338	(N/A)	2.7	1.8	48.27
Blue spruce	109	(N/A)	2.7	0.6	15.61
White ash	339	(N/A)	2.3	1.8	56.46
Black walnut	219	(N/A)	1.6	1.1	54.86
Sugar maple	222	(N/A)	1.6	1.2	55.38
Northern red oak	14	(N/A)	1.2	0.1	4.81
Mountain ash	44	(N/A)	0.8	0.2	22.14
Apple	18	(N/A)	0.8	0.1	8.77
Cherry plum	15	(N/A)	0.4	0.1	15.48
Pin oak	116	(N/A)	0.4	0.6	116.38
Common chokecherry	15	(N/A)	0.4	0.1	15.48
Red maple	109	(N/A)	0.4	0.6	109.08
Citywide total	19,111	(N/A)	100.0	100.0	74.07

Table 7: Summary of Benefits in Dollars

Inwood

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

2/18/2022

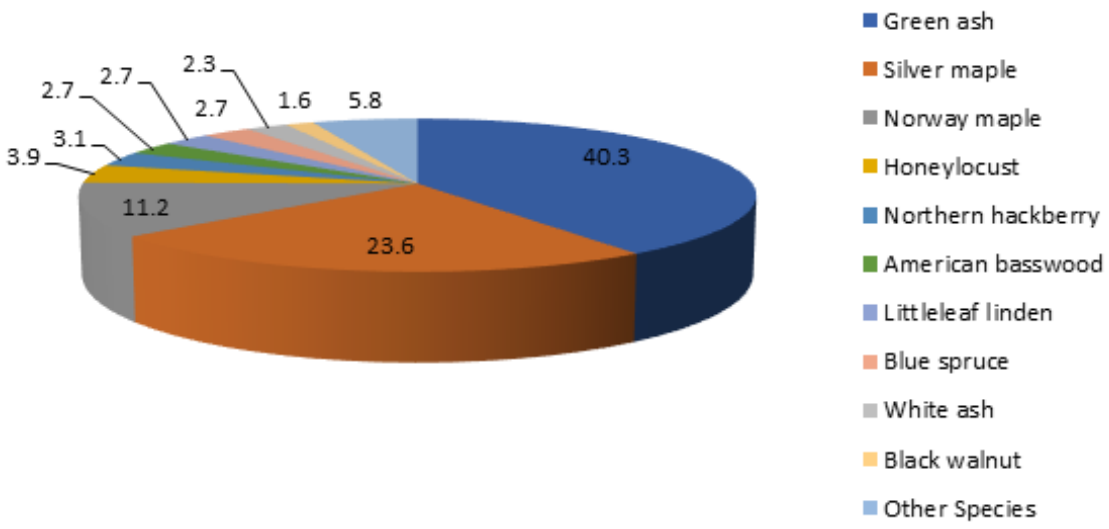
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	16,967	(N/A)	65.76	(N/A)	0.00	(N/A)
CO2	2,610	(N/A)	10.12	(N/A)	0.00	(N/A)
Air Quality	3,098	(N/A)	12.01	(N/A)	0.00	(N/A)
Stormwater	27,585	(N/A)	106.92	(N/A)	0.00	(N/A)
Aesthetic/Other	19,111	(N/A)	74.07	(N/A)	0.00	(N/A)
Total Benefits	69,370	(N/A)	268.88	(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	69,370	(N/A)	268.88	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Inwood

