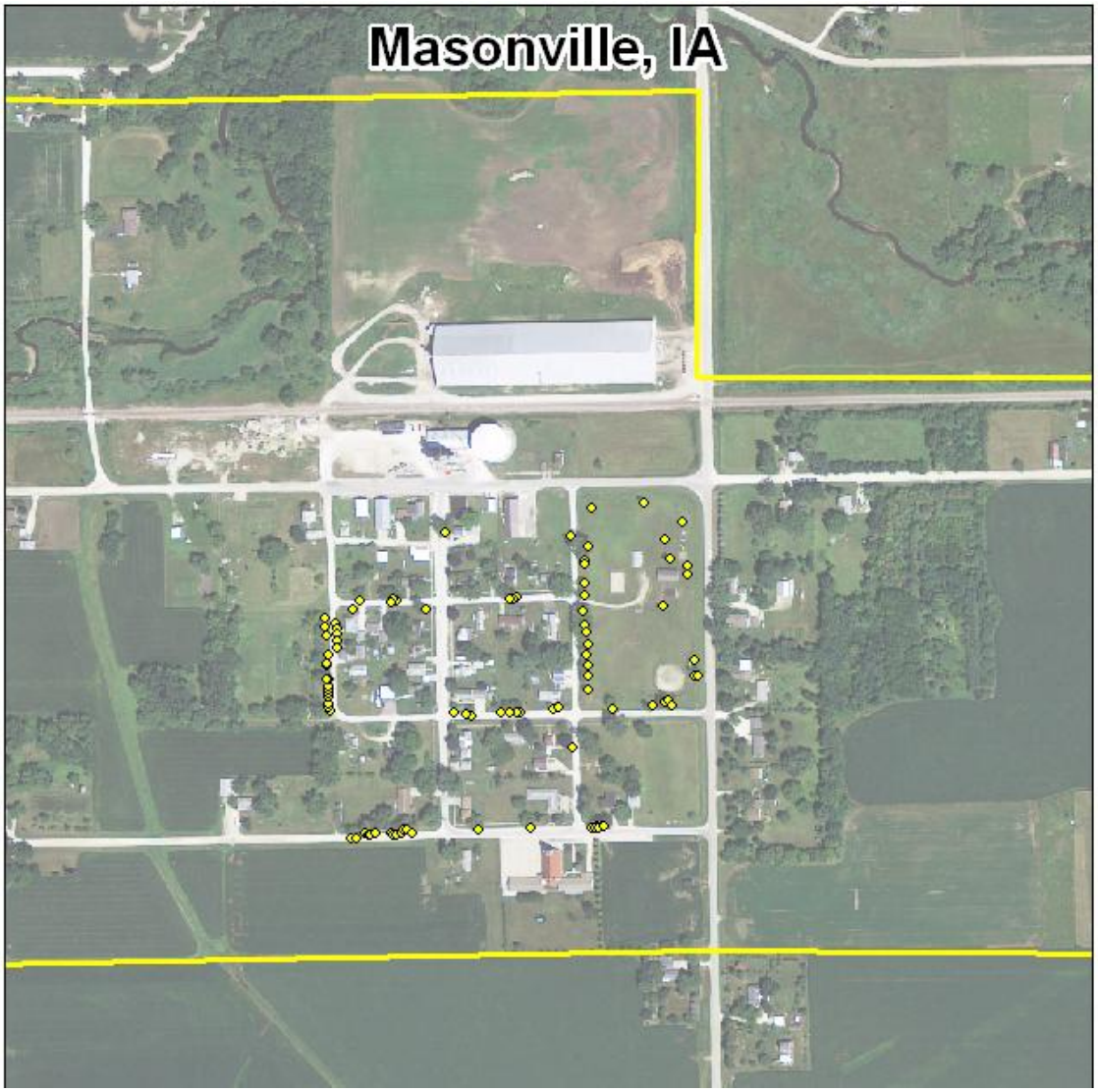
MASONVILLE, IA



2012 Management Plan

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Executive Summary

Overview:

This plan was developed to assist the City of Masonville with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities 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 that kills all species of our native ash trees. There is a strong possibility that over 5% of Masonville's city-managed ash trees could die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over several years mitigating public safety issues.

