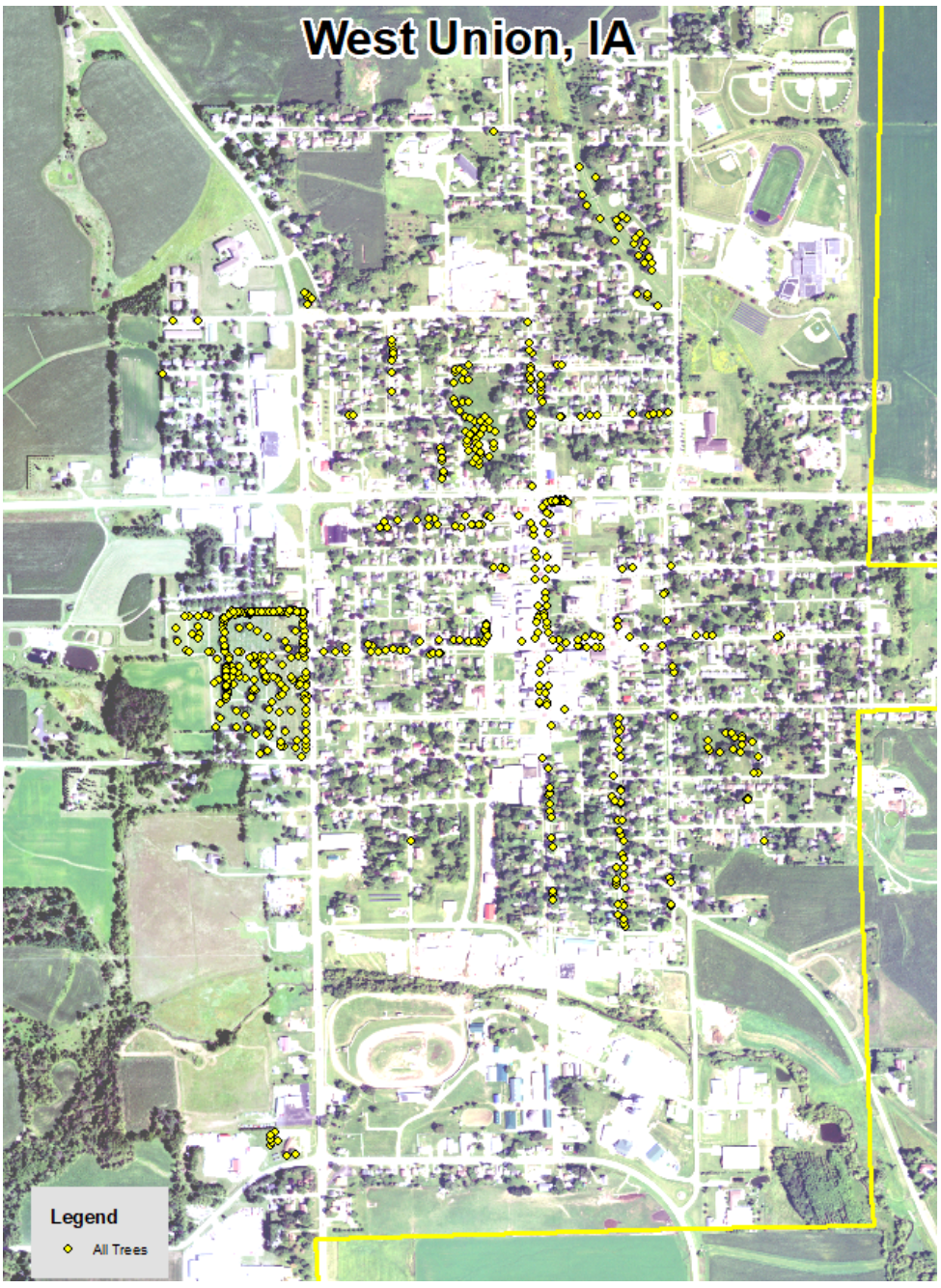
West Union, IA



2022 Urban Forest Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of West Union with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 11% of West Union's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2021, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 648 trees inventoried.

- West Union's trees provide $86,894 of benefits annually, an average of $134 a tree
- There are over 49 species of trees
- The top three genera are: Maple 24%, Cedar 23%, and Ash 11%
- 7% of trees are in need of some type of management
- 27 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 27 trees needing removal, 7 trees are over 24 inches in diameter at 4.5 ft and should be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 40 of the 69 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 with a visual survey yearly
- It is recommended to request a budget increase to $9,275 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist West Union with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the recovery from Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal or treatment and replacement planting. With proper planning and management of the current canopy in West Union, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of West Union's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of West Union and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet West Union's urban forestry goals.

Inventory

In 2021, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms associated with EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory Results

The data collected for the 648 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. West Union's trees reduce energy related costs by approximately $22,669 annually (Appendix A, Table 1). These savings are both in Electricity (108.8 MWh) and in Natural Gas (14,707.2 Therms).

Annual Stormwater Benefits

West Union's trees intercept about 1,306,181 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $35,398 of benefits to the city.

Annual Air Quality Benefits

Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic matter (ozone). In West Union, it is estimated that trees remove 1,334.2 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $3,659 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In West Union, trees sequester about 367,426 lbs of carbon a year with an associated value of $2,756 (Appendix A, Table 5). In addition, the trees store 4,585,139 lbs of carbon, with a yearly benefit of $34,389 (Appendix A, Table 4).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. West Union receives $22,414 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, West Union's trees provide $ 86,894 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 648 trees in West Union provide approximately $134 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

West Union has over 49 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	153	24%
Cedar	147	23%
Ash	69	11%
Other deciduous	55	8%
Apple (Crab)	35	5%
Spruce	34	5%
Lilac	28	4%
Oak	27	4%
Other evergreen	19	3%
Linden/Basswood	14	2%
Walnut	12	2%
Locust	8	1%
Other	47	~7%

Age Class

Most of West Union's trees (~55%) are under 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. West Union's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for West Union indicate that 94% of the trees are in good health, with only 1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 94% of West Union's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 2.5% of the population. This 2.5% is an estimate of trees that need management follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	14	2%
Crown Raising	1	<1%
Tree Removal	27	4%
Crown Reduction	3	<1%

Canopy Cover

The total canopy with both private and public trees is 10%, 174 acres. The canopy cover on city owned properties included in the West Union inventory includes approximately 12.12 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years on all lands. To achieve this goal it is estimated that 130 trees need to be planted annually on public and/or private lands.

Land Use and Location

The majority of West Union's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

Land Use	
Single family residential	29%
Park/vacant/other	4%
Industrial/Large commercial	60%
Small commercial	6%
Multifamily residential	<1%

Location	
Planting strip	25%
Median	3%
Cutout (surrounded by pavement)	9%
Front yard	63%

Changes in Forest Structure Since Plan in 2011

Of note, West Union had 648 trees in 2021 compared with 273 in 2011. This is likely due to additional areas being inventoried.

West Union also increased total canopy coverage from 7 acres in 2011 to 12.12 in 2021. This is also likely due to additional areas being inventoried.

Recommendations

Risk Management

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

Hazardous trees

West Union has 5 trees that need immediate maintenance. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter trees first. There are 2 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. There are a total of 45 trees with needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 27 removals, 6 are ash trees. There are a total of 69 ash trees, and 40 of those have signs and symptoms that have been associated with EAB. Some trees were marked and were planned for removal by the city around the time of inventory. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

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

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 (24%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and woodpecker damage.

Budget and Emerald Ash Borer Plan

West Union has 27 trees to be removed with varying costs in addition to all additional city-owned ash trees which will need to be removed sometime in the next few years.

Prices will vary but have been estimated at the following by size:

Size	#	$ per tree	Total by size
0-3”	8	$10	$80
3-6”	1	$20	$20
6-12”	3	$200	$600
12-18”	5	$600	$3000
18-24”	3	$800	$2400
24-30”	2	$1000	$2000
30-36”	1	$1200	$1200
36-42”	3	$1500	$4500
>42”	1	$2000	$2000
			$15,800
Total	27	Avg. $/Tree	$585/tree

In addition, there are 63 additional ash trees that will eventually need to be removed. At an average of $585/tree, this would cost around $36,855. Again, some trees were planned for removal shortly after inventory and numbers will vary.

West Union will need to plant 33 more trees over the next 6 years to replace trees currently recommended for removal. This will be an estimated cost of $4125 (estimated $125/newly planted tree). In addition, at least 1.2 trees should be planted for each ash removed.

It is recommended that West Union budgets around $500 annually to pruning and young tree maintenance each year.

Factoring in all above budget items, including removal of all ash, it is recommended that West Union budget $55,655 over the next 6 years, or a total of $9275 each year.

