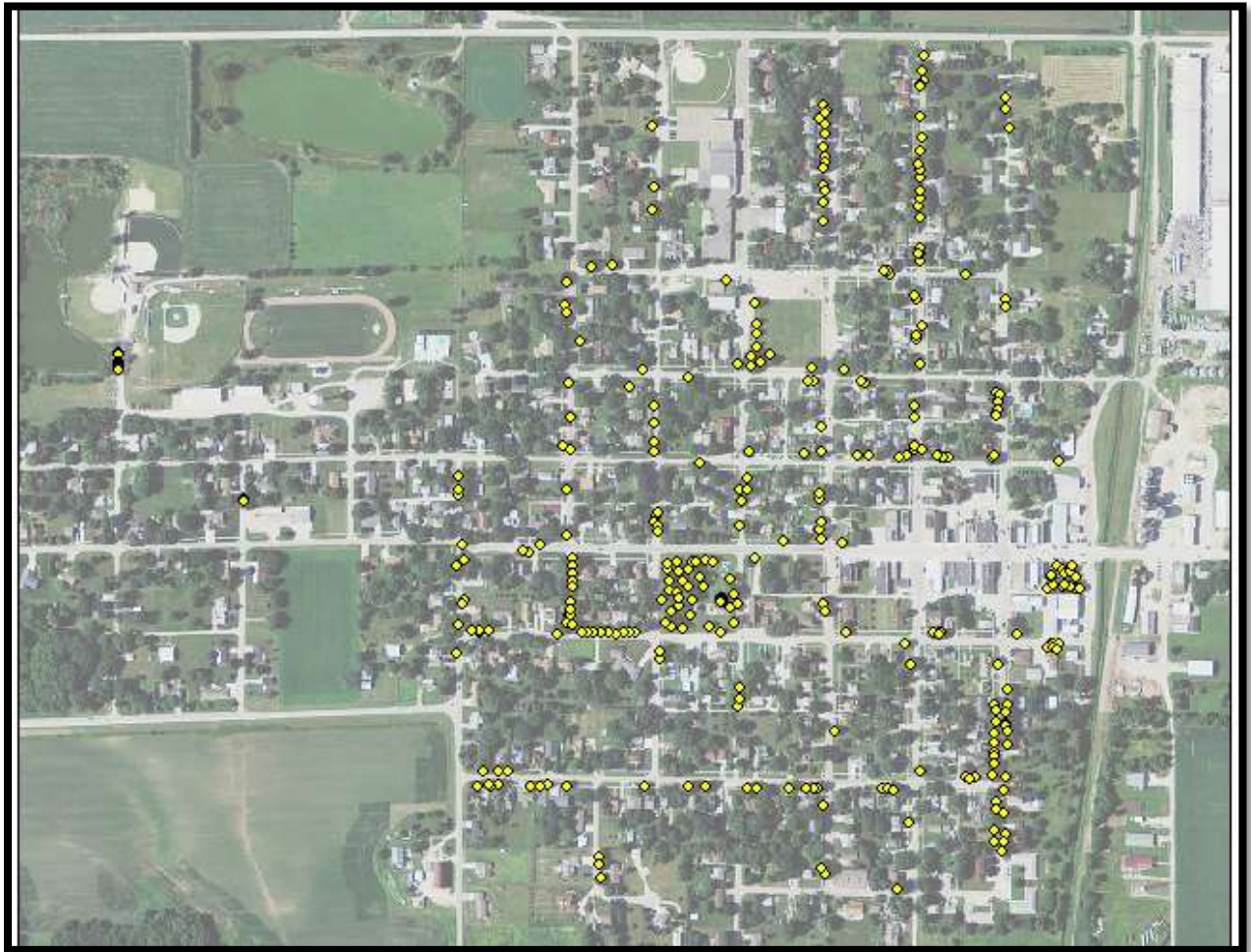# Community Tree Management Plan
For Sheffield, IA

Prepared by the Iowa DNR
Bureau of Forestry
2014

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Executive Summary

Overview

This plan was developed to assist the City of Sheffield with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management of this resource is critical to fully reaping these rewards. 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 *(Fraxinus spp.)*. There is a strong possibility that 27% of Sheffield's city-owned tree population (87 ash trees) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be spread out over time, mitigating the financial burden as well as public safety issues.

Inventory and Results

In June 2013, a tree inventory was conducted by volunteers 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 327 trees inventoried.
- Sheffield's trees provide $64,824 of benefits annually, at an average of $198 a tree
- There are at least 34 different species of trees in Sheffield
- The top three genus are: Maple 35%, Ash 27%, and Cottonwood 5%
- 68% of trees are in need of some type of maintenance (trimming, removal, etc.):
    - 22 trees are recommended for removal; some of these are critical concerns while others can be considered routine over the next 6 years
    - 199 trees need maintenance in the form of trimming

Recommendations

The core recommendations are detailed in the *Recommendations* section. Some key ones include:
- Begin planting new trees using a diverse mix of species wherever space is available and replacing existing trees that are in poor health to diversify the tree population and buffer against catastrophic tree pests such as EAB
- Address the 22 trees recommended for removal according to their priority level: 4 are "critical concern" trees which need to be addressed immediately; 15 should be removed in the next 1-3 years; and 3 sometime in the next 6 years *City ownership of the trees recommended for removal should be verified prior to any removal*
- Schedule maintenance (trimming, etc.) for the 199 trees identified by the inventory
- Begin regularly monitoring the ash tree population for signs or symptoms associated with EAB

Introduction

This plan was developed to assist Sheffield 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 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 and replacement planting. With proper planning and management of the current canopy in Sheffield, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In June 2013, a tree inventory was conducted in Sheffield that included 100% of the city owned trees on both streets and parks. The survey was done as a part of the Iowa State University Community Tree Steward program led by Dr. Jesse Randall. Approximately two dozen volunteers in the class collected tree data using a handheld Global Positioning System (GPS) receivers. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in ArcGIS 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 of 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 327 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Sheffield's trees reduce energy related costs by approximately $19,102 annually (Appendix A, Table 1). These savings are both in Electricity (89.7 MWh) and in Natural Gas (12,546 Therms).