Inventory and Results:

In the summer of 2011, a street tree inventory was conducted using an integrated Global Positioning System (GPS) data collector. This involved a complete inventory of street trees within the City's Right-of-Way and some parkland. Below are some key findings of the 94 trees inventoried.

- Masonville street trees provide roughly $14,770 of annual benefits, an average of $157 per tree.
- The top three species groups are: Maples (41%), Elm (13%) and Ash (11%).
- Approximately 10% of trees are in need of some type of management.
- For various reasons, 3 trees are recommended for removal.

Recommendations:

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

- All trees should be pruned on a routine schedule- one third of the city every other year.
- Plant a diverse mix of trees that *does not include*: ash, soft maple, autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar and tree-of-heaven.
- Check ash trees with a visual survey yearly.

Introduction

This plan was developed to assist Masonville with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with a great proportion 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 Masonville, these costs can be extended over several years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important component of Masonville's infrastructure and are one of the greatest assets to the community. Through research, it has been shown that trees provide a community with numerous public benefits including: improved air quality, storm water runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and creating a desirable place to live. It is essential that these benefits be maintained for the people of Masonville and future generations through sound urban forestry management.

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

Inventory

In the summer of 2011, a tree inventory was conducted that included the city-owned street trees and some park trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver/data logger. This devise records Geographic Information System (GIS) coordinates with an accuracy of 3 meters. The data can then 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 collector was written to be compatible with a state-of-the-art software suite called i-Tree. This software was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. This software is in the public domain and can be accessed for free.

To quantify the urban forest structure and its benefits, specific data is collected for each tree. This data includes: location, land use, tree species, diameter at 4.5 ft (DBH), 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 by the data loggers was downloaded and analyzed by software developed by the USDA Forest service called *Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM)*. This is software is also part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis of Masonville's inventory data.

Annual Benefits

Annual Energy Benefits:

Trees conserve energy by shading buildings and blocking winds. Masonville's trees reduce energy related costs by approximately $3,197 annually (Appendix A, Table 1). These savings are both in Electricity (15.5 MWh) and in Natural Gas (2,061 Therms).

Annual Storm water Benefits:

Masonville's trees intercept about 144,297 gallons of rainfall and snow melt per year (Appendix A, Table 2). This interception provides $3,911 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 that emit volatile organic matter (ozone). In Masonville, it is estimated that trees remove 187 lbs. of air pollution (ozone (O_3), particulate matter less than 10 microns (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $525 (Appendix A, Table 3).

Annual Carbon Benefits:

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. Of the 94 trees inventoried, the amount of carbon stored amounts to approximately 454,680 total lbs of CO_2 (Appendix A, Table 4). Those trees are sequestering about 35,348 lbs of carbon per year (Appendix A, Table 5). The benefits these trees provide from summer shading and from reductions in household wind infiltration in the winter result in approximately 26,003 fewer lbs of CO_2 being released into the atmosphere (Appendix A Table 5).

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. Masonville receives approximately $3,727 in annual social benefits from its street trees (Appendix A, Table 6).

Financial Summary of all Benefits:

According to the USDA Forest Service i-Tree STRATUM analysis, Masonville's trees provide $14,770 of benefits annually. Benefits of individual trees vary based on size, species, health and location. On average, each of the 94 trees in Masonville's inventory provides approximately $157 annually.

Forest Structure

Species Distribution:

There were over 17 different tree species surveyed. The distribution of trees by genus is as follows:

Genus	# of trees	% of total
Maple (*acer*)	39	41.5%
Elm (*ulmus*)	12	12.8%
Ash (*fraxius*)	10	10.6%
Eastern Red Cedar (*Juniperus*)	8	8.5%
Spruce (*picea*)	6	6.4%
Cherry (*prunus*)	6	6.4%
Walnut (*juglans*)	6	6.4%
Arborvitae (*Thuja*)	2	2.1%
Other evergreens	2	2.1%
Other broadleaves	1	1.1%
Pine (*Pinus*)	1	1.1%
Poplar (*populus*)	1	1.1%
	94	100.0%

Size Distribution:

The table below summarizes distribution of surveyed trees by their diameter in inches when measured at 4.5 above the ground. Trees between 6 to 12 inches in diameter were most abundant (36%). See Appendix A, Figure 2 for a breakdown of size distributions by species.