Species Distribution of Public Trees

2/18/2022



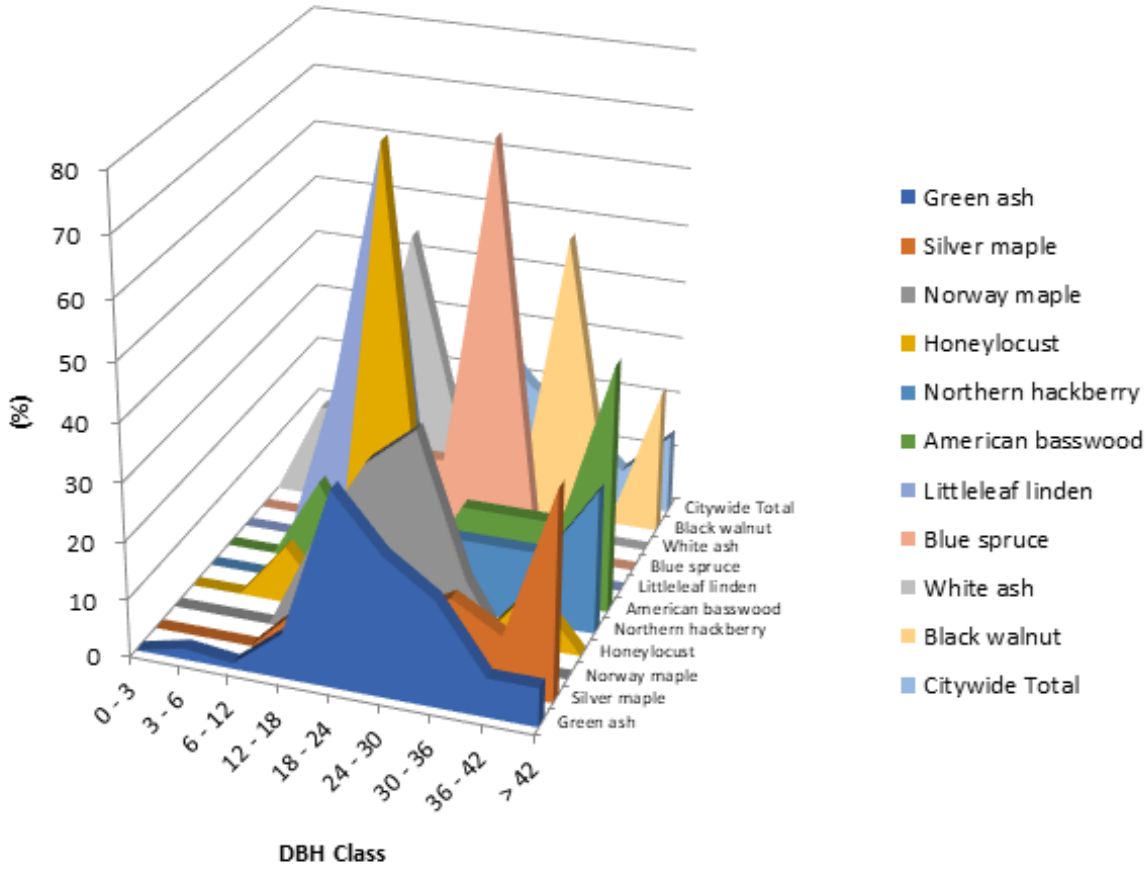
Species	Percent
Green ash	40.3
Silver maple	23.6
Norway maple	11.2
Honeylocust	3.9
Northern hackberry	3.1
American basswood	2.7
Littleleaf linden	2.7
Blue spruce	2.7
White ash	2.3
Black walnut	1.6
Other Species	5.8
Total	100.0

Figure 2: Relative Age Class

Inwood

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

2/18/2022



	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	1.92	0.96	7.69	33.65	24.04	18.27	6.73	6.73
Silver maple	0.00	0.00	0.00	8.20	21.31	9.84	14.75	9.84	36.07
Norway maple	0.00	0.00	0.00	17.24	31.03	37.93	13.79	0.00	0.00
Honeylocust	0.00	0.00	10.00	0.00	80.00	0.00	0.00	10.00	0.00
Northern hackberry	0.00	0.00	0.00	0.00	37.50	12.50	12.50	12.50	25.00
American basswood	0.00	0.00	14.29	0.00	0.00	14.29	14.29	14.29	42.86
Littleleaf linden	0.00	0.00	28.57	71.43	0.00	0.00	0.00	0.00	0.00
Blue spruce	0.00	0.00	0.00	14.29	14.29	71.43	0.00	0.00	0.00
White ash	0.00	16.67	16.67	50.00	16.67	0.00	0.00	0.00	0.00
Black walnut	0.00	0.00	0.00	0.00	25.00	0.00	50.00	0.00	25.00
Citywide Total	0.00	2.71	2.33	12.02	29.07	19.38	14.34	6.20	13.95