Annual Stormwater Benefits

Sheffield's trees intercept about 947,784 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides $25,687 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 mater (ozone). In Sheffield, it is estimated that trees remove 1,196 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 $3,393 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Sheffield, trees sequester about 149,864 lbs of carbon each year with an associated value of $1,124 (Appendix A, Table 5). This equates to 3,476,539 lbs of carbon being stored in Sheffield's trees with total benefit of $26,074 (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. Sheffield receives $14,515 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Sheffield's trees provide $64,824 of benefits annually. Benefits of individual trees vary based on size, species, health and

location, but on average each of the 327 trees in Sheffield provide approximately $198 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Sheffield has over 34 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Maple	116	35%
Ash	87	27%
Cottonwood	17	5%
Locust	16	5%
Hackberry	13	4%
All others	< 10 ea.	< 3% ea.

Size Class

Sheffield's tree population is skewed toward larger trees in terms of its size class distribution; just 10% of Sheffield's trees are less than 12 inches in diameter at 4.5 ft (Appendix A, Figure 2). This indicates an imbalance in the city's tree population and suggests that as the larger, older trees decline and are removed, there is a lack of younger trees being planted to replace them. Having too many large trees and too few young ones increases the risk for catastrophic storm damage and a long "lag period" following major damage.

Condition: Wood and Foliage Health

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. Unfortunately, data on the foliage health was not collected by the volunteers. However, the survey results for structural/wood health of Sheffield's trees indicate that 88% of the trees are in either good or fair health, while 12% of the trees are either in poor health or are considered dead or dying (Appendix A, Figures 3 & 4 and Appendix B, Figure 3).

These 12% of trees classified as poor, dead, or dying represent opportunity costs to the city where time and space are being sacrificed. Trees in poor health should be removed and replaced with new, healthy trees to diversify and improve the overall health and resiliency of Sheffield's urban tree population.

Canopy Cover

The amount of tree canopy cover over Sheffield is over 10 acres (Appendix A, Figure 5). According to the U.S. Census, Sheffield occupies 3584 acres of land. Thus the canopy cover on city land is less than 1%.

Land Use and Location

The majority of Sheffield's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figures 6 & 7).

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, Figures 4 & 5). Crown cleaning removes dead, diseased, and broken limbs. Staking/training is for recently planted young trees that need to be staked, pruned, or shaped for proper architecture to prevent problems later on. Raising removes lower branches from the tree trunk to eliminate obstructions or clearance issues. Crown reduction is removing individual limbs to avoid interference with nearby structures, utility wires, or other branches.

Maintenance Need	# Trees	Details
Tree Removal	22	4 critical concern, 15 immediate, 3 routine
Trimming:	199	19 immediate, 180 routine

- Crown Cleaning (168)
- Crown Reduction (7)
- Raising (29)

Recommendations

Risk Management

Hazardous trees and branches 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 immediately.

Hazardous trees & branches: Critical concerns and Immediate needs
Sheffield has 4 "critical concern" trees that are considered hazardous and should be taken down promptly. After that, there should be follow up on the trees marked as needing "immediate" maintenance attention, meaning within the next three years. There are a total of 34 trees with these needs. Refer to the maps in Figures 3 and 4 of Appendix B to view the locations of these trees.

Routine maintenance trees
After dealing with the critical concern and immediate need trees, there are 183 trees needing "routine" maintenance within the next six years (Appendix B, Figures 3 & 4). Of this number, 180 need trimming and 3 are recommended for removal & replacement with something new.

After addressing the trees mentioned above, any remaining trees that are listed in "poor" health (either wood or foliage) should be targeted for replacement as time and resources allow.

Routine Pruning

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. It is generally recommended that all trees be inspected for pruning needs every five to ten years. This would equate to pruning roughly 30 trees per year in Sheffield.

Planting

Theoretically, the city should be planting (and removing) about 2-4 trees per year in order to sustain the tree population and to spread the trees equally out among different ages (size classes). This assumes the typical lifespan of a tree in Sheffield to be 80-140 years; if the trees are not living that long, or if the goal is to *increase* the tree population, the target will be higher (6-8 trees/yr). 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 Sheffield.

It is important to plant a diverse mix of differing species in the urban forest to maintain canopy health, since most insects and diseases target a single genus of trees (e.g., ash, maple, oak). Current diversity recommendations advise that a single genus not make up more than 20% of the urban forest and a single species (e.g. 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 the genus Maple, at 35% (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 for various reasons include: cottonwood, poplar, boxelder, Chinese elm, evergreens, willow, or black walnut, and any others identified in the city tree code.

A list containing generally acceptable and recommended trees for planting in Iowa is provided with this plan. Ensure each individual planting is tailored for the environmental conditions, available space, and other factors.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that all ash trees which are showing any signs or symptoms of EAB be checked annually with a visual survey for tree death and for additional symptoms (canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage). All other ash trees in the city which aren't exhibiting these symptoms should still be routinely monitored as time allows.

Proposed Work Schedule & Estimated Costs

EAB could potentially kill all 87 ash trees in Sheffield within 4 years of its arrival, with tree removal costs likely to exceed $60,000. By budgeting for routine maintenance, replacement,

and removals now, the city can be proactive and preventative rather than reactive when this pest arrives.