Size Classes (inches of diameter at 4.5 feet)	# of trees	% of trees
0 - 3	4	4.3%
3 - 6	9	9.6%
6 - 12	36	38.3%
12 - 18	24	25.5%
18 - 24	12	12.8%
24 - 30	4	4.3%
30 - 36	1	1.1%
36 - 42	2	2.1%
42+	2	2.1%
	94	100.0%

Condition: Foliage and Wood:

Leaf condition is a good indicator of the overall health of urban trees. The foliage condition results for Masonville indicated that 80% of the trees were in good health, 19% in fair health, 1% in poor health and <1% dead or dying. (Appendix A, Figure 3). Leaf health is largely a function of climatic factors during the growing season. This year was not too cool or too wet, therefore, leaf diseases were not as much an issue.

The condition of the wood in urban trees is another important indicator of tree health. The wood forms the structural support system for the leaves and branches. Extensive decay in the main stem makes a tree structurally unsafe which leads to a tree becoming a safety hazard. In Masonville, 59% of the surveyed trees were in good health, 33% in fair health, 8% in poor health and <1% dead or dying. (Appendix A, Figure 4). The 8% in poor, or dead or dying, condition should be assessed more carefully. Some of these trees with poor wood condition are being recommended for removal due to public safety concerns. The 33% in fair health is to a large extent a reflection of having many maple trees which tend to have problems with decay or cracking in their main stem. The City already has too many maple trees, so please encourage less planting of this species group.

Management Needs:

Each surveyed tree was assessed for recommended maintenance needs. The following tables list the specific management needs and recommendations. (See Appendix B, figures 3 & 5).

Priority Task	# of trees	% of trees
none	85	90.4%
clean	3	3.2%
remove	3	3.2%
reduce	2	2.1%
stake/train	1	1.1%
	94	100.0%

Maintenance Recommendation	# of trees	% of trees
None	84	89.4%
mature tree (routine)	10	10.6%
	94	100.0%

Land Use and Location:

The majority of Masonville's surveyed trees are 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.

<u>Land Use</u>

Single family residential	49%
Park/vacant/other	50%
Industrial	1%

<u>Location</u>

Front yard	28%
Planting strip	5%
Back yard	17%
Other maintained locations (e.g. parks)	50%

Recommendations

Risk Management:

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have 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:

A total of 3 trees are recommended for removal for one reason or another. All three of these trees had poor wood condition and showed signs of severe decay. These trees with severe decay could easily break off or topple over in storms or under ice and snow loads. All three trees are in the City Park. One is a boxelder, one a Norway maple and one is a green ash. All three of these trees should be removed fairly soon.

Pruning Cycle:

Proper pruning can extend the life and improve the overall health of trees, and can reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning (stake/train), crown cleaning (clean), crown raising (raise), and crown reduction (reduce). 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. Staking and training is recommended for younger trees so they can develop good architecture. It is recommended that all trees be pruned on a routine schedule every five to seven years.

Priority Task	# of trees	% of trees
none	85	90.4%
clean	3	3.2%
remove	3	3.2%
reduce	2	2.1%
stake/train	1	1.1%
	94	100.0%

Planting:

Most of the planting over the next six years should replace the trees that are recommended for removal. It is recommended to plant two 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 as the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Masonville.

Since most insects and diseases target a particular genus (e.g. ash) or species (e.g. green ash) of trees, it is important to always plant a diverse mix of species. Current diversity recommendations advise that any genus (e.g. maple, oak or ash) not make up more than 20% of the urban forest. Any single species (e.g. silver maple, sugar maple, white oak or bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (41%) and Ash (11%) (Appendix A, Figure 1). Maples should not be planted until this percentage is dramatically 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: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, and willow. I noticed that white poplar was recommended in your City Tree Ordinance. This tree can become invasive so should probably be taken off of your list.

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 death 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 (EAB) Plan

Ash Tree Removal:

Ash trees in poor condition and displaying signs and symptoms of EAB should be considered for removal (Appendix B, Figure 2). *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 many millions ash trees throughout the Eastern United States and Canada. Ash in both forestlands and urban settings constitutes a very significant portion of the canopy cover. 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 its spread beyond its known locations 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 urban 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 your budget permits, all removed ash trees should be replaced. All trees should meet the restrictions in your city's ordinance (Appendix C). The new plantings should be a diverse mix and should not include ash, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

Postponed Work:

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

Private Ash Trees:

It is strongly recommended that private property owners start removing ash trees on their property as trees are infested with Emerald Ash Borer. Trees that are on private property are part of Masonville's urban forest. Private property owners should be given direction to the proper species to plant, spacing, and location. Masonville has a city ordinance for trees.