Figure 3: Foliage Condition

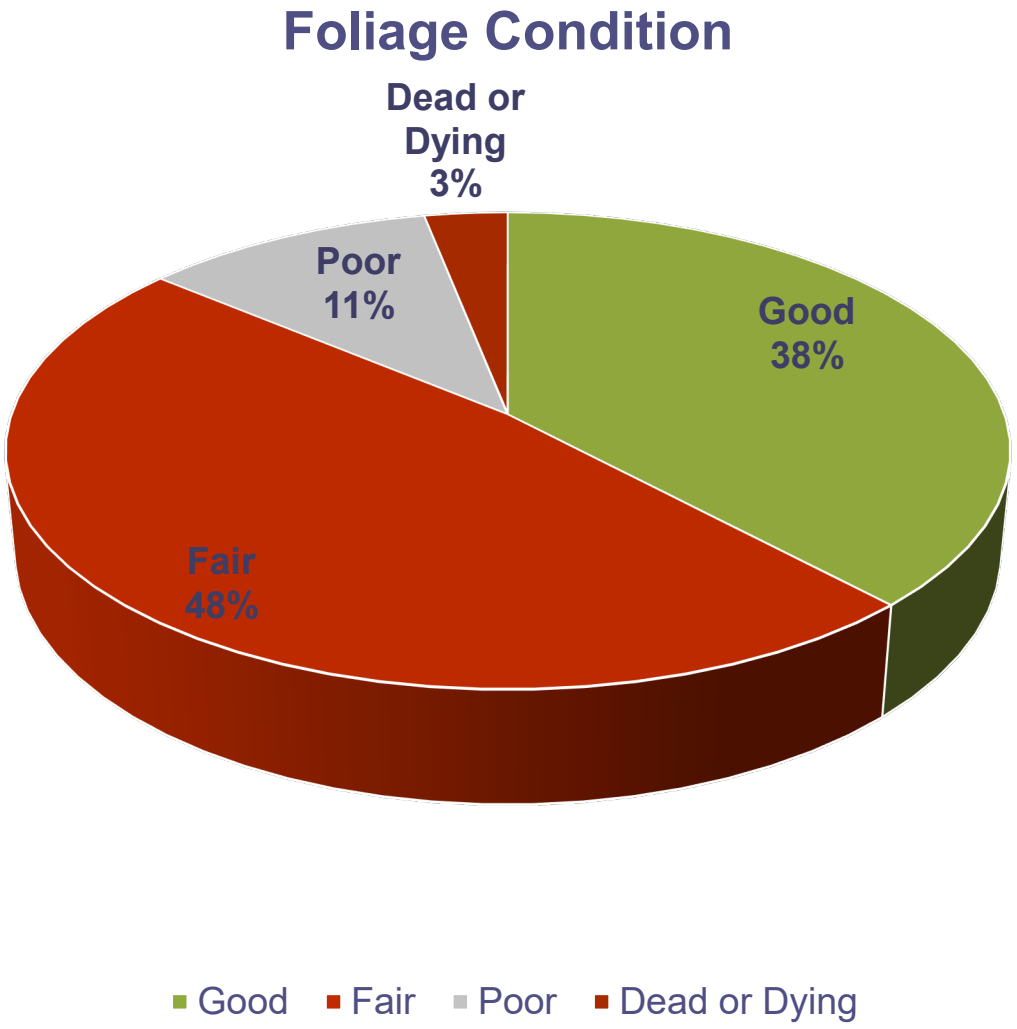


Figure 4: Wood Condition

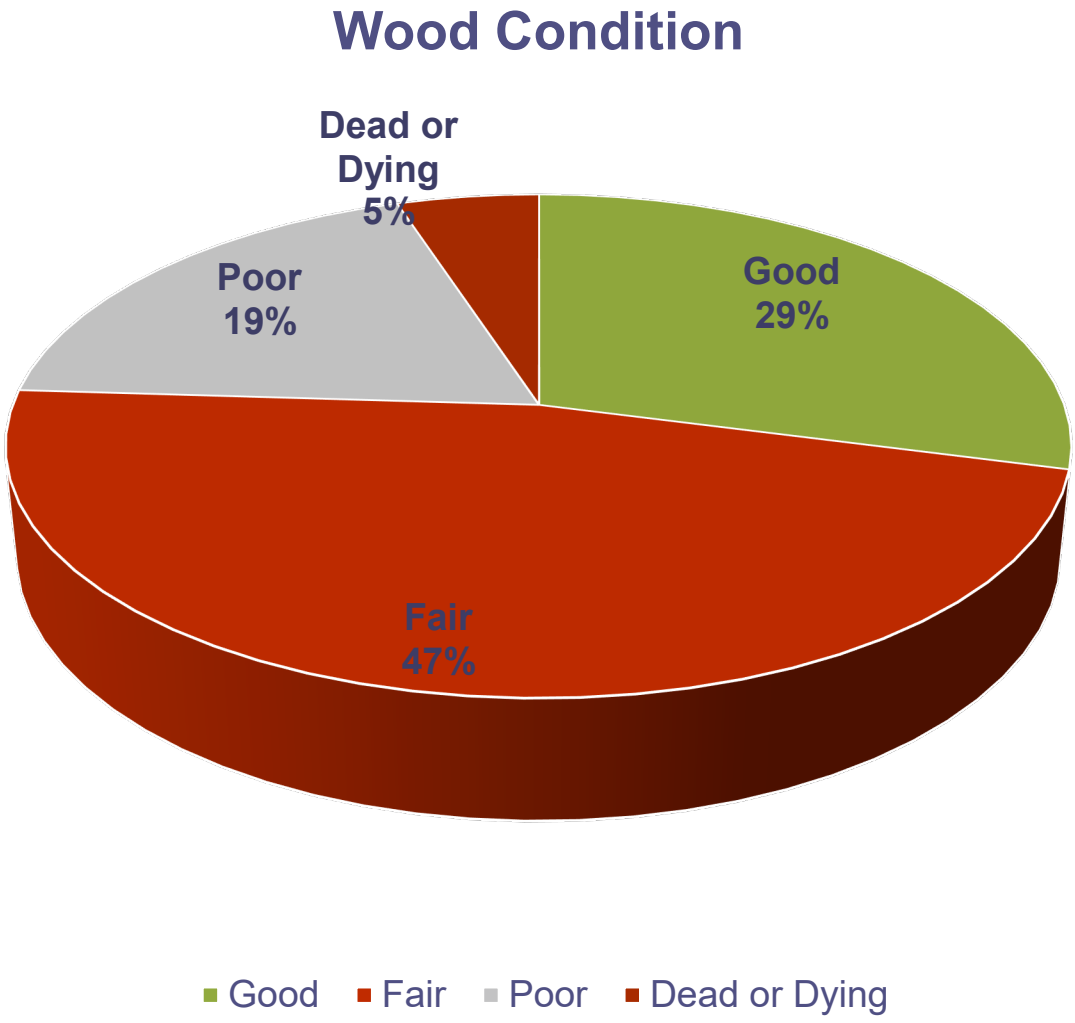