The following is a proposed 6-year work plan that would address the highest priority issues at this time. Estimated costs are based on $700/tree average for removal, $75/tree average for trimming*, and $150/tree average for planting. *Individual homeowners are presumed to be responsible for light trimming and staking/training of young trees in the City right-of-way. For new tree plantings & replacements, it is recommended that Sheffield apply for grants. 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.

Year 1	Estimated Costs
Removals: 4 of the 22 recommended trees	$2800
Planting and replacements: 2-4 new trees	$450
Trimming: 34 of the 199 recommended trees	$2550

Year 2	
Removals: 4 of the 22 recommended trees	$2800
Planting and replacements: 2-4 new trees	$450
Trimming: 33 of the 199 recommended trees	$2475

Year 3	
Removals: 4 of the 22 recommended trees	$2800
Planting and replacements: 2-4 new trees	$450
Trimming: 33 of the 199 recommended trees	$2475

Year 4	
Removals: 4 of the 22 recommended trees	$2800
Planting and replacements: 2-4 new trees	$450
Trimming: 33 of the 199 recommended trees	$2475

Year 5	
Removals: 3 of the 22 recommended trees	$2100
Planting and replacements: 2-4 new trees	$450
Trimming: 33 of the 199 recommended trees	$2475

Year 6	
Removals: 3 of the 22 recommended trees	$2100
Planting and replacements: 2-4 new trees	$450
Trimming: 33 of the 199 recommended trees	$2475

Annually thereafter	
Removals: 2-4/year avg. focusing on poor condition ash & maple	$2100

Planting and replacements: 2-4/year avg. $450
Routine trimming: 30 trees/year avg. $2250
Routine monitoring for EAB symptoms on ash trees

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Maps and figures provided by Emma Bruemmer, Urban Forestry Coordinator. All data and information used for this report may be obtained by contacting the Iowa DNR Forestry Bureau.

Works Cited

Census Bureau. 2000. http://censtats.census.gov/data/IA/1601964290.pdf (April, 2010)

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, D.J. and J.F. 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

Sheffield, IA

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Sheffield

Annual Energy Benefits of Public Trees by Species

3/21/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	14.1	1,073	2,050.3	2,009	3,083	(N/A)	15.3	16.1	61.65
Green ash	13.3	1,007	1,823.3	1,787	2,794	(N/A)	13.8	14.6	62.08
Maple	8.5	647	1,164.1	1,141	1,788	(N/A)	10.1	9.4	54.17
Ash	7.7	585	1,108.8	1,087	1,671	(N/A)	8.6	8.8	59.70
Broadleaf Deciduous	2.4	183	374.7	367	550	(N/A)	5.8	2.9	28.94
Sugar maple	5.9	450	804.8	789	1,239	(N/A)	5.5	6.5	68.81
Eastern cottonwood	5.5	419	751.8	737	1,156	(N/A)	5.2	6.1	67.99
Black locust	4.6	347	681.0	667	1,014	(N/A)	4.9	5.3	63.38
Northern hackberry	5.3	400	743.8	729	1,129	(N/A)	4.0	5.9	86.88
Black ash	3.5	266	521.9	511	777	(N/A)	3.7	4.1	64.76
Honeylocust	4.3	327	554.8	544	871	(N/A)	3.7	4.6	72.57
Silver maple	3.2	242	407.9	400	641	(N/A)	3.1	3.4	64.14
Apple	1.0	75	162.8	160	235	(N/A)	2.8	1.2	26.09
Basswood	1.9	145	262.0	257	402	(N/A)	2.1	2.1	57.46
Red maple	0.9	67	106.7	105	171	(N/A)	1.2	0.9	42.86
Pin oak	0.9	66	111.0	109	175	(N/A)	1.2	0.9	43.72
Other street trees	6.7	509	915.8	897	1,406	(N/A)	9.2	7.4	46.87
Citywide total	89.7	6,807	12,545.7	12,295	19,102	(N/A)	100.0	100.0	58.42

Table 2: Annual Stormwater Benefits

Sheffield

Annual Stormwater Benefits of Public Trees by Species

3/21/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	141,524	3,836	(N/A)	15.3	14.9	76.71
Green ash	148,101	4,014	(N/A)	13.8	15.6	89.20
Maple	78,060	2,116	(N/A)	10.1	8.2	64.11
Ash	75,451	2,045	(N/A)	8.6	8.0	73.03
Broadleaf Deciduous	11,814	320	(N/A)	5.8	1.3	16.85
Sugar maple	77,079	2,089	(N/A)	5.5	8.1	116.05
Eastern cottonwood	66,706	1,808	(N/A)	5.2	7.0	106.34
Black locust	49,337	1,337	(N/A)	4.9	5.2	83.57
Northern hackberry	57,709	1,564	(N/A)	4.0	6.1	120.31
Black ash	37,459	1,015	(N/A)	3.7	4.0	84.60
Honeylocust	53,086	1,439	(N/A)	3.7	5.6	119.89
Silver maple	39,373	1,067	(N/A)	3.1	4.2	106.71
Apple	4,913	133	(N/A)	2.8	0.5	14.79
Basswood	18,588	504	(N/A)	2.1	2.0	71.97
Red maple	5,437	147	(N/A)	1.2	0.6	36.84
Pin oak	5,732	155	(N/A)	1.2	0.6	38.83
Other street trees	77,417	2,098	(N/A)	9.2	8.2	69.94
Citywide total	947,784	25,687	(N/A)	100.0	100.0	78.55