Budget

Purposed Budget Increase:

EAB could potentially kill all of the ash trees in Masonville within a decade after its arrival. It is recommended that the City apply for grants to fund replacement tree planting. 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. We recommend removing the 5 trees with severe decay that are located in the Park (Appendix B, Figure 3). You should replant 2 trees for everyone removed (10 total trees). Finally, we recommend that the City adopt a policy of allocating somewhere between $2 to $4 per capita per year into a forestry budget to be used for planting, removals and maintenance of Masonville's urban forest.

Recommended Budget for the next 5 years: $4,250.

FY 2011 Budget

Removal: $500
Planting: $200
Routine trimming: $100
Watering & Maintenance: $50

FY 2012 Budget

Removal: $500
Planting: $200
Routine trimming: $100
Watering & Maintenance: $50

FY 2013 Budget

Removal: $500
Planting: $200
Routine trimming: $100
Watering & Maintenance: $50

FY 2014 Budget

Removal: $500
Planting: $200
Routine trimming: $100
Watering & Maintenance: $50

FY 2015 Budget

Removal: $500
Planting: $200
Routine trimming: $100
Watering & Maintenance: $50

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

12/8/2011

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	6.9	525	899.0	881	1,406	(N/A)	28.7	44.0	52.08
Green ash	2.1	160	283.3	278	437	(N/A)	10.6	13.7	43.75
Siberian elm	1.7	129	201.9	198	327	(N/A)	9.6	10.2	36.35
Norway maple	1.0	77	156.0	153	230	(N/A)	8.5	7.2	28.70
Eastern red cedar	0.1	9	18.0	18	26	(N/A)	8.5	0.8	3.28
Black walnut	1.1	85	135.4	133	218	(N/A)	6.4	6.8	36.36
Black cherry	0.4	34	77.0	75	109	(N/A)	6.4	3.4	18.19
Boxelder	0.7	53	86.6	85	138	(N/A)	4.3	4.3	34.58
Black spruce	0.1	9	19.9	20	29	(N/A)	3.2	0.9	9.56
American elm	0.2	19	35.1	34	53	(N/A)	3.2	1.7	17.66
Blue spruce	0.1	10	20.4	20	30	(N/A)	2.1	0.9	14.80
Northern white cedar	0.1	9	19.0	19	27	(N/A)	2.1	0.9	13.58
Broadleaf Deciduous	0.1	8	16.9	17	24	(N/A)	1.1	0.8	24.47
Conifer Evergreen	0.1	5	10.2	10	15	(N/A)	1.1	0.5	14.80
Conifer Evergreen Small	0.0	0	0.7	1	1	(N/A)	1.1	0.0	0.93
Norway spruce	0.1	4	9.5	9	14	(N/A)	1.1	0.4	13.58
Scotch pine	0.1	4	9.5	9	14	(N/A)	1.1	0.4	13.58
Cottonwood	0.5	37	63.1	62	99	(N/A)	1.1	3.1	98.63
Other street trees	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	15.5	1,177	2,061.4	2,020	3,197	(N/A)	100.0	100.0	34.01

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

12/8/2011

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	77,546	2,102	(N/A)	28.7	53.7	77.84
Green ash	17,934	486	(N/A)	10.6	12.4	48.60
Siberian elm	10,084	273	(N/A)	9.6	7.0	30.36
Norway maple	8,611	233	(N/A)	8.5	6.0	29.17
Eastern red cedar	1,308	35	(N/A)	8.5	0.9	4.43
Black walnut	7,077	192	(N/A)	6.4	4.9	31.97
Black cherry	1,587	43	(N/A)	6.4	1.1	7.17
Boxelder	5,088	138	(N/A)	4.3	3.5	34.47
Black spruce	1,268	34	(N/A)	3.2	0.9	11.46
American elm	1,297	35	(N/A)	3.2	0.9	11.72
Blue spruce	1,511	41	(N/A)	2.1	1.1	20.47
Northern white cedar	1,191	32	(N/A)	2.1	0.8	16.14
Broadleaf Deciduous	586	16	(N/A)	1.1	0.4	15.88
Conifer Evergreen	755	20	(N/A)	1.1	0.5	20.47
Conifer Evergreen Small	24	1	(N/A)	1.1	0.0	0.66
Norway spruce	595	16	(N/A)	1.1	0.4	16.14
Scotch pine	595	16	(N/A)	1.1	0.4	16.14
Cottonwood	7,238	196	(N/A)	1.1	5.0	196.17
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	144,297	3,911	(N/A)	100.0	100.0	41.60