Visual Survey for signs and symptoms of EAB

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

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

<u>Proposed Budget Increase</u>

EAB could potentially kill all ash trees in West Union within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $9275 (total ash + all other removals *removal cost + (planting and maintenance *1.2 of removals) /6) a year. Additionally, it is recommended that West Union apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing to be removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 27 inches and at $15 per inch, about 10 trees could be treated per year (every other year treatment) would be $4000. This would be 20 trees selected for treatment, and West Union would still need to find $24,000 (total ash - 20 *removal cost) for removal. Alternatively, if there are 30 treatable trees, it would cost approximately $6000 a year for treatment and leave $18,000 (total ash-30 *removal cost) 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 since EAB has been found in West Union. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

West Union

Annual Energy Benefits of Public Trees

5/30/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	15.6	1,181	1,876.1	1,839	3,020	(N/A)	22.7	13.3	20.54
Broadleaf Deciduous Small	0.8	58	132.8	130	188	(N/A)	8.3	0.8	3.48
Silver maple	14.8	1,125	1,950.7	1,912	3,036	(N/A)	7.9	13.4	59.54
Norway maple	11.8	898	1,729.5	1,695	2,593	(N/A)	7.1	11.4	56.37
Apple	2.7	209	425.7	417	626	(N/A)	5.4	2.8	17.88
Sugar maple	10.8	820	1,410.5	1,382	2,203	(N/A)	5.2	9.7	64.78
Green ash	10.2	778	1,395.4	1,367	2,145	(N/A)	4.5	9.5	73.98
Ash	7.4	563	1,070.3	1,049	1,612	(N/A)	4.0	7.1	62.01
Spruce	2.7	203	337.2	331	534	(N/A)	3.1	2.4	26.69
Red maple	3.4	261	459.3	450	711	(N/A)	2.8	3.1	39.52
Lilac	0.3	23	51.8	51	74	(N/A)	2.6	0.3	4.34
White ash	4.8	361	611.8	600	960	(N/A)	2.2	4.2	68.60
Conifer Evergreen Small	0.2	16	32.1	32	47	(N/A)	2.0	0.2	3.62
Black walnut	0.8	62	105.0	103	165	(N/A)	1.9	0.7	13.77
Littleleaf linden	1.4	110	211.7	207	317	(N/A)	1.7	1.4	28.85
Japanese tree lilac	0.3	24	53.5	52	76	(N/A)	1.7	0.3	6.90
Northern red oak	1.0	74	132.8	130	204	(N/A)	1.4	0.9	22.64
Blue spruce	1.0	79	141.9	139	218	(N/A)	1.2	1.0	27.24
Bur oak	2.7	202	352.6	346	547	(N/A)	1.2	2.4	68.43
Honeylocust	2.5	187	324.9	318	506	(N/A)	1.2	2.2	63.19
Northern pin oak	1.5	110	214.4	210	321	(N/A)	1.1	1.4	45.79
Norway spruce	1.1	82	142.7	140	221	(N/A)	0.9	1.0	36.89
Northern hackberry	1.9	145	268.7	263	408	(N/A)	0.9	1.8	68.04
Elm	0.6	43	82.4	81	124	(N/A)	0.9	0.5	20.64
Dogwood	0.0	1	3.1	3	4	(N/A)	0.8	0.0	0.87
Eastern red cedar	0.6	42	82.2	81	123	(N/A)	0.8	0.5	24.57
Amur maple	0.4	31	63.2	62	93	(N/A)	0.6	0.4	23.18
Southern magnolia	0.1	9	18.4	18	27	(N/A)	0.5	0.1	8.90
Eastern cottonwood	1.2	91	164.8	162	253	(N/A)	0.5	1.1	84.32
Red pine	0.4	33	59.1	58	91	(N/A)	0.5	0.4	30.47
American basswood	0.8	60	117.5	115	175	(N/A)	0.5	0.8	58.23
Conifer Evergreen Medium	0.3	20	39.9	39	59	(N/A)	0.5	0.3	19.75
Eastern white pine	0.5	36	64.0	63	99	(N/A)	0.5	0.4	33.04
Cottonwood	1.5	110	189.3	186	296	(N/A)	0.5	1.3	98.63
Swamp white oak	0.2	16	33.7	33	49	(N/A)	0.3	0.2	24.47
Birch	0.3	26	46.3	45	71	(N/A)	0.3	0.3	35.62
White oak	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Paper birch	0.3	20	38.1	37	57	(N/A)	0.2	0.3	57.32
Black cherry	0.2	14	24.7	24	38	(N/A)	0.2	0.2	38.13
Eastern hophornbeam	0.0	2	3.8	4	5	(N/A)	0.2	0.0	5.40
Northern catalpa	0.3	20	38.1	37	57	(N/A)	0.2	0.3	57.32
Conifer Evergreen Large	0.1	10	14.6	14	24	(N/A)	0.2	0.1	24.14
Kwanzan cherry	0.1	6	12.8	13	18	(N/A)	0.2	0.1	18.19
Broadleaf Evergreen Small	0.0	2	4.0	4	6	(N/A)	0.2	0.0	5.61
River birch	0.3	20	39.6	39	59	(N/A)	0.2	0.3	58.69
Kentucky coffeetree	0.2	18	27.0	26	44	(N/A)	0.2	0.2	44.23
Hickory	0.3	25	46.9	46	71	(N/A)	0.2	0.3	70.91
Broadleaf Deciduous Mediu	0.3	24	47.4	46	71	(N/A)	0.2	0.3	70.84
Broadleaf Evergreen Large	0.1	7	14.0	14	21	(N/A)	0.2	0.1	20.59
Total	108.8	8,256	14,707.2	14,413	22,669	(N/A)	100.0	100.0	34.98

Table 2: Annual Stormwater Benefits

West Union

Annual Stormwater Benefits of Public Trees

5/30/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree	
Northern white cedar	206,693	5,601	(N/A)	22.7	15.8	38.10	
Broadleaf Deciduous Small	2,422	66	(N/A)	8.3	0.2	1.22	
Silver maple	208,655	5,655	(N/A)	7.9	16.0	110.87	
Norway maple	116,503	3,157	(N/A)	7.1	8.9	68.64	
Apple	9,807	266	(N/A)	5.4	0.8	7.59	
Sugar maple	144,878	3,926	(N/A)	5.2	11.1	115.48	
Green ash	134,192	3,637	(N/A)	4.5	10.3	125.40	
Ash	74,746	2,026	(N/A)	4.0	5.7	77.91	
Spruce	46,285	1,254	(N/A)	3.1	3.5	62.72	
Red maple	26,381	715	(N/A)	2.8	2.0	39.72	
Lilac	922	25	(N/A)	2.6	0.1	1.47	
White ash	51,345	1,391	(N/A)	2.2	3.9	99.39	
Conifer Evergreen Small	2,384	65	(N/A)	2.0	0.2	4.97	
Black walnut	7,035	191	(N/A)	1.9	0.5	15.89	
Littleleaf linden	13,604	369	(N/A)	1.7	1.0	33.52	
Japanese tree lilac	1,024	28	(N/A)	1.7	0.1	2.52	
Northern red oak	5,578	151	(N/A)	1.4	0.4	16.79	
Blue spruce	16,018	434	(N/A)	1.2	1.2	54.26	
Bur oak	38,018	1,030	(N/A)	1.2	2.9	128.79	
Honeylocust	29,363	796	(N/A)	1.2	2.2	99.47	
Northern pin oak	13,175	357	(N/A)	1.1	1.0	51.01	
Norway spruce	25,992	704	(N/A)	0.9	2.0	117.40	
Northern hackberry	22,709	615	(N/A)	0.9	1.7	102.57	
Elm	3,647	99	(N/A)	0.9	0.3	16.47	
Dogwood	37	1	(N/A)	0.8	0.0	0.20	
Eastern red cedar	8,173	221	(N/A)	0.8	0.6	44.30	
Amur maple	1,460	40	(N/A)	0.6	0.1	9.89	
Southern magnolia	789	21	(N/A)	0.5	0.1	7.13	
Eastern cottonwood	18,421	499	(N/A)	0.5	1.4	166.40	
Red pine	8,908	241	(N/A)	0.5	0.7	80.46	
American basswood	7,550	205	(N/A)	0.5	0.6	68.20	
Conifer Evergreen Medium	3,823	104	(N/A)	0.5	0.3	34.54	
Eastern white pine	10,543	286	(N/A)	0.5	0.8	95.24	
Cottonwood	21,717	589	(N/A)	0.5	1.7	196.17	
Swamp white oak	1,172	32	(N/A)	0.3	0.1	15.88	
Birch	1,995	54	(N/A)	0.3	0.2	27.03	
White oak	18	0	(N/A)	0.2	0.0	0.48	
Paper birch	2,591	70	(N/A)	0.2	0.2	70.21	
Black cherry	667	18	(N/A)	0.2	0.1	18.06	
Eastern hophornbeam	69	2	(N/A)	0.2	0.0	1.86	
Northern catalpa	2,591	70	(N/A)	0.2	0.2	70.21	
Conifer Evergreen Large	1,539	42	(N/A)	0.2	0.1	41.70	
Kwanzan cherry	264	7	(N/A)	0.2	0.0	7.17	
Broadleaf Evergreen Small	78	2	(N/A)	0.2	0.0	2.10	
River birch	2,479	67	(N/A)	0.2	0.2	67.19	
Kentucky coffeetree	1,466	40	(N/A)	0.2	0.1	39.72	
Hickory	3,943	107	(N/A)	0.2	0.3	106.85	
Broadleaf Deciduous Medium	3,764	102	(N/A)	0.2	0.3	102.01	
Broadleaf Evergreen Large	750	20	(N/A)	0.2	0.1	20.32	
Citywide total	1,306,181	35,398	(N/A)	100.0	100.0	54.63	