Table 3: Annual Air Quality Benefits

Sheffield

Annual Air Quality Benefits of Public Trees by Species

3/21/2014

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							
Norway maple	30.0	5.2	14.6	1.3	162	68.7	9.9	9.4	64.2	425	-6.9	-26	196.4	561 (N/A)	15.3	11.22
Green ash	18.2	2.9	8.7	0.8	97	63.4	9.2	8.8	60.1	395	0.0	0	172.2	492 (N/A)	13.8	10.93
Maple	19.5	3.3	9.0	0.9	103	40.6	5.9	5.6	38.6	253	-6.4	-24	117.0	333 (N/A)	10.1	10.08
Ash	15.9	2.7	7.7	0.7	86	37.3	5.4	5.1	35.0	231	-3.7	-14	106.2	303 (N/A)	8.6	10.83
Broadleaf Deciduous	3.9	0.6	1.8	0.2	21	11.9	1.7	1.6	10.9	73	0.0	0	32.6	94 (N/A)	5.8	4.93
Sugar maple	11.7	2.0	5.6	0.5	63	28.2	4.1	3.9	26.8	176	-9.0	-34	73.8	205 (N/A)	5.5	11.37
Eastern cottonwood	10.7	1.7	4.9	0.5	56	26.3	3.8	3.7	25.0	164	0.0	0	76.6	220 (N/A)	5.2	12.96
Black locust	10.8	1.9	5.2	0.5	58	22.3	3.2	3.1	20.7	138	-2.5	-9	65.2	187 (N/A)	4.9	11.67
Northern hackberry	10.7	1.8	5.2	0.5	58	25.4	3.7	3.5	23.9	158	0.0	0	74.8	215 (N/A)	4.0	16.58
Black ash	8.1	1.4	3.9	0.4	44	17.1	2.5	2.3	15.9	106	-1.9	-7	49.8	142 (N/A)	3.7	11.87
Honeylocust	10.6	1.7	4.8	0.5	56	20.2	3.0	2.8	19.5	127	-8.5	-32	54.6	151 (N/A)	3.7	12.54
Silver maple	6.1	1.0	3.1	0.3	33	14.9	2.2	2.1	14.4	94	-3.2	-12	40.8	115 (N/A)	3.1	11.45
Apple	1.5	0.3	0.7	0.1	8	5.0	0.7	0.7	4.5	30	0.0	0	13.4	38 (N/A)	2.8	4.28
Basswood	2.0	0.3	1.0	0.1	11	9.1	1.3	1.3	8.7	57	0.0	0	23.9	68 (N/A)	2.1	9.69
Red maple	1.0	0.2	0.5	0.0	6	4.1	0.6	0.6	4.0	26	-0.4	-1	10.6	30 (N/A)	1.2	7.47
Pin oak	0.7	0.1	0.4	0.0	4	4.1	0.6	0.6	3.9	26	-1.4	-5	9.0	24 (N/A)	1.2	6.02
Other street trees	11.9	2.0	6.5	0.7	66	32.0	4.7	4.4	30.4	199	-13.2	-49	79.4	216 (N/A)	9.2	7.21
Citywide total	173.3	29.3	83.7	7.9	931	430.7	62.5	59.6	406.5	2,677	-57.2	-215	1,196.3	3,393 (N/A)	100.0	10.38

Table 4: Annual Carbon Stored

Sheffield

Stored CO2 Benefits of Public Trees by Species

3/21/2014

Species	Total Stored CO_2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	493,420	3,701	(N/A)	15.3	14.2	74.01
Green ash	591,313	4,435	(N/A)	13.8	17.0	98.55
Maple	208,889	1,567	(N/A)	10.1	6.0	47.47
Ash	261,394	1,960	(N/A)	8.6	7.5	70.02
Broadleaf	61,561	462	(N/A)	5.8	1.8	24.30
Sugar maple	343,835	2,579	(N/A)	5.5	9.9	143.26
Eastern	363,629	2,727	(N/A)	5.2	10.5	160.42
Black locust	177,294	1,330	(N/A)	4.9	5.1	83.11
Northern	170,519	1,279	(N/A)	4.0	4.9	98.38
Black ash	133,353	1,000	(N/A)	3.7	3.8	83.35
Honeylocust	137,730	1,033	(N/A)	3.7	4.0	86.08
Silver maple	130,228	977	(N/A)	3.1	3.8	97.67
Apple	24,945	187	(N/A)	2.8	0.7	20.79
Basswood	64,262	482	(N/A)	2.1	1.9	68.85
Red maple	11,973	90	(N/A)	1.2	0.3	22.45
Pin oak	16,433	123	(N/A)	1.2	0.5	30.81
Other street trees	129,619	2,143	(N/A)	9.2	8.2	71.44
Citywide total	3,476,539	26,074	(N/A)	100.0	100.0	79.74