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

12/8/2011

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Silver maple	11.0	1.9	5.7	0.5	60	32.5	4.8	4.6	31.3	204	-6.5	-24	85.7	239	(N/A)	28.7	8.87
Green ash	1.7	0.3	0.9	0.1	9	10.0	1.5	1.4	9.5	62	0.0	0	25.3	72	(N/A)	10.6	7.17
Siberian elm	0.7	0.1	0.5	0.0	4	7.8	1.2	1.1	7.7	50	0.0	0	19.2	54	(N/A)	9.6	5.99
Norway maple	1.6	0.3	0.8	0.1	9	5.0	0.7	0.7	4.6	31	-0.4	-1	13.3	38	(N/A)	8.5	4.74
Eastern red cedar	0.0	0.0	0.1	0.0	0	0.6	0.1	0.1	0.5	3	-0.6	-2	0.7	1	(N/A)	8.5	0.18
Black walnut	0.5	0.1	0.3	0.0	3	5.2	0.8	0.7	5.1	33	0.0	0	12.7	36	(N/A)	6.4	5.95
Black cherry	0.3	0.0	0.2	0.0	2	2.3	0.3	0.3	2.0	14	0.0	0	5.4	15	(N/A)	6.4	2.55
Boxelder	0.5	0.1	0.3	0.0	3	3.3	0.5	0.5	3.2	21	-0.2	-1	8.0	22	(N/A)	4.3	5.60
Black spruce	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	4	-0.4	-1	1.2	3	(N/A)	3.2	1.01
American elm	0.0	0.0	0.0	0.0	0	1.2	0.2	0.2	1.1	7	0.0	0	2.7	8	(N/A)	3.2	2.54
Blue spruce	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	2.1	1.53
Northern white cedar	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	3	-0.3	-1	1.1	3	(N/A)	2.1	1.48
Broadleaf Deciduous	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	1.1	3.47
Conifer Evergreen	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	2	(N/A)	1.1	1.53
Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	1.1	0.09
Norway spruce	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	1.1	1.48
Scotch pine	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	1.1	1.48
Cottonwood	1.6	0.3	0.7	0.1	8	2.3	0.3	0.3	2.2	14	0.0	0	7.7	23	(N/A)	1.1	22.55
Other street trees	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)	0.0	0.00
Citywide total	18.4	3.1	10.0	0.9	102	73.4	10.7	10.2	70.2	459	-9.6	-36	187.5	525	(N/A)	100.0	5.59

Table 4: Annual Carbon Stored

Masonville

Stored CO2 Benefits of Public Trees by Species

12/8/2011

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	255,268	1,915	(N/A)	28.7	56.1	70.91
Green ash	55,265	414	(N/A)	10.6	12.2	41.45
Siberian elm	20,947	157	(N/A)	9.6	4.6	17.46
Norway maple	26,662	200	(N/A)	8.5	5.9	25.00
Eastern red cedar	304	2	(N/A)	8.5	0.1	0.28
Black walnut	16,756	126	(N/A)	6.4	3.7	20.95
Black cherry	5,447	41	(N/A)	6.4	1.2	6.81
Boxelder	11,973	90	(N/A)	4.3	2.6	22.45
Black spruce	370	3	(N/A)	3.2	0.1	0.92
American elm	2,724	20	(N/A)	3.2	0.6	6.81
Blue spruce	568	4	(N/A)	2.1	0.1	2.13
Northern white	513	4	(N/A)	2.1	0.1	1.93
Broadleaf	1,101	8	(N/A)	1.1	0.2	8.26
Conifer Evergreen	284	2	(N/A)	1.1	0.1	2.13
Conifer Evergreen	3	0	(N/A)	1.1	0.0	0.02
Norway spruce	257	2	(N/A)	1.1	0.1	1.93
Scotch pine	257	2	(N/A)	1.1	0.1	1.93
Cottonwood	55,982	420	(N/A)	1.1	12.3	419.86
Other street trees	0	0	(N/A)	0.0	0.0	0.00
Citywide total	454,680	3,410	(N/A)	100.0	100.0	36.28