Table 3: Annual Air Quality Benefits

West Union

Annual Air Quality Benefits of Public Trees

5/30/2022

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 white cedar	22.9	4.5	19.6	2.8	153	71.9	10.6	10.2	70.5	454	-83.7	-314	129.3	293 (N/A)	22.7	1.99
Broadleaf Deciduous Small	0.3	0.0	0.2	0.0	2	3.9	0.5	0.5	3.4	24	0.0	0	8.9	25 (N/A)	8.3	0.47
Silver maple	37.2	6.3	18.2	1.6	200	69.9	10.2	9.8	67.0	437	-20.3	-76	200.0	562 (N/A)	7.9	11.01
Norway maple	24.4	4.2	11.9	1.1	131	57.6	8.3	7.9	53.7	356	-5.7	-21	163.3	466 (N/A)	7.1	10.14
Apple	2.3	0.4	1.2	0.1	12	13.6	1.9	1.8	12.5	83	0.0	0	33.7	96 (N/A)	5.4	2.74
Sugar maple	24.7	4.2	11.6	1.1	132	50.9	7.5	7.1	48.9	319	-19.1	-72	137.0	379 (N/A)	5.2	11.15
Green ash	22.0	3.5	9.9	1.0	116	48.9	7.1	6.8	46.4	305	0.0	0	145.7	420 (N/A)	4.5	14.49
Ash	16.0	2.8	7.8	0.7	86	36.0	5.2	5.0	33.7	223	-3.7	-14	103.3	295 (N/A)	4.0	11.35
Spruce	5.4	1.1	4.4	0.7	35	12.5	1.8	1.8	12.1	79	-22.0	-82	17.7	31 (N/A)	3.1	1.57
Red maple	5.8	1.0	2.8	0.3	31	16.3	2.4	2.3	15.6	102	-2.0	-8	44.4	126 (N/A)	2.8	6.97
Lilac	0.1	0.0	0.1	0.0	0	1.5	0.2	0.2	1.4	9	0.0	0	3.4	10 (N/A)	2.6	0.57
White ash	7.6	1.2	3.6	0.3	40	22.3	3.3	3.1	21.5	140	0.0	0	63.0	180 (N/A)	2.2	12.87
Conifer Evergreen Small	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	0.9	6	-1.2	-4	1.3	3 (N/A)	2.0	0.20
Black walnut	0.7	0.1	0.4	0.0	4	3.9	0.6	0.5	3.7	24	0.0	0	9.9	28 (N/A)	1.9	2.34
Littleleaf linden	2.2	0.4	1.1	0.1	12	7.0	1.0	1.0	6.6	44	-1.1	-4	18.3	51 (N/A)	1.7	4.67
Japanese tree lilac	0.1	0.0	0.1	0.0	1	1.6	0.2	0.2	1.4	10	0.0	0	3.6	10 (N/A)	1.7	0.93
Northern red oak	0.8	0.1	0.5	0.0	5	4.6	0.7	0.6	4.4	29	-1.2	-4	10.7	29 (N/A)	1.4	3.24
Blue spruce	2.4	0.5	1.9	0.3	16	4.9	0.7	0.7	4.7	31	-6.0	-23	10.1	24 (N/A)	1.2	2.98
Bur oak	7.6	1.2	3.3	0.3	39	12.6	1.8	1.8	12.1	79	0.0	0	40.7	118 (N/A)	1.2	14.78
Honeylocust	5.8	1.0	2.6	0.3	30	11.6	1.7	1.6	11.2	73	-4.6	-17	31.1	86 (N/A)	1.2	10.73
Northern pin oak	2.6	0.4	1.3	0.1	14	7.1	1.0	1.0	6.6	44	-0.6	-2	19.5	56 (N/A)	1.1	7.95
Norway spruce	3.2	0.6	2.5	0.4	21	5.1	0.7	0.7	4.9	32	-15.7	-59	2.4	-6 (N/A)	0.9	-1.07
Northern hackberry	4.0	0.7	2.0	0.2	22	9.2	1.3	1.3	8.7	57	0.0	0	27.4	79 (N/A)	0.9	13.16
Elm	0.1	0.0	0.1	0.0	1	2.7	0.4	0.4	2.6	17	0.0	0	6.4	18 (N/A)	0.9	2.99
Dogwood	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.2	1 (N/A)	0.8	0.11
Eastern red cedar	1.7	0.3	1.4	0.2	11	2.7	0.4	0.4	2.5	17	-4.5	-17	5.1	11 (N/A)	0.8	2.19
Amur maple	0.3	0.1	0.2	0.0	2	2.0	0.3	0.3	1.8	12	0.0	0	5.0	14 (N/A)	0.6	3.55
Southern magnolia	0.0	0.0	0.1	0.0	0	0.6	0.1	0.1	0.5	3	-0.2	-1	1.1	3 (N/A)	0.5	1.02
Eastern cottonwood	2.8	0.4	1.3	0.1	15	5.8	0.8	0.8	5.5	36	0.0	0	17.5	51 (N/A)	0.5	16.85
Red pine	1.0	0.2	0.8	0.1	7	2.1	0.3	0.3	2.0	13	-4.1	-15	2.8	4 (N/A)	0.5	1.45
American basswood	0.9	0.2	0.5	0.0	5	3.8	0.6	0.5	3.6	24	-0.8	-3	9.2	26 (N/A)	0.5	8.52
Conifer Evergreen Medium	0.5	0.1	0.4	0.1	3	1.3	0.2	0.2	1.2	8	-1.4	-5	2.6	6 (N/A)	0.5	2.06
Eastern white pine	1.3	0.2	1.0	0.2	8	2.3	0.3	0.3	2.2	14	-5.6	-21	2.1	1 (N/A)	0.5	0.44
Cottonwood	4.8	0.8	2.1	0.2	25	6.9	1.0	1.0	6.6	43	0.0	0	23.2	68 (N/A)	0.5	22.55
Swamp white oak	0.1	0.0	0.1	0.0	1	1.0	0.1	0.1	1.0	6	0.0	0	2.5	7 (N/A)	0.3	3.47
Birch	0.3	0.0	0.2	0.0	2	1.6	0.2	0.2	1.5	10	-0.1	0	4.0	11 (N/A)	0.3	5.69
White oak	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)	0.2	0.08
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)	0.2	9.34
Black cherry	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)	0.2	6.56
Eastern hophornbeam	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)	0.2	0.71
Northern catalpa	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)	0.2	9.34
Conifer Evergreen Large	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)	0.2	2.82
Kwanzan cherry	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	0.2	2.55
Broadleaf Evergreen Small	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)	0.2	0.75
River birch	0.5	0.1	0.2	0.0	3	1.3	0.2	0.2	1.2	8	-0.1	0	3.6	10 (N/A)	0.2	10.16
Kentucky coffeetree	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7 (N/A)	0.2	7.42
Hickory	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12 (N/A)	0.2	12.48
Broadleaf Deciduous Medium	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14 (N/A)	0.2	13.58
Broadleaf Evergreen Large	0.0	0.0	0.1	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2 (N/A)	0.2	2.16
Citywide total	214.8	37.2	116.7	12.6	1,199	517.3	75.5	72.0	492.8	3,227	-204.6	-767	1,334.2	3,659 (N/A)	100.0	5.65

Table 4: Annual Carbon Stored

West Union

Stored CO2 Benefits of Public Trees

5/30/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	189,046	1,418	(N/A)	22.7	4.1	9.65
Broadleaf Deciduous	7,183	54	(N/A)	8.3	0.2	1.00
Silver maple	910,425	6,828	(N/A)	7.9	19.9	133.89
Norway maple	400,202	3,002	(N/A)	7.1	8.7	65.25
Apple	38,560	289	(N/A)	5.4	0.8	8.26
Sugar maple	753,485	5,651	(N/A)	5.2	16.4	166.21
Green ash	749,697	5,623	(N/A)	4.5	16.4	193.89
Ash	263,004	1,973	(N/A)	4.0	5.7	75.87
Spruce	53,354	400	(N/A)	3.1	1.2	20.01
Red maple	64,888	487	(N/A)	2.8	1.4	27.04
Lilac	2,366	18	(N/A)	2.6	0.1	1.04
White ash	143,481	1,076	(N/A)	2.2	3.1	76.86
Conifer Evergreen Sm	559	4	(N/A)	2.0	0.0	0.32
Black walnut	23,226	174	(N/A)	1.9	0.5	14.52
Littleleaf linden	47,787	358	(N/A)	1.7	1.0	32.58
Japanese tree lilac	3,088	23	(N/A)	1.7	0.1	2.11
Northern red oak	13,350	100	(N/A)	1.4	0.3	11.13
Blue spruce	18,059	135	(N/A)	1.2	0.4	16.93
Bur oak	266,290	1,997	(N/A)	1.2	5.8	249.65
Honeylocust	75,285	565	(N/A)	1.2	1.6	70.58
Northern pin oak	43,432	326	(N/A)	1.1	0.9	46.53
Norway spruce	40,794	306	(N/A)	0.9	0.9	50.99
Northern hackberry	66,175	496	(N/A)	0.9	1.4	82.72
Elm	6,207	47	(N/A)	0.9	0.1	7.76
Dogwood	69	1	(N/A)	0.8	0.0	0.10
Eastern red cedar	5,510	41	(N/A)	0.8	0.1	8.27
Amur maple	5,761	43	(N/A)	0.6	0.1	10.80
Southern magnolia	490	4	(N/A)	0.5	0.0	1.22
Eastern cottonwood	94,290	707	(N/A)	0.5	2.1	235.72
Red pine	10,028	75	(N/A)	0.5	0.2	25.07
American basswood	31,675	238	(N/A)	0.5	0.7	79.19
Conifer Evergreen Me	3,230	24	(N/A)	0.5	0.1	8.07
Eastern white pine	14,176	106	(N/A)	0.5	0.3	35.44
Cottonwood	167,946	1,260	(N/A)	0.5	3.7	419.86
Swamp white oak	2,201	17	(N/A)	0.3	0.0	8.26
Birch	4,725	35	(N/A)	0.3	0.1	17.72
White oak	12	0	(N/A)	0.2	0.0	0.09
Paper birch	8,458	63	(N/A)	0.2	0.2	63.43
Black cherry	3,037	23	(N/A)	0.2	0.1	22.78
Eastern hophornbeam	178	1	(N/A)	0.2	0.0	1.33
Northern catalpa	8,458	63	(N/A)	0.2	0.2	63.43
Conifer Evergreen La	1,170	9	(N/A)	0.2	0.0	8.78
Kwanzan cherry	908	7	(N/A)	0.2	0.0	6.81
Broadleaf Evergreen S	178	1	(N/A)	0.2	0.0	1.33
River birch	7,945	60	(N/A)	0.2	0.2	59.59
Kentucky coffeetree	3,672	28	(N/A)	0.2	0.1	27.54
Hickory	15,773	118	(N/A)	0.2	0.3	118.30
Broadleaf Deciduous	14,280	107	(N/A)	0.2	0.3	107.10
Broadleaf Evergreen I	1,025	8	(N/A)	0.2	0.0	7.68
Citywide total	4,585,139	34,389	(N/A)	100.0	100.0	53.07