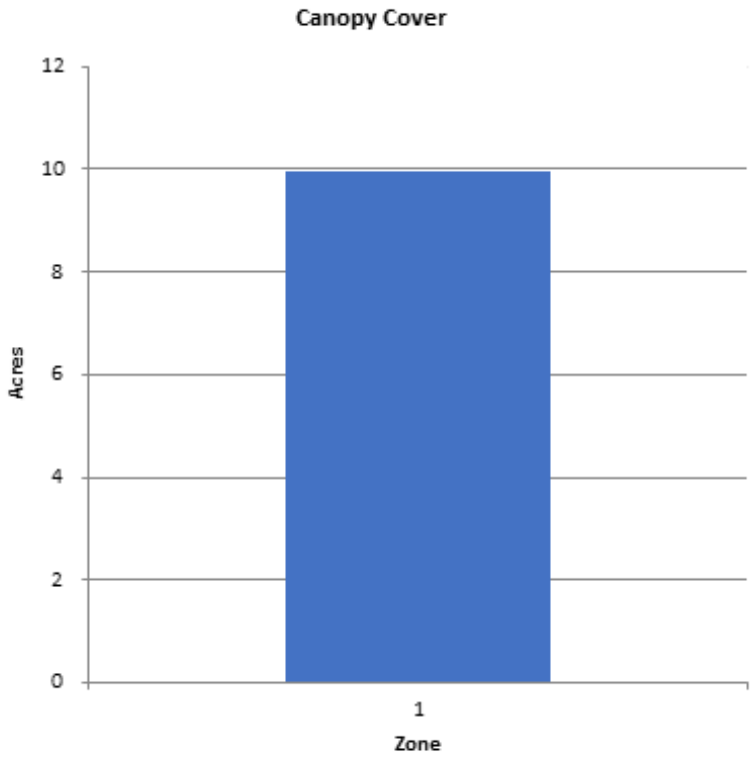


Figure 5: Canopy Cover in Acres

Inwood

Canopy Cover of Public Trees (Acres)