Table 5: Annual Carbon Sequestered

Annual CO_2 Benefits of Public Trees by Species

12/8/2011

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	23,168	174	-1,225	-5	-9	11,606	87	33,544	252	(N/A)	28.7	54.7	9.32
Green ash	4,798	36	-265	-2	-2	3,531	26	8,062	60	(N/A)	10.6	13.1	6.05
Siberian elm	2,369	18	-101	-2	-1	2,857	21	5,124	38	(N/A)	9.6	8.4	4.27
Norway maple	1,377	10	-128	-2	-1	1,696	13	2,943	22	(N/A)	8.5	4.8	2.76
Eastern red cedar	94	1	-1	-2	0	191	1	282	2	(N/A)	8.5	0.5	0.26
Black walnut	2,199	16	-80	-1	-1	1,889	14	4,006	30	(N/A)	6.4	6.5	5.01
Black cherry	683	5	-26	-1	0	745	6	1,401	11	(N/A)	6.4	2.3	1.75
Boxelder	1,436	11	-57	-1	0	1,182	9	2,559	19	(N/A)	4.3	4.2	4.80
Black spruce	63	0	-2	-1	0	203	2	263	2	(N/A)	3.2	0.4	0.66
American elm	333	2	-13	-1	0	411	3	730	5	(N/A)	3.2	1.2	1.83
Blue spruce	77	1	-3	0	0	212	2	287	2	(N/A)	2.1	0.5	1.07
Northern white cedar	105	1	-2	0	0	189	1	291	2	(N/A)	2.1	0.5	1.09
Broadleaf Deciduous	224	2	-5	0	0	176	1	394	3	(N/A)	1.1	0.6	2.96
Conifer Evergreen	39	0	-1	0	0	106	1	143	1	(N/A)	1.1	0.2	1.07
Conifer Evergreen	1	0	0	0	0	6	0	6	0	(N/A)	1.1	0.0	0.05
Norway spruce	53	0	-1	0	0	94	1	146	1	(N/A)	1.1	0.2	1.09
Scotch pine	53	0	-1	0	0	94	1	146	1	(N/A)	1.1	0.2	1.09
Cottonwood	479	4	-269	0	-2	813	6	1,023	8	(N/A)	1.1	1.7	7.67
Other street trees	0	0	0	0	0	0	0	0	0	(N/A)	0.0	0.0	0.00
Citywide total	37,549	282	-2,182	-18	-17	26,003	195	61,351	460	(N/A)	100.0	100.0	4.90

Table 6: Annual Social and Aesthetic Benefits.

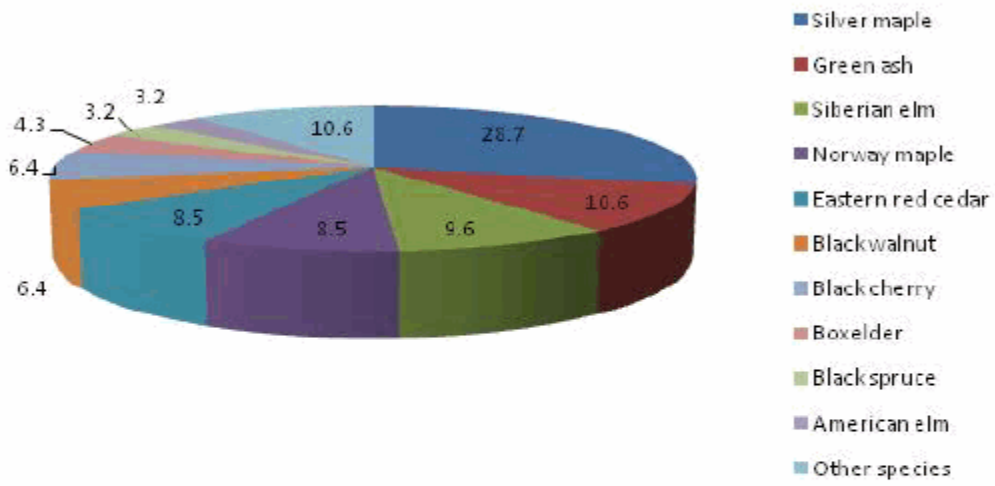
Annual Aesthetic/Other Benefits of Public Trees by Species