Table 5: Annual Carbon Sequestered

West Union

Annual CO Benefits of Public Trees

5/30/2022

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 white cedar	12,554	94	-908	-264	-9	26,109	196	37,492	281 (N/A)	22.7	10.2	1.91
Broadleaf Deciduous Smal	1,346	10	-36	-20	0	1,275	10	2,564	19 (N/A)	8.3	0.7	0.36
Silver maple	64,412	483	-4,371	-168	-34	24,857	186	84,729	635 (N/A)	7.9	23.1	12.46
Norway maple	14,803	111	-1,921	-129	-15	19,845	149	32,598	244 (N/A)	7.1	8.9	5.31
Apple	4,156	31	-185	-39	-2	4,608	35	8,541	64 (N/A)	5.4	2.3	1.83
Sugar maple	30,005	225	-3,618	-126	-28	18,130	136	44,391	333 (N/A)	5.2	12.1	9.79
Green ash	19,826	149	-3,599	-114	-28	17,191	129	33,304	250 (N/A)	4.5	9.1	8.61
Ash	6,345	48	-1,262	-85	-10	12,452	93	17,450	131 (N/A)	4.0	4.7	5.03
Spruce	3,003	23	-256	-46	-2	4,492	34	7,192	54 (N/A)	3.1	2.0	2.70
Red maple	3,485	26	-311	-32	-3	5,773	43	8,915	67 (N/A)	2.8	2.4	3.71
Lilac	528	4	-12	-8	0	506	4	1,014	8 (N/A)	2.6	0.3	0.45
White ash	11,341	85	-689	-41	-5	7,974	60	18,586	139 (N/A)	2.2	5.1	9.96
Conifer Evergreen Small	174	1	-3	-8	0	343	3	506	4 (N/A)	2.0	0.1	0.29
Black walnut	1,771	13	-112	-9	-1	1,378	10	3,027	23 (N/A)	1.9	0.8	1.89
Littleleaf linden	4,776	36	-231	-19	-2	2,427	18	6,954	52 (N/A)	1.7	1.9	4.74
Japanese tree lilac	511	4	-15	-7	0	520	4	1,009	8 (N/A)	1.7	0.3	0.69
Northern red oak	1,452	11	-64	-11	-1	1,626	12	3,003	23 (N/A)	1.4	0.8	2.50
Blue spruce	997	7	-87	-20	-1	1,742	13	2,633	20 (N/A)	1.2	0.7	2.47
Bur oak	3,454	26	-1,278	-32	-10	4,462	33	6,606	50 (N/A)	1.2	1.8	6.19
Honeylocust	4,860	36	-361	-19	-3	4,135	31	8,615	65 (N/A)	1.2	2.3	8.08
Northern pin oak	1,528	11	-208	-17	-2	2,440	18	3,742	28 (N/A)	1.1	1.0	4.01
Norway spruce	187	1	-196	-27	-2	1,801	14	1,765	13 (N/A)	0.9	0.5	2.21
Northern hackberry	2,586	19	-318	-20	-3	3,202	24	5,450	41 (N/A)	0.9	1.5	6.81
Elm	1,253	9	-30	-7	0	953	7	2,168	16 (N/A)	0.9	0.6	2.71
Dogwood	43	0	-1	-1	0	28	0	70	1 (N/A)	0.8	0.0	0.10
Eastern red cedar	0	0	-26	-10	0	934	7	898	7 (N/A)	0.8	0.2	1.35
Amur maple	609	5	-28	-5	0	681	5	1,257	9 (N/A)	0.6	0.3	2.36
Southern magnolia	59	0	-2	-2	0	192	1	247	2 (N/A)	0.5	0.1	0.62
Eastern cottonwood	2,681	20	-453	-14	-3	2,021	15	4,236	32 (N/A)	0.5	1.2	10.59
Red pine	562	4	-48	-8	0	739	6	1,245	9 (N/A)	0.5	0.3	3.11
American basswood	2,119	16	-152	-9	-1	1,315	10	3,273	25 (N/A)	0.5	0.9	8.18
Conifer Evergreen Mediun	224	2	-16	-5	0	445	3	649	5 (N/A)	0.5	0.2	1.62
Eastern white pine	375	3	-68	-11	-1	804	6	1,100	8 (N/A)	0.5	0.3	2.75
Cottonwood	1,437	11	-806	-18	-6	2,439	18	3,052	23 (N/A)	0.5	0.8	7.63
Swamp white oak	448	3	-11	-2	0	352	3	787	6 (N/A)	0.3	0.2	2.95
Birch	610	5	-23	-3	0	571	4	1,155	9 (N/A)	0.3	0.3	4.33
White oak	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Paper birch	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.2	0.3	7.93
Black cherry	268	2	-15	-2	0	308	2	560	4 (N/A)	0.2	0.2	4.20
Eastern hophornbeam	38	0	-1	-1	0	37	0	74	1 (N/A)	0.2	0.0	0.55
Northern catalpa	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.2	0.3	7.93
Conifer Evergreen Large	116	1	-6	-2	0	216	2	324	2 (N/A)	0.2	0.1	2.43
Kwanzan cherry	114	1	-4	-1	0	124	1	232	2 (N/A)	0.2	0.1	1.74
Broadleaf Evergreen Small	27	0	-1	-1	0	38	0	64	0 (N/A)	0.2	0.0	0.48
River birch	470	4	-38	-3	0	440	3	869	7 (N/A)	0.2	0.2	6.52
Kentucky coffeetree	445	3	-18	-2	0	393	3	819	6 (N/A)	0.2	0.2	6.14
Hickory	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.2	0.4	9.97
Broadleaf Deciduous Medi	0	0	-69	-4	-1	539	4	466	3 (N/A)	0.2	0.1	3.49
Broadleaf Evergreen Large	197	1	-5	-1	0	152	1	343	3 (N/A)	0.2	0.1	2.57
Citywide total	208,371	1,563	-22,015	-1,379	-175	182,449	1,368	367,426	2,756 (N/A)	100.0	100.0	4.25

Table 6: Annual Social and Aesthetic Benefits

West Union

Annual Aesthetic/Other Benefits of Public Trees

5/30/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	3,608	(N/A)	22.7	16.1	24.54
Broadleaf Deciduous Small	58	(N/A)	8.3	0.3	1.07
Silver maple	4,977	(N/A)	7.9	22.2	97.58
Norway maple	1,385	(N/A)	7.1	6.2	30.11
Apple	234	(N/A)	5.4	1.0	6.69
Sugar maple	2,828	(N/A)	5.2	12.6	83.18
Green ash	1,492	(N/A)	4.5	6.7	51.46
Ash	599	(N/A)	4.0	2.7	23.05
Spruce	674	(N/A)	3.1	3.0	33.72
Red maple	523	(N/A)	2.8	2.3	29.06
Lilac	27	(N/A)	2.6	0.1	1.58
White ash	1,280	(N/A)	2.2	5.7	91.41
Conifer Evergreen Small	174	(N/A)	2.0	0.8	13.37
Black walnut	205	(N/A)	1.9	0.9	17.06
Littleleaf linden	526	(N/A)	1.7	2.3	47.79
Japanese tree lilac	27	(N/A)	1.7	0.1	2.48
Northern red oak	147	(N/A)	1.4	0.7	16.35
Blue spruce	164	(N/A)	1.2	0.7	20.53
Bur oak	258	(N/A)	1.2	1.2	32.29
Honeylocust	1,230	(N/A)	1.2	5.5	153.71
Northern pin oak	161	(N/A)	1.1	0.7	22.98
Norway spruce	47	(N/A)	0.9	0.2	7.85
Northern hackberry	323	(N/A)	0.9	1.4	53.78
Elm	171	(N/A)	0.9	0.8	28.56
Dogwood	0	(N/A)	0.8	0.0	0.03
Eastern red cedar	0	(N/A)	0.8	0.0	0.00
Amur maple	35	(N/A)	0.6	0.2	8.67
Southern magnolia	22	(N/A)	0.5	0.1	7.32
Eastern cottonwood	182	(N/A)	0.5	0.8	60.76
Red pine	141	(N/A)	0.5	0.6	47.08
American basswood	165	(N/A)	0.5	0.7	54.93
Conifer Evergreen Medium	62	(N/A)	0.5	0.3	20.71
Eastern white pine	94	(N/A)	0.5	0.4	31.39
Cottonwood	86	(N/A)	0.5	0.4	28.57
Swamp white oak	52	(N/A)	0.3	0.2	26.22
Birch	65	(N/A)	0.3	0.3	32.69
White oak	5	(N/A)	0.2	0.0	5.26
Paper birch	58	(N/A)	0.2	0.3	57.69
Black cherry	15	(N/A)	0.2	0.1	15.48
Eastern hophornbeam	2	(N/A)	0.2	0.0	2.06
Northern catalpa	58	(N/A)	0.2	0.3	57.69
Conifer Evergreen Large	32	(N/A)	0.2	0.1	32.32
Kwanzan cherry	6	(N/A)	0.2	0.0	6.40
Broadleaf Evergreen Small	1	(N/A)	0.2	0.0	0.99
River birch	43	(N/A)	0.2	0.2	43.05
Kentucky coffeetree	46	(N/A)	0.2	0.2	45.86
Hickory	66	(N/A)	0.2	0.3	65.59
Broadleaf Deciduous Medium	0	(N/A)	0.2	0.0	0.00
Broadleaf Evergreen Large	58	(N/A)	0.2	0.3	58.26
Citywide total	22,414	(N/A)	100.0	100.0	34.59