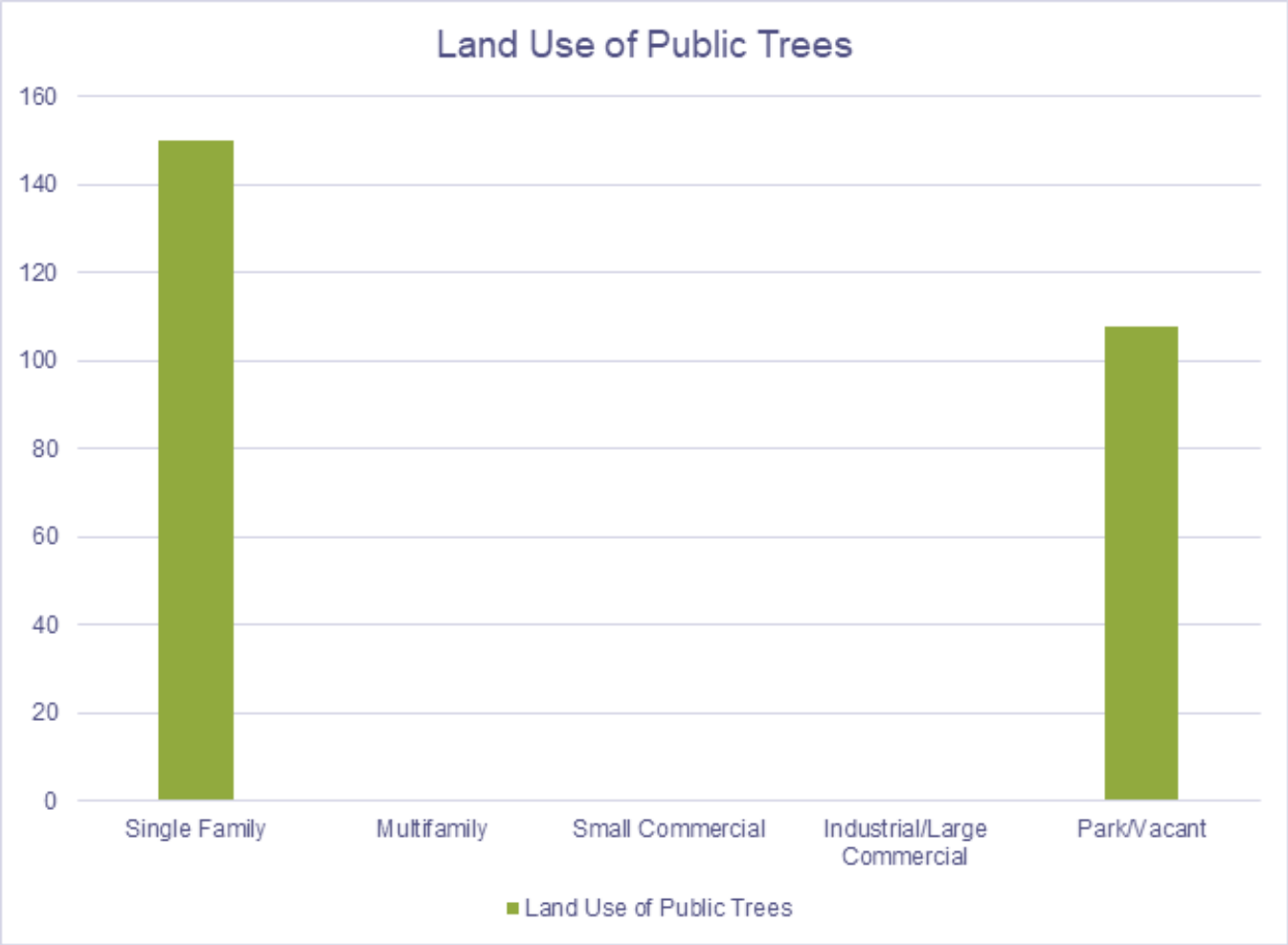
2/18/2022



Zone	Acres	% of Total Canopy Cover
1	10	100.0
Citywide total	10	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	10	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