Table 5: Annual Carbon Sequestered

Sheffield

Annual CO$_2$ Benefits of Public Trees by Species

3/21/2014

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
Norway maple	15,278	115	-2,368	-10	-18	23,719	178	36,620	275 (N/A)	15.3	12.9	5.49
Green ash	31,976	240	-2,838	-9	-21	22,251	167	51,379	385 (N/A)	13.8	18.1	8.56
Maple	9,100	68	-1,003	-6	-8	14,297	107	22,389	168 (N/A)	10.1	7.9	5.09
Ash	9,275	70	-1,255	-5	-9	12,924	97	20,939	157 (N/A)	8.6	7.4	5.61
Broadleaf Deciduous	2,959	22	-295	-4	-2	4,038	30	6,699	50 (N/A)	5.8	2.4	2.64
Sugar maple	15,417	116	-1,650	-4	-12	9,941	75	23,704	178 (N/A)	5.5	8.4	9.88
Eastern cottonwood	10,700	80	-1,745	-3	-13	9,262	69	18,214	137 (N/A)	5.2	6.4	8.04
Black locust	5,264	39	-851	-3	-6	7,663	57	12,073	91 (N/A)	4.9	4.3	5.66
Northern hackberry	7,201	54	-818	-3	-6	8,851	66	15,231	114 (N/A)	4.0	5.4	8.79
Black ash	3,190	24	-640	-2	-5	5,872	44	8,419	63 (N/A)	3.7	3.0	5.26
Honeylocust	4,932	37	-661	-2	-5	7,228	54	11,496	86 (N/A)	3.7	4.1	7.19
Silver maple	11,026	83	-625	-2	-5	5,339	40	15,738	118 (N/A)	3.1	5.6	11.80
Apple	2,043	15	-120	-2	-1	1,662	12	3,583	27 (N/A)	2.8	1.3	2.99
Basswood	4,583	34	-308	-1	-2	3,214	24	7,488	56 (N/A)	2.1	2.6	8.02
Red maple	1,615	12	-57	-1	0	1,478	11	3,035	23 (N/A)	1.2	1.1	5.69
Pin oak	1,990	15	-79	-1	-1	1,460	11	3,370	25 (N/A)	1.2	1.2	6.32
Other street trees	13,316	100	-1,372	-6	-10	11,242	84	23,180	174 (N/A)	9.2	8.2	5.80
Citywide total	149,864	1,124	-16,687	-64	-126	150,443	1,128	283,556	2,127 (N/A)	100.0	100.0	6.50

Table 6: Annual Social and Aesthetic Benefits

Sheffield

Annual Aesthetic/Other Benefits of Public Trees by Species

3/21/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,418	(N/A)	15.3	9.8	28.36
Green ash	2,599	(N/A)	13.8	17.9	57.76
Maple	1,169	(N/A)	10.1	8.1	35.43
Ash	865	(N/A)	8.6	6.0	30.89
Broadleaf Deciduous	173	(N/A)	5.8	1.2	9.11
Sugar maple	1,509	(N/A)	5.5	10.4	83.84
Eastern cottonwood	852	(N/A)	5.2	5.9	50.11
Black locust	473	(N/A)	4.9	3.3	29.58
Northern hackberry	876	(N/A)	4.0	6.0	67.36
Black ash	290	(N/A)	3.7	2.0	24.15
Honeylocust	1,269	(N/A)	3.7	8.8	105.79
Silver maple	936	(N/A)	3.1	6.5	93.57
Apple	120	(N/A)	2.8	0.8	13.39
Basswood	396	(N/A)	2.1	2.7	56.57
Red maple	228	(N/A)	1.2	1.6	56.88
Pin oak	201	(N/A)	1.2	1.4	50.34
Other street trees	1,140	(N/A)	9.2	7.9	38.01
Citywide total	14,515	(N/A)	100.0	100.0	44.39

Table 7: Summary of Benefits in Dollars
Average Annual Benefits of Public Trees by
Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	3,083	275	561	3,836	1,418	$9,171.83	(±0)	14.15
Green ash	2,794	385	492	4,014	2,599	$10,283.73	(±0)	15.86
Maple	1,788	168	333	2,116	1,169	$5,572.88	(±0)	8.60
Ash	1,671	157	303	2,045	865	$5,041.48	(±0)	7.78
Broadleaf Deciduous Small	550	50	94	320	173	$1,187.14	(±0)	1.83
Sugar maple	1,238	178	205	2,089	1,509	$5,218.91	(±0)	8.05
Eastern cottonwood	1,156	137	220	1,808	852	$4,172.64	(±0)	6.44
Black locust	1,014	91	187	1,337	473	$3,101.77	(±0)	4.78
Northern hackberry	1,129	114	215	1,564	876	$3,898.85	(±0)	6.01
Black ash	777	63	142	1,015	290	$2,287.72	(±0)	3.53
Honeylocust	871	86	151	1,439	1,269	$3,815.70	(±0)	5.89
Silver maple	641	118	115	1,067	936	$2,876.68	(±0)	4.44
Apple	235	27	38	133	120	$553.76	(±0)	0.85
Basswood	402	56	68	504	396	$1,425.94	(±0)	2.20
Red maple	171	23	30	147	228	$598.93	(±0)	0.92
Pin oak	175	25	24	155	201	$580.92	(±0)	0.90
Other street trees	1,406	174	216	2,098	1,140	$5,034.86	(±0)	7.77
Citywide total	19,102	2,127	3,393	25,687	14,515	$64,823.75	(±0)	100.00
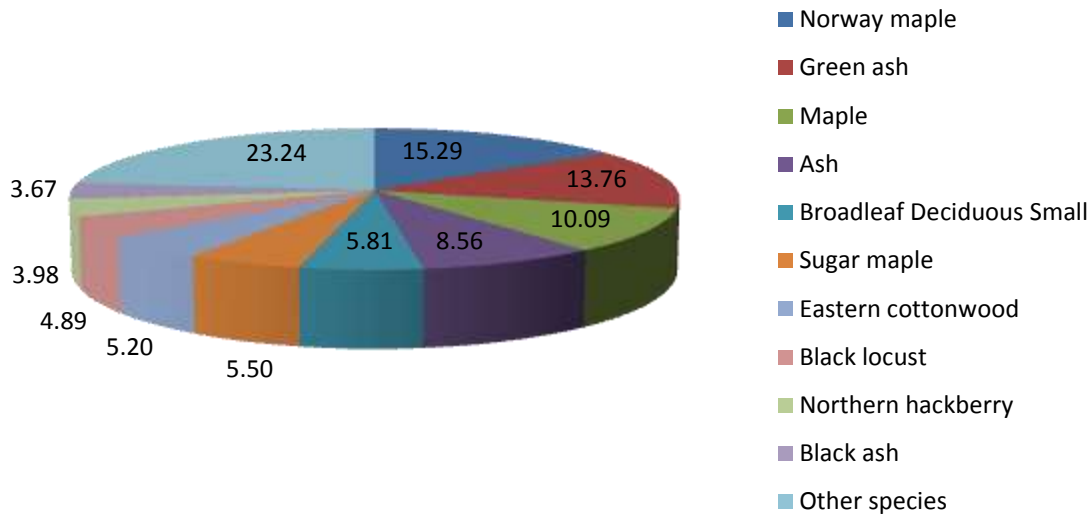
Figure 1: Species Distribution