Table 7: Summary of Benefits in Dollars

West Union

Total Annual Benefits of Public Trees by Species ($)

5/30/2022

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Northern white cedar	3,020	281	293	5,601	3,608	12,803	(N/A)	14.7
Broadleaf Deciduous Sn	188	19	25	66	58	356	(N/A)	0.4
Silver maple	3,036	635	562	5,655	4,977	14,865	(N/A)	17.1
Norway maple	2,593	244	466	3,157	1,385	7,846	(N/A)	9.0
Apple	626	64	96	266	234	1,285	(N/A)	1.5
Sugar maple	2,203	333	379	3,926	2,828	9,669	(N/A)	11.1
Green ash	2,145	250	420	3,637	1,492	7,944	(N/A)	9.1
Ash	1,612	131	295	2,026	599	4,663	(N/A)	5.4
Spruce	534	54	31	1,254	674	2,548	(N/A)	2.9
Red maple	711	67	126	715	523	2,142	(N/A)	2.5
Lilac	74	8	10	25	27	143	(N/A)	0.2
White ash	960	139	180	1,391	1,280	3,951	(N/A)	4.5
Conifer Evergreen Smal	47	4	3	65	174	292	(N/A)	0.3
Black walnut	165	23	28	191	205	611	(N/A)	0.7
Littleleaf linden	317	52	51	369	526	1,315	(N/A)	1.5
Japanese tree lilac	76	8	10	28	27	149	(N/A)	0.2
Northern red oak	204	23	29	151	147	554	(N/A)	0.6
Blue spruce	218	20	24	434	164	860	(N/A)	1.0
Bur oak	547	50	118	1,030	258	2,004	(N/A)	2.3
Honeylocust	506	65	86	796	1,230	2,681	(N/A)	3.1
Northern pin oak	321	28	56	357	161	922	(N/A)	1.1
Norway spruce	221	13	-6	704	47	980	(N/A)	1.1
Northern hackberry	408	41	79	615	323	1,466	(N/A)	1.7
Elm	124	16	18	99	171	428	(N/A)	0.5
Dogwood	4	1	1	1	0	7	(N/A)	0.0
Eastern red cedar	123	7	11	221	0	362	(N/A)	0.4
Amur maple	93	9	14	40	35	191	(N/A)	0.2
Southern magnolia	27	2	3	21	22	75	(N/A)	0.1
Eastern cottonwood	253	32	51	499	182	1,017	(N/A)	1.2
Red pine	91	9	4	241	141	488	(N/A)	0.6
American basswood	175	25	26	205	165	594	(N/A)	0.7
Conifer Evergreen Medi	59	5	6	104	62	236	(N/A)	0.3
Eastern white pine	99	8	1	286	94	489	(N/A)	0.6
Cottonwood	296	23	68	589	86	1,061	(N/A)	1.2
Swamp white oak	49	6	7	32	52	146	(N/A)	0.2
Birch	71	9	11	54	65	211	(N/A)	0.2
White oak	1	0	0	0	5	7	(N/A)	0.0
Paper birch	57	8	9	70	58	202	(N/A)	0.2
Black cherry	38	4	7	18	15	82	(N/A)	0.1
Eastern hophornbeam	5	1	1	2	2	11	(N/A)	0.0
Northern catalpa	57	8	9	70	58	202	(N/A)	0.2
Conifer Evergreen Large	24	2	3	42	32	103	(N/A)	0.1
Kwanzan cherry	18	2	3	7	6	36	(N/A)	0.0
Broadleaf Evergreen Sm	6	0	1	2	1	10	(N/A)	0.0
River birch	59	7	10	67	43	186	(N/A)	0.2
Kentucky coffeetree	44	6	7	40	46	143	(N/A)	0.2
Hickory	71	10	12	107	66	266	(N/A)	0.3
Broadleaf Deciduous M	71	3	14	102	0	190	(N/A)	0.2
Broadleaf Evergreen La	21	3	2	20	58	104	(N/A)	0.1

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Citywide Total	22,669	2,756	3,659	35,398	22,414	86,894	(N/A)	100.0