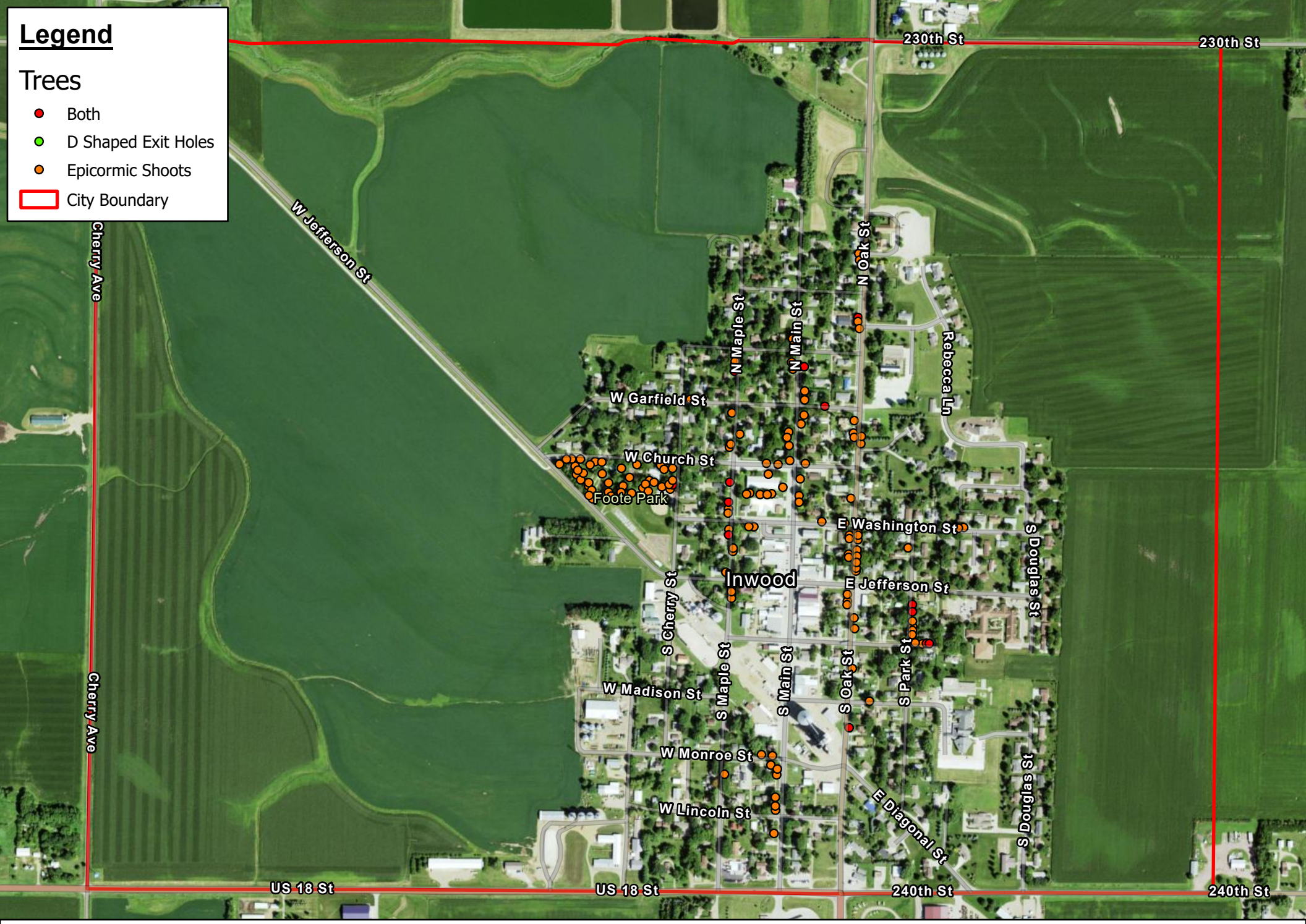
Figure 4: Location of Trees with Recommended Maintenance