Relative Age Distribution of Top 10 Public Tree Species (%)
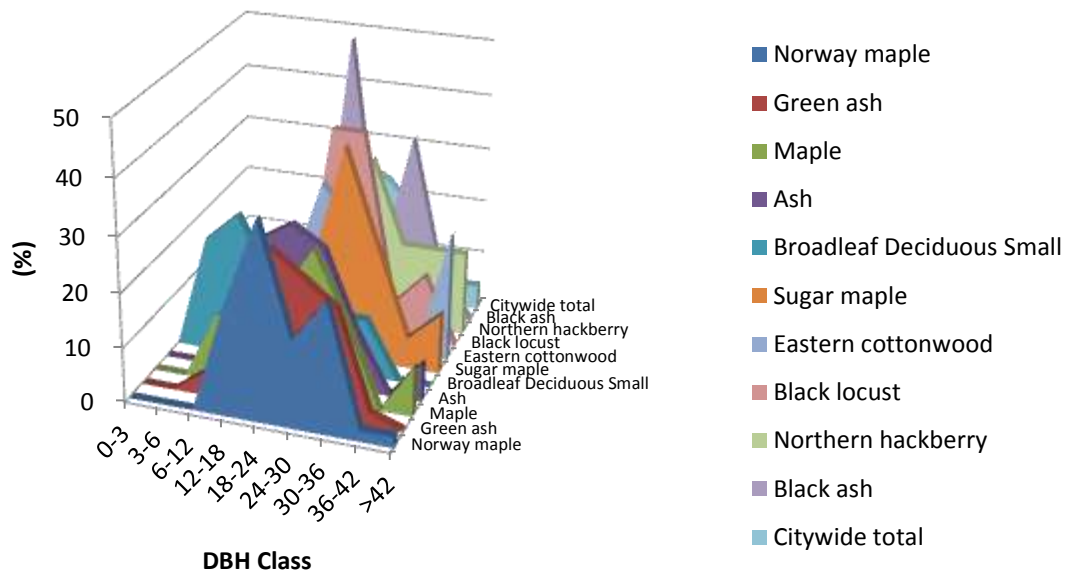
Figure 2: Relative Age Class

Wood Condition

Dead or Dying 3% **Poor** 8%

Fair 20%

Good 69%

- Dead or Dying
- Poor
- Fair
- Good
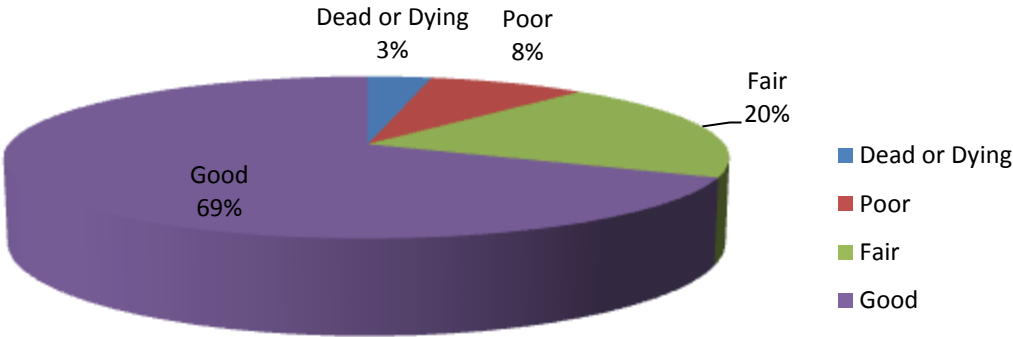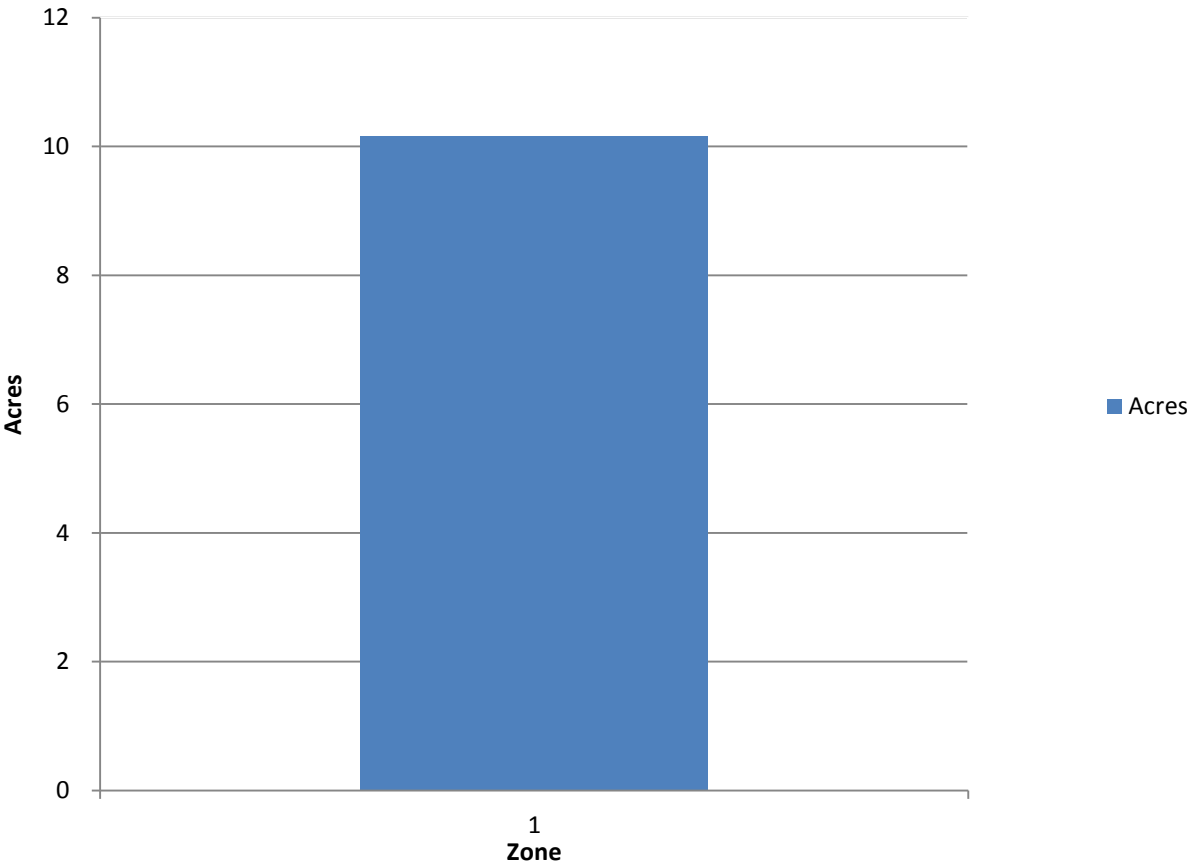
Figure 4: Wood Condition