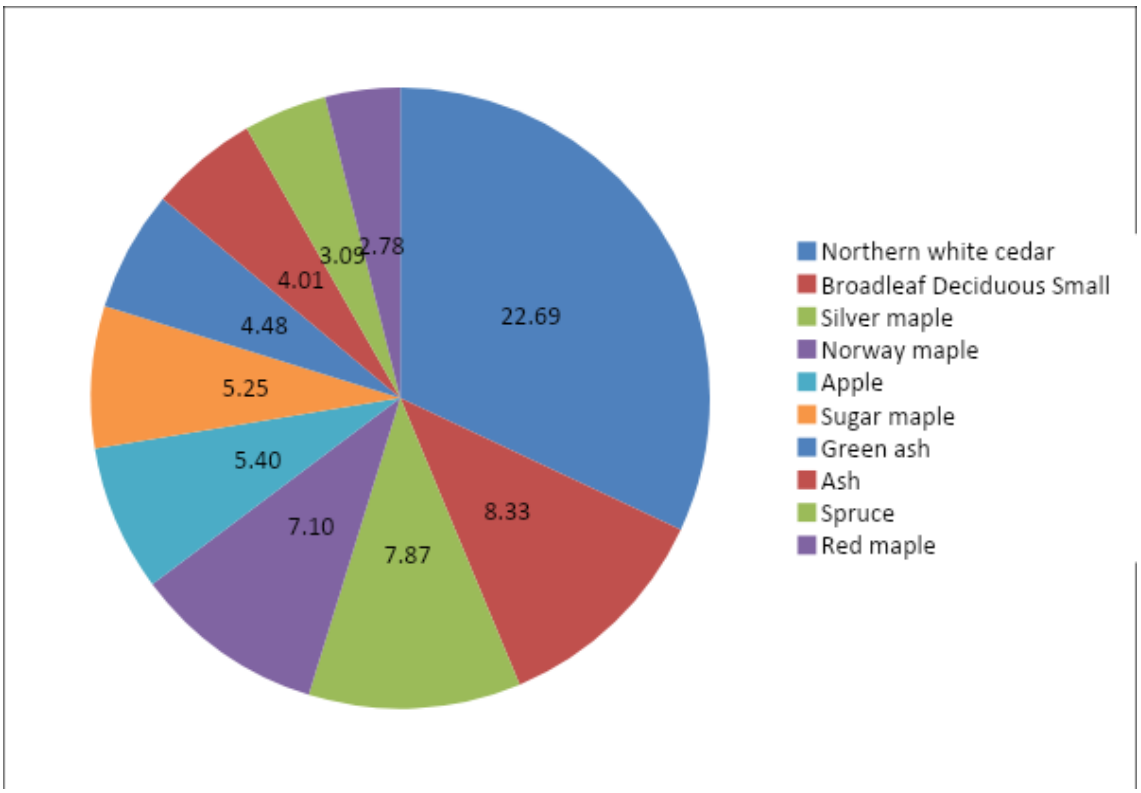

Figure 1: Species Distribution

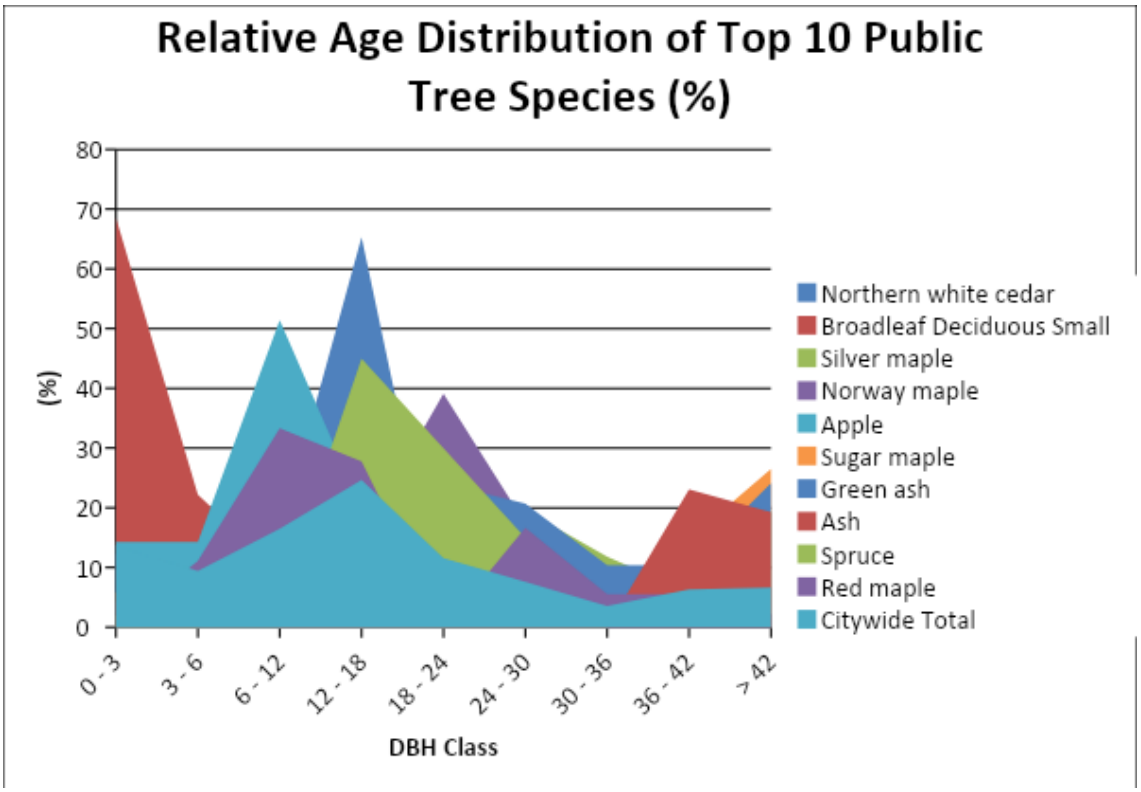

Figure 2: Relative Age Class

Figure 3: Foliage Condition

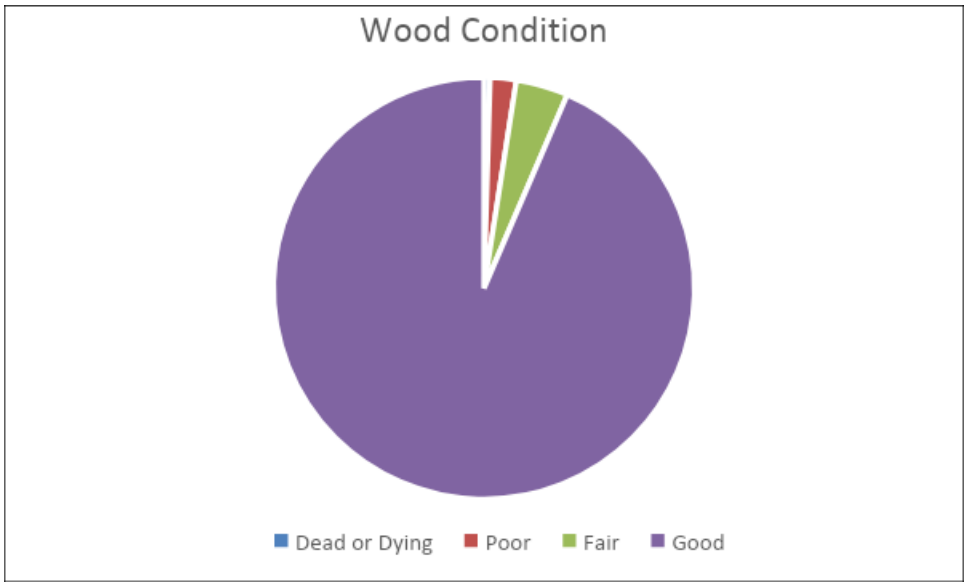

Figure 4: Wood Condition

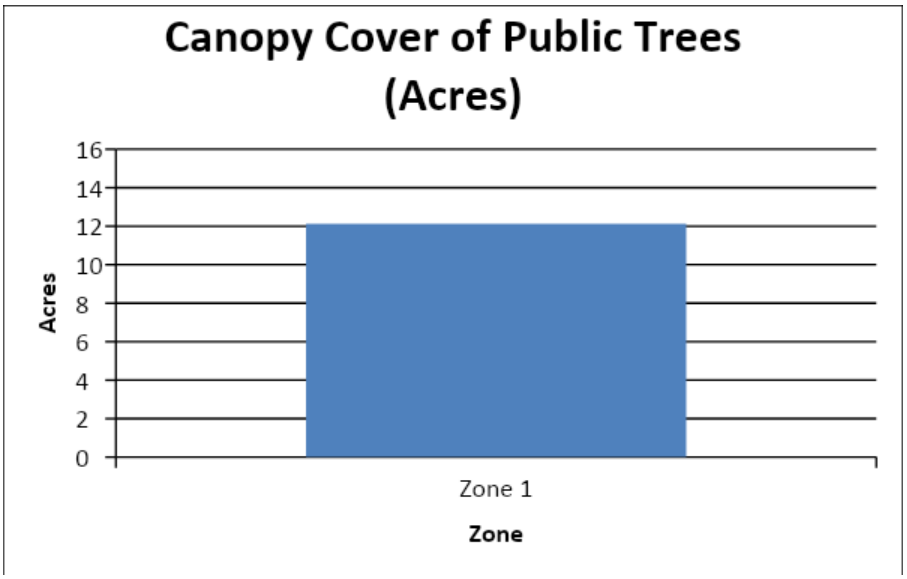

Figure 5: Canopy Cover in Acres

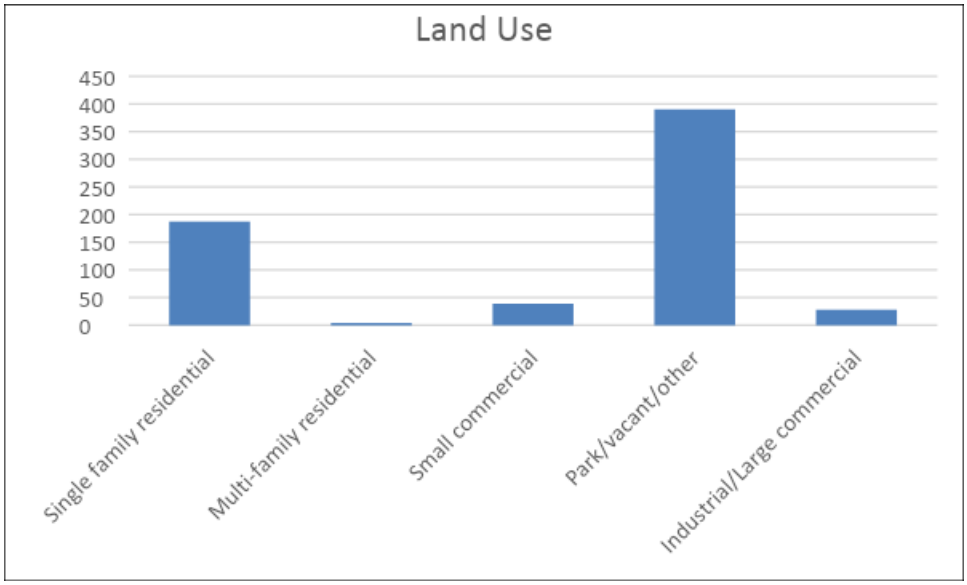

Figure 6: Land Use of city/park trees

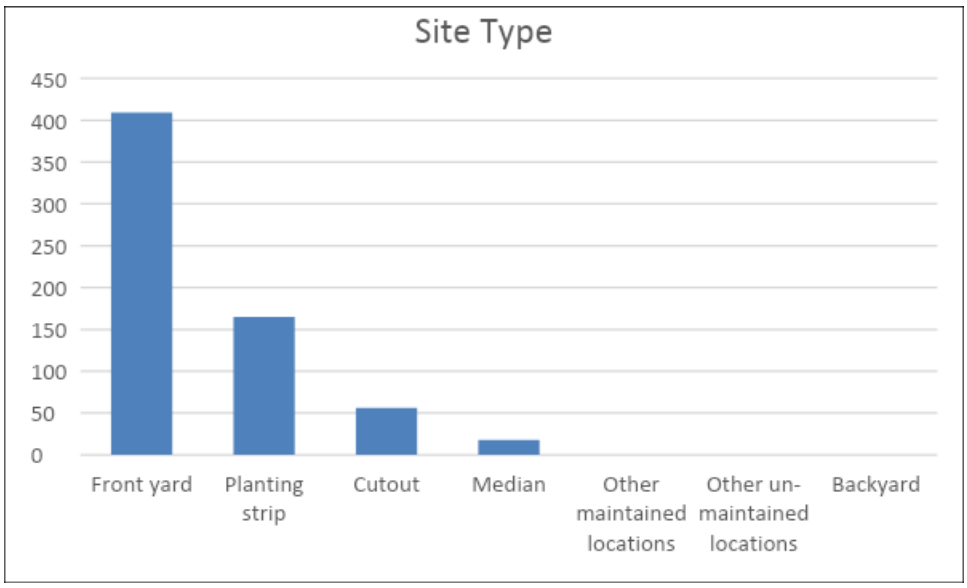

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

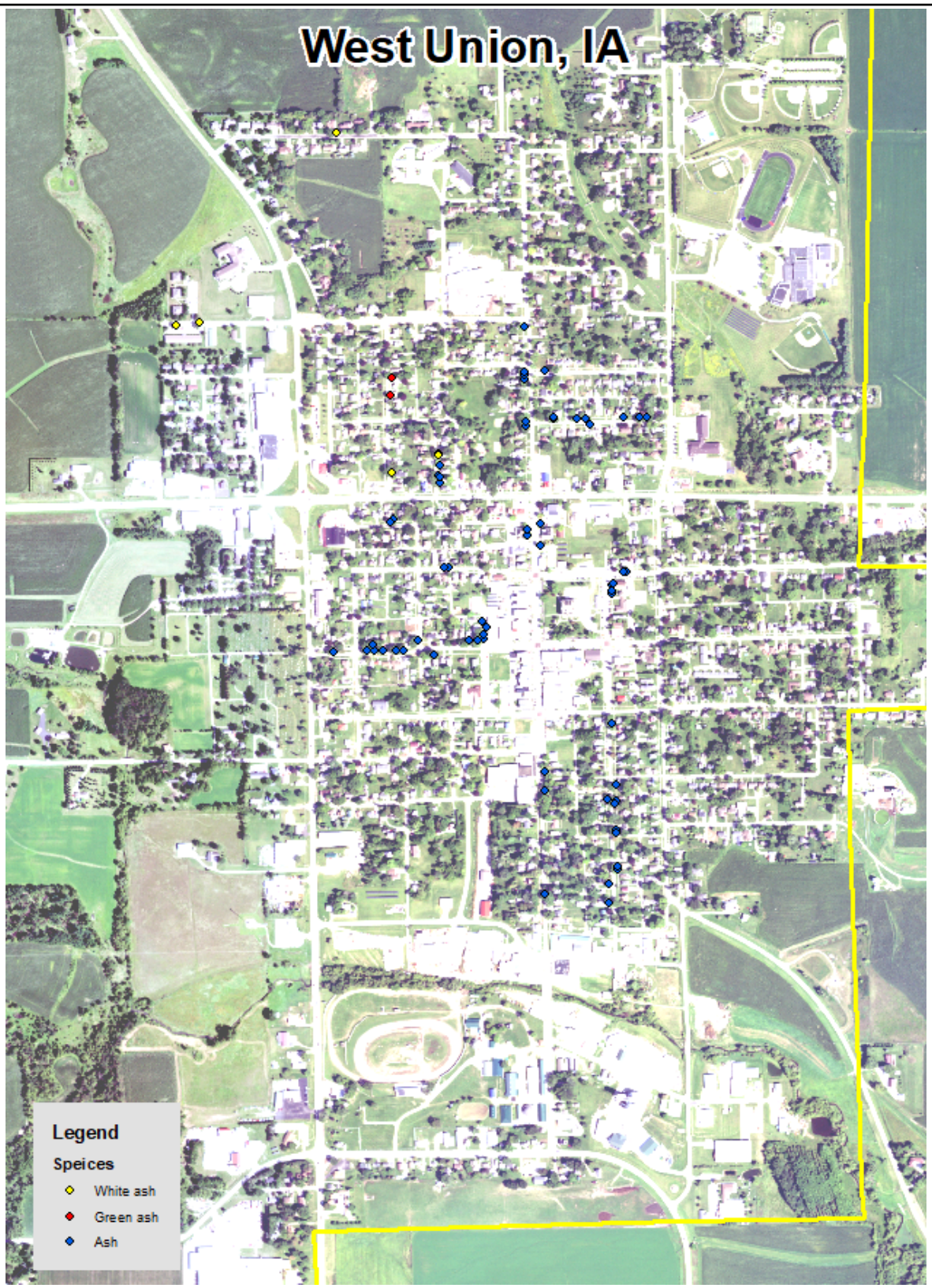

Figure 1: Location of Ash Trees

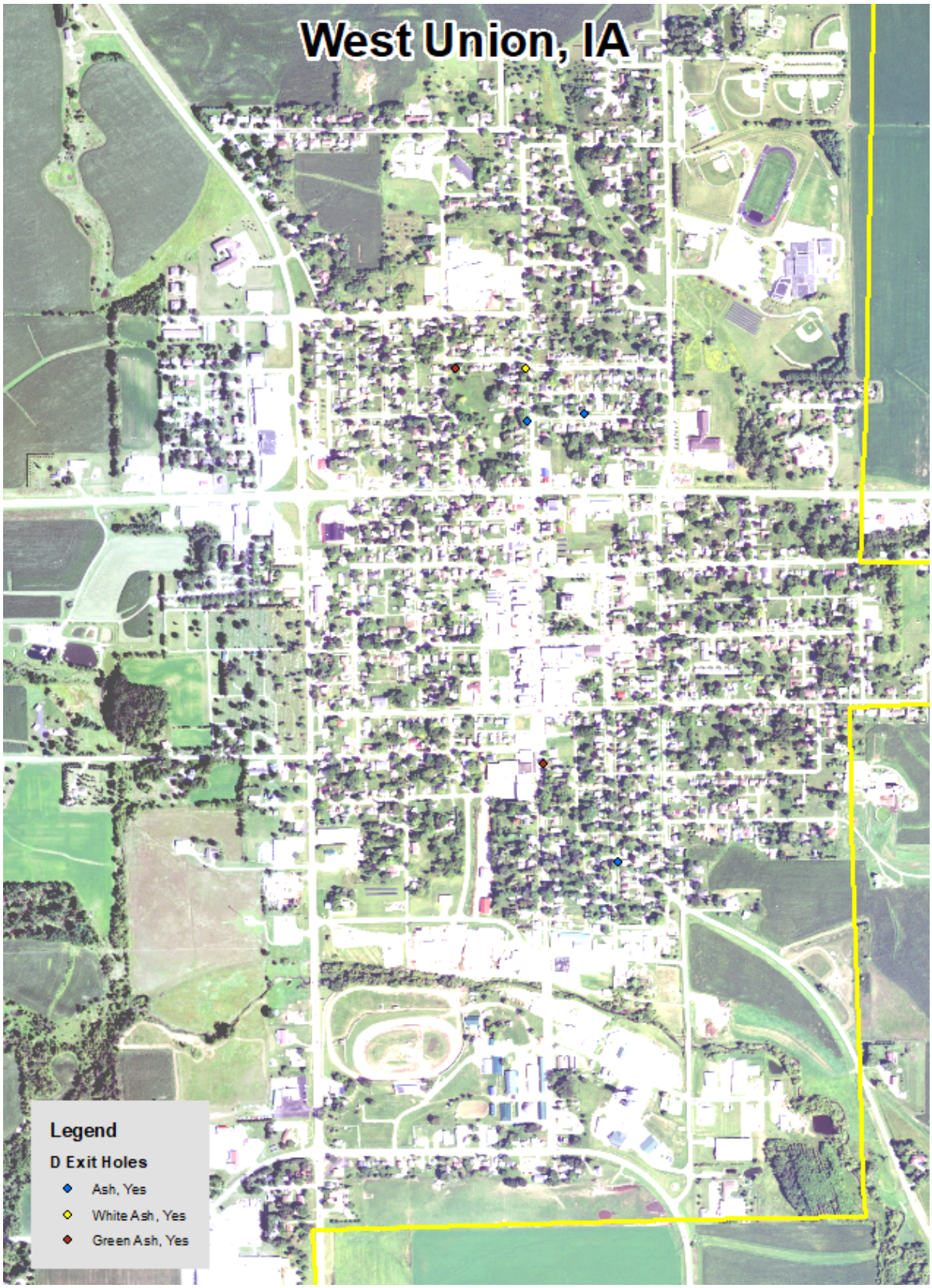