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

Ash Tree Location

0 370 740 1,480 Feet

N



EAB Signs/Symptoms

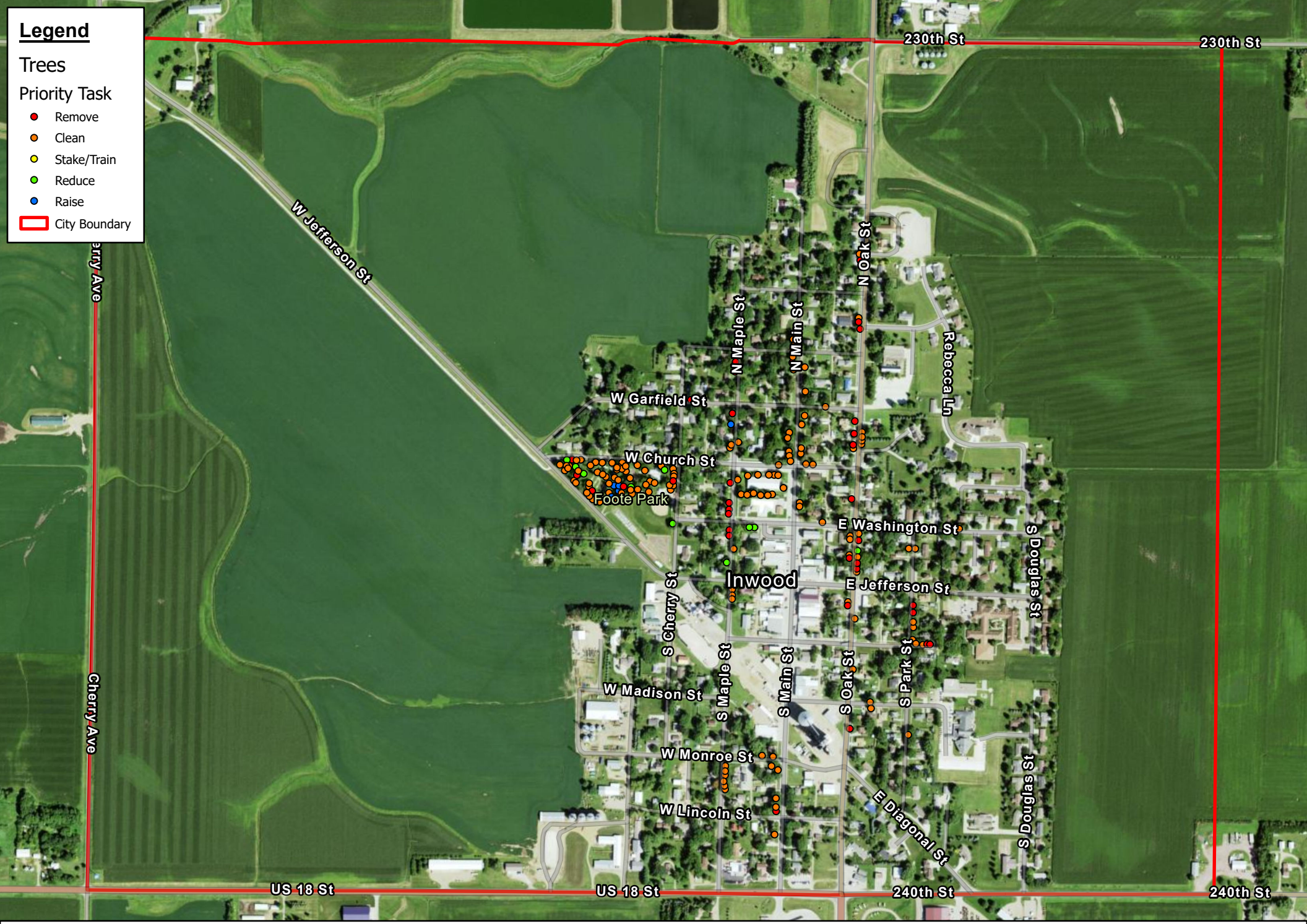
0 370 740 1,480 Feet

N

Poor Condition Trees

0 370 740 1,480 Feet

N



Priority Task

0 370 740 1,480 Feet

N

APPENDIX C: INWOOD TREE ORDINANCES

3.01 TITLE. This Ordinance shall be known as tile Municipal Tree Ordinance for tile City of Inwood, in Lyon County, State of Iowa.

3.02 PURPOSE. It is the purpose of this Ordinance to promote and protect the public health, safety and general welfare by providing for the regulation of the planting, maintenance and removal of trees, shrubs, and other plants within the City of Inwood.

3.03 DEFINITIONS. Street Trees: "Street trees" are herein defined as trees, shrubs, bushes, and all other woody vegetation on land lying between property lines on either side of all streets, avenues, or ways within tile City. Park Trees: "Park trees" are herein defined as trees, shrubs, bushes and all other woody vegetation in public parks having individual names, and all areas owned by the City, or to which the public has free access to a park.

3.04 CREATION AND ESTABLISHMENT OF A CITY TREE BOARD. There is hereby created and established a City Tree Board for tile City of Inwood, IA, which shall consist of at least six members, citizens and residents of this city, who shall be appointed by the mayor with the approval of the City Council.

3.05 TERM OF OFFICE. The term of the persons to be appointed by the mayor shall be three years except that the term of two of the members appointed to the first board shall be for only one year and the term of two members of the first board shall be for two years. In the event that a vacancy shall occur during the term of any member, his or her successor shall be appointed for the unexpired portion of the term.

3.06 COMPENSATION. Members of the Board shall serve without compensation.

3.07 DUTIES AND RESPONSIBILITIES. It shall be the responsibility of the Board to study, investigate, counsel, and develop and/or update annually, and administer a written plan for the care, preservation, trimming, planting, replanting, removal or disposal of trees and shrubs in public ways, streets and alleys. Such plan will be presented annually to the City Commission and upon their acceptance and approval shall constitute the official comprehensive city tree plan for the City of Inwood, IA. The Board, when requested by the City Commission, shall consider, investigate, make findings, report and recommend upon any special matter of question coming within the scope of its work.