Canopy Cover

Figure 5: Canopy Cover in Acres

Land use Public Trees by Zone (%)
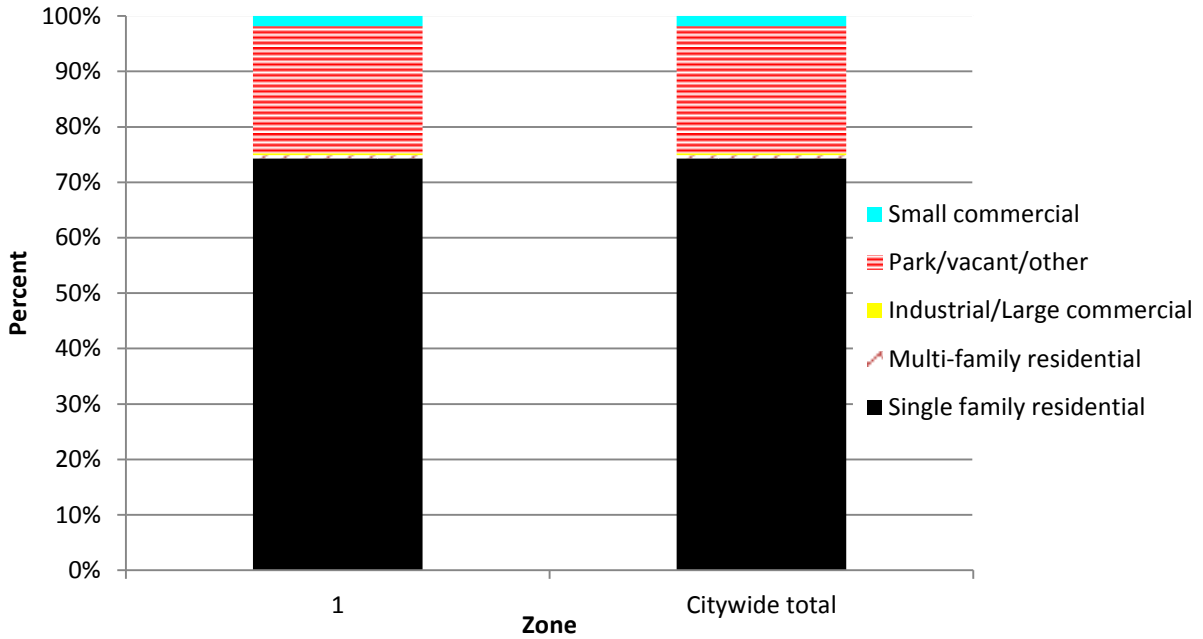
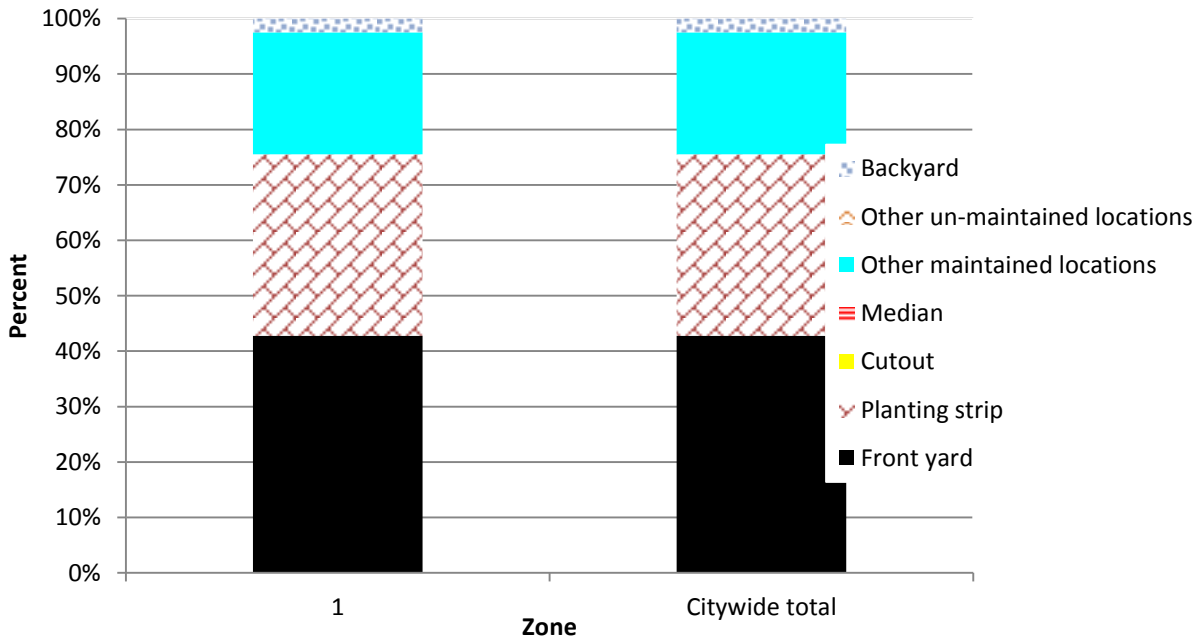**Figure 6: Land Use of city/park trees**