Figure 2: Location of EAB symptoms

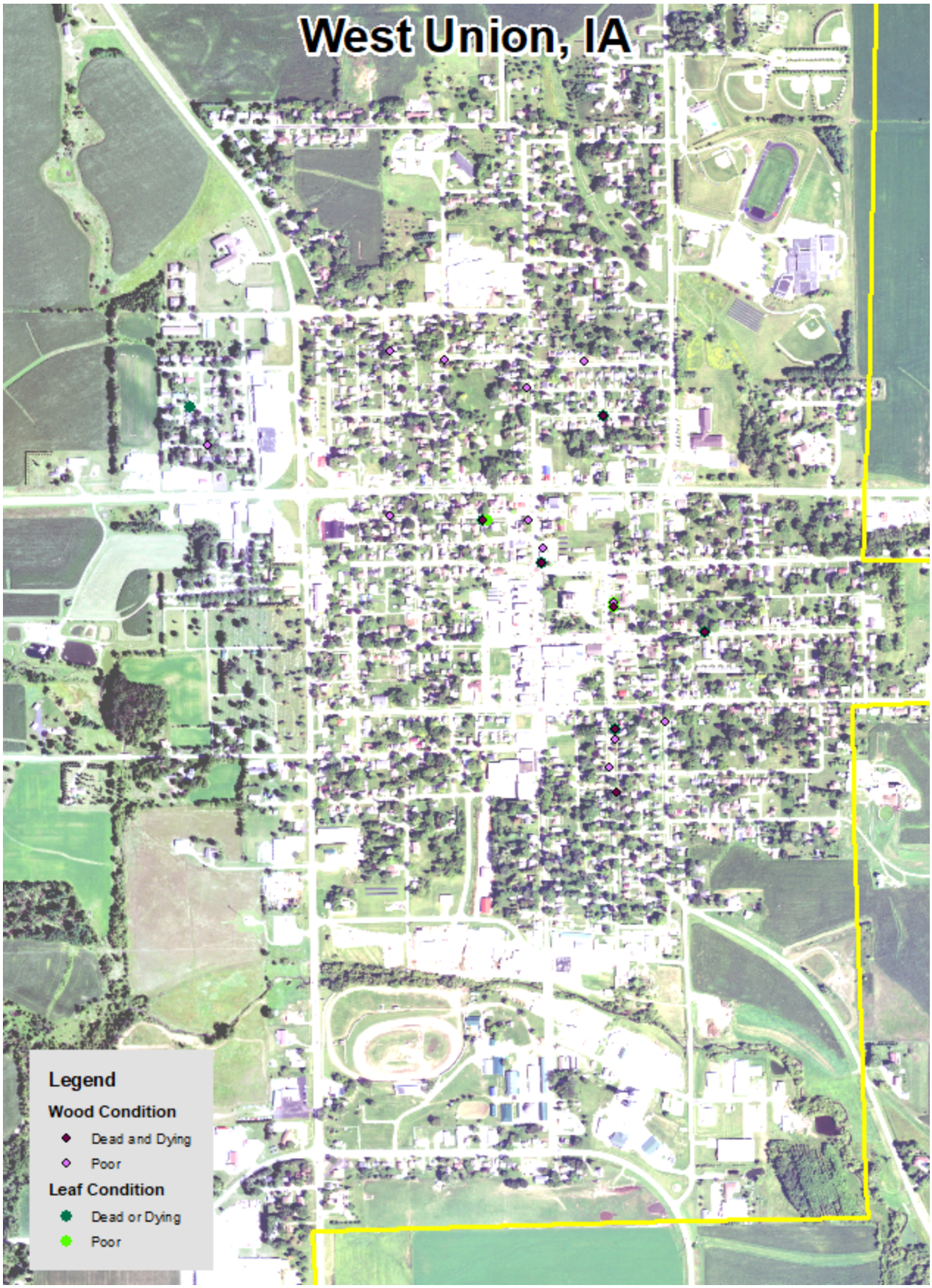

Figure 3: Location of Poor Condition Trees

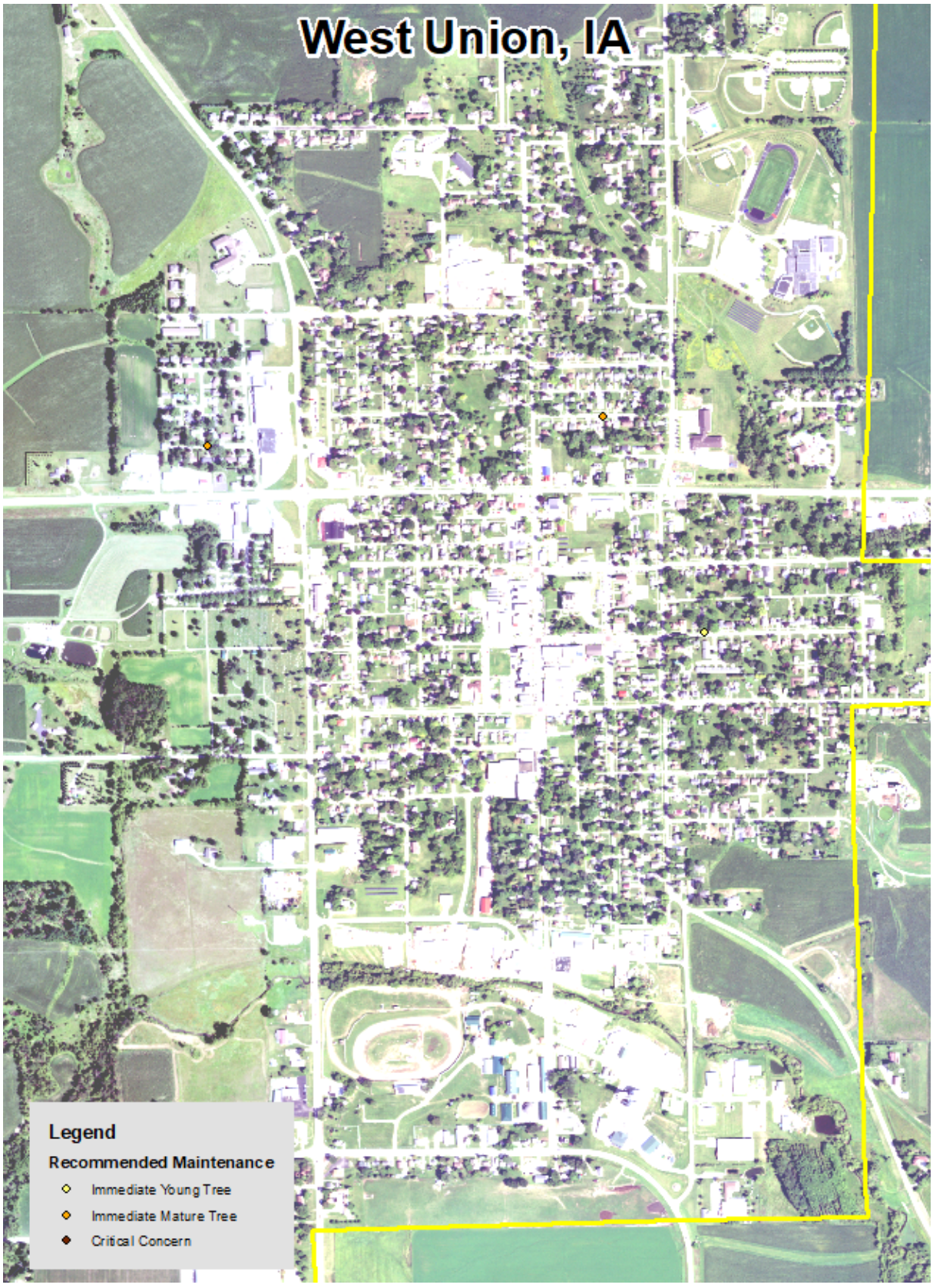

Figure 4: Location of Trees with Recommended Maintenance

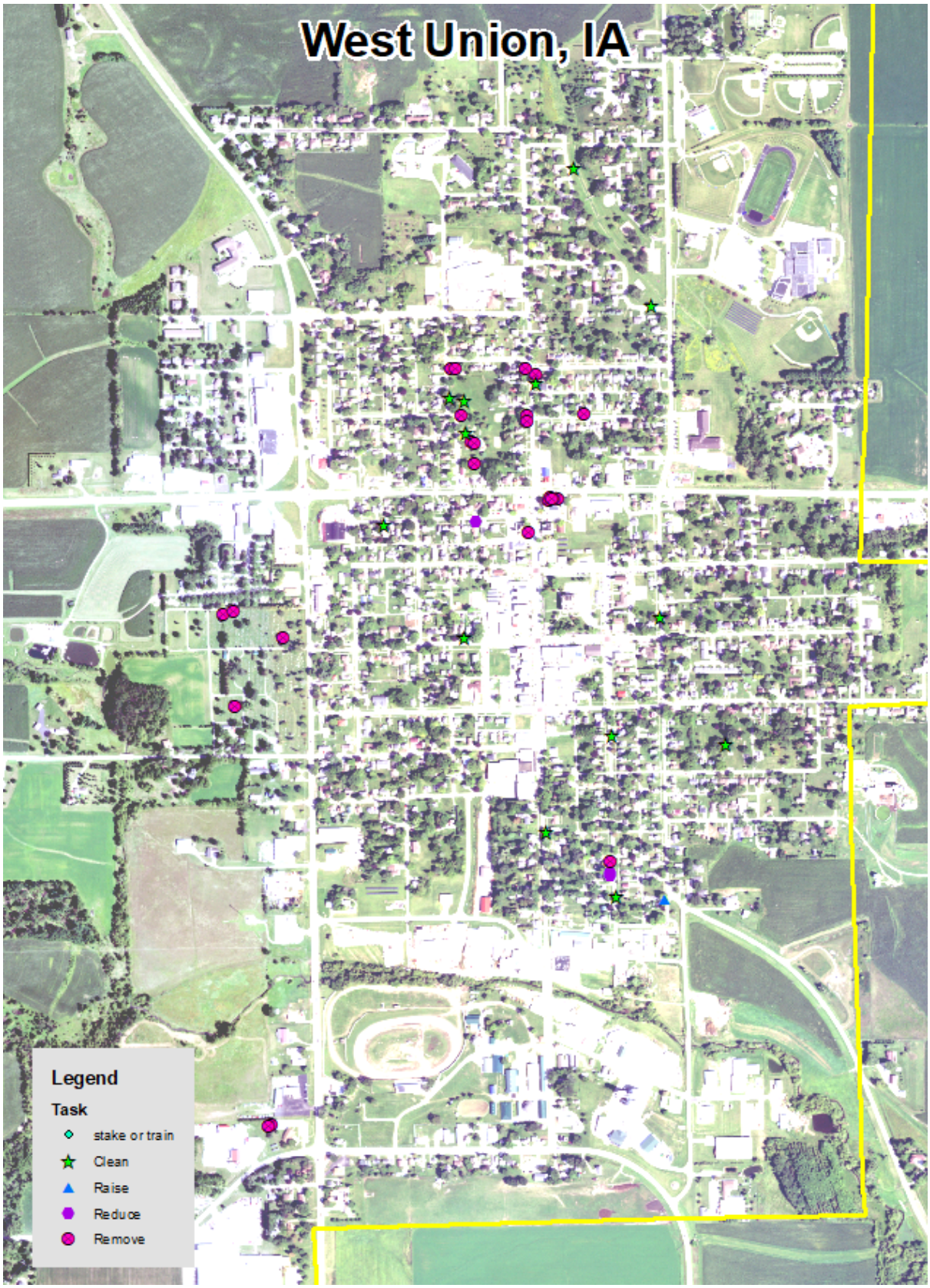

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: West Union Tree Ordinances

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

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

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

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

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

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

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

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

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

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

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

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

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

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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 Directory at 515-725-8200.