3.08 OPERATION. The Board shall choose its own officers, make its own rules and regulations and keep a journal of its proceedings. A majority of the members shall be a quorum for the transaction of business. ,

3.09 SPECIES, CULTIVARS, AND VARIETIES. The Tree Board shall develop and maintain a list of desirable trees for planting along streets in three classes: small, medium and large. A list of tree species not suitable for planting as Street Trees will also be created and enforced by the Tree Board.

3.10 DISTANCE FROM STREET CORNERS AND FIREPLUGS. No Street Tree shall be planted closer than 20 feet from any street corner, measured from the point of nearest intersecting curb or curb lines. No Street Tree shall be planted closer than 10 feet from any fireplug.

3.11 UTILITIES. No Street Trees other than those species listed as Small Trees by the Tree Board may be planted under or within 10 lateral feet from any overhead utility wire, or over or within 5 lateral feet from any underground water line, sewer line, transmission line or other utility.

3.12 PUBLIC TREE CARE. The City shall have the right to plant, trim, spray, preserve and remove trees, plants and shrubs within the lines of all streets, alleys, avenues, lanes, squares and public grounds, as may be necessary to insure safety when servicing City utilities or to preserve the symmetry and beauty of such public grounds. The City Tree Board may remove or cause or order to be removed, any tree or part thereof which is in an unsafe condition or which by reason of its nature is injurious to sewers, electric power lines, gas lines, water lines or other public improvements, or is affected with any injurious fungus, insect or other pest.

3.13 TRIMMING; CORNER CLEARANCE. Every owner of any tree overhanging any street or right-of-way within the City shall trim the branches so that such branches shall not obstruct the light from any street lamp or obstruct the view of any street intersection and so that there shall be a clear space of eight feet (8') above the walkways fifteen (15) above the street or alleys. Said owners shall remove all dead, diseased or dangerous trees, or broken or decayed limbs which constitute a menace to the safety of the public. The City shall have the right to trim any tree or shrub on private property when it interferes with the proper spread of light along the street from a street light, or interferes with visibility of any traffic control device or sign, such trimming to be confined to the area immediately above the right-of-way.

3.14 DEAD OR DISEASED TREE REMOVAL ON PRIVATE PROPERTY. The City Tree Board shall recommend the removal of any dead or diseased trees on private property within the city, when such trees constitute a hazard to life and property, or harbor insects or disease which constitutes a potential threat to other trees within the City. Per Iowa Code 364.12(e), the property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. This City will be responsible TITLE VI 250 for the removal and cost of such diseased or dead wood on publicly owned property or right-of-way.

3.15 REVIEW BV CITY COUNCIL. The City Council shall have the right to review the conduct, acts and decisions of the City Tree Board. Any person may appeal any recommendation of the City Tree Board by filing a written appeal within 20 days of the City Tree Board decision to the City Council who may hear the matter and make final decision.

3.16 TREE TOPPING. Tree topping shall be prohibited as a normal practice for any person, firm, or City department of any Street Tree, Park Tree, of other tree on public property. Topping is defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes, or certain trees under utility wires or other obstructions where other pruning practices are impractical may be exempted from this Ordinance at the determination of the City Tree Board.

3.17 REMOVAL OF STUMPS. All stumps of Street and Park Trees shall be removed below the surface of the ground so that the tops of the stump shall not project above the surface of the ground. The City shall only be responsible for the removal of those stumps of trees the City cuts down.

3.18 NUISANCE AND CONDEMNATION. All Street Trees planted in violation of, or not maintained in strict compliance with the provisions of this Ordinance, or are dead, diseased or dangerous are declared a public nuisance. The Tree Board shall cause written notice to be served on the property owner requiring such nuisance to be corrected within 60 days or the City may correct and the cost of correction may be assessed against the property owner unless said assessment is waived by the City Council. If it is determined that an emergency exists by reason of the continuing maintenance of the nuisance, the City may correct said nuisance without prior notice. The City may assess the property owner for the cost of the correction after notice to the property owner.

3.19 INTERFERENCE. No person shall prevent, delay, or interfere with the Tree Board in the execution or enforcement of the Ordinance.

3.20 PENALTIES. Any person or firm, or corporation violating or failing to comply with any of the provisions of this Ordinance shall be guilty of a misdemeanor, and upon conviction thereof shall be fined a sum of not more than $100.00, or may be imprisoned for a term not exceeding thirty (30) days, or both. Each day said violation is in existence or occurs shall be considered a separate offense.

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.