Location Public Trees by Zone (%)

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 3: Location of Poor Condition Trees
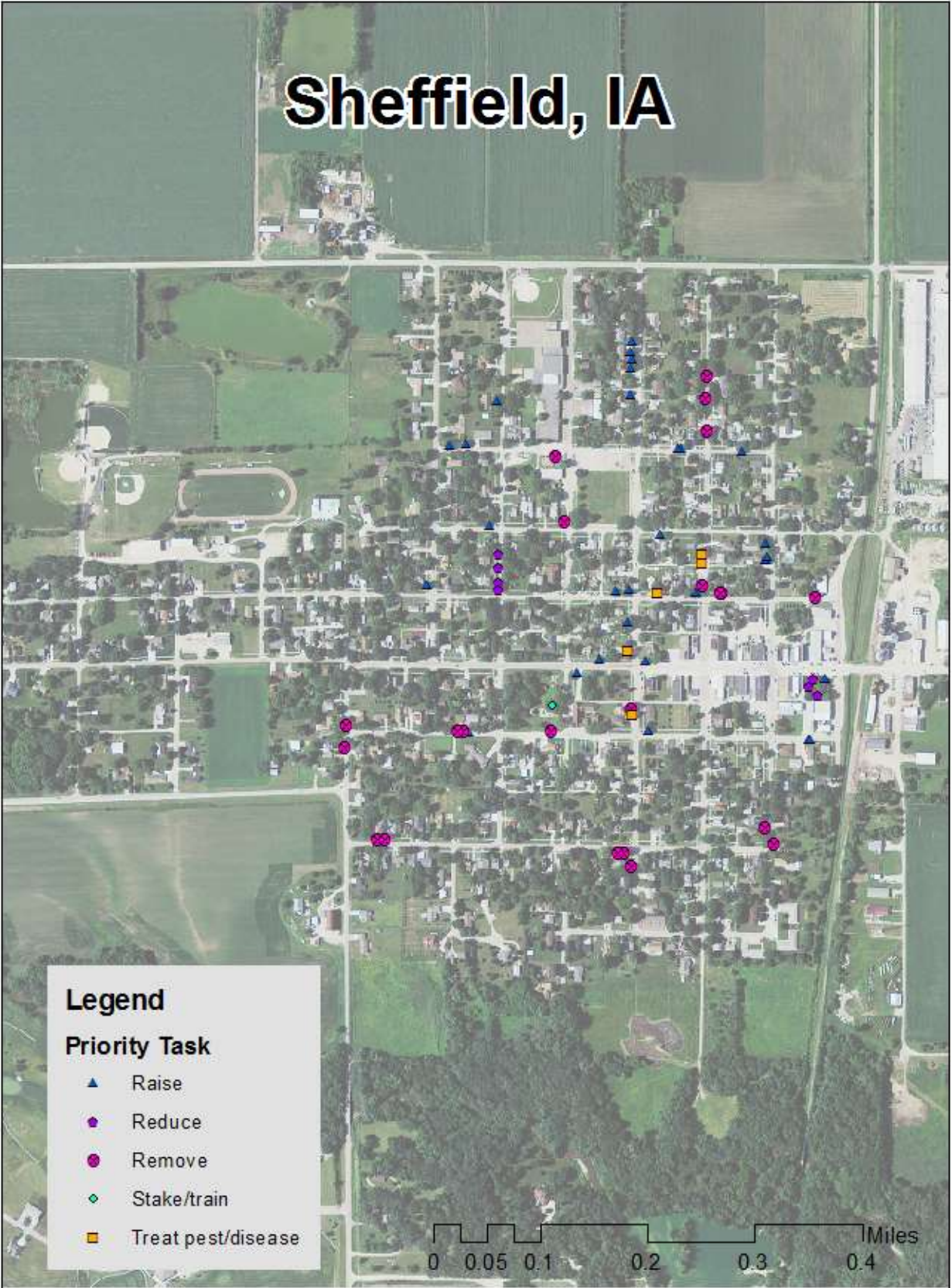
Figure 4: Location of Trees with Recommended Maintenance

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

Appendix C: Proposed Emerald Ash Borer Plan

Ash Tree Removal

Ash tree removal will be prioritized with dead, dying, hazardous trees to be removed first. Next will be all ash in poor condition and displaying signs and symptoms of EAB. *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million 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 ash trees will be replaced. All trees will meet the guidelines in the City Code.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on trees 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.