12/8/2011

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	2,043	(N/A)	28.7	54.8	75.65
Green ash	462	(N/A)	10.6	12.4	46.19
Siberian elm	258	(N/A)	9.6	6.9	28.68
Norway maple	153	(N/A)	8.5	4.1	19.18
Eastern red cedar	98	(N/A)	8.5	2.6	12.24
Black walnut	241	(N/A)	6.4	6.5	40.09
Black cherry	38	(N/A)	6.4	1.0	6.40
Boxelder	145	(N/A)	4.3	3.9	36.29
Black spruce	46	(N/A)	3.2	1.2	15.24
American elm	60	(N/A)	3.2	1.6	19.89
Blue spruce	42	(N/A)	2.1	1.1	21.08
Northern white cedar	31	(N/A)	2.1	0.8	15.42
Broadleaf Deciduous	26	(N/A)	1.1	0.7	26.22
Conifer Evergreen	21	(N/A)	1.1	0.6	21.08
Conifer Evergreen Small	4	(N/A)	1.1	0.1	4.27
Norway spruce	15	(N/A)	1.1	0.4	15.42
Scotch pine	15	(N/A)	1.1	0.4	15.42
Cottonwood	29	(N/A)	1.1	0.8	28.57
Other street trees	0	(±NaN)	0.0	0.0	0.00
Citywide total	3,727	(N/A)	100.0	100.0	39.65

Species Distribution of Public Trees (%)

12/8/2011

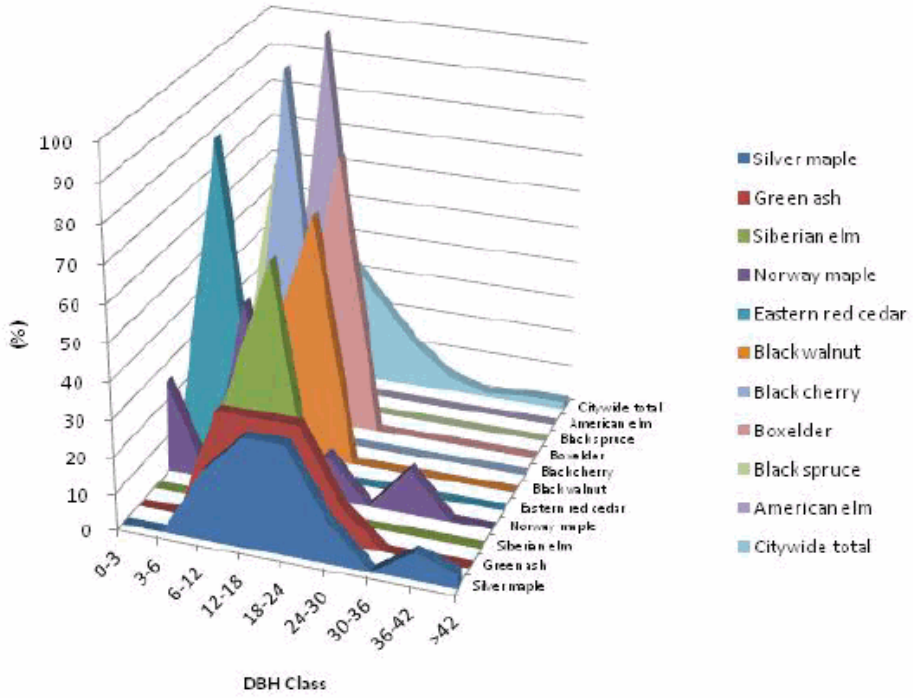


Species	Percent
Silver maple	28.7
Green ash	10.6
Siberian elm	9.6
Norway maple	8.5
Eastern red cedar	8.5
Black walnut	6.4
Black cherry	6.4
Boxelder	4.3
Black spruce	3.2
American elm	3.2
Other species	10.6
Total	100.0

Figure 1: Species Distribution

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

12/8/2011



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Silver maple	0.0	0.0	18.5	29.6	29.6	11.1	0.0	7.4	3.7
Green ash	0.0	0.0	30.0	30.0	30.0	10.0	0.0	0.0	0.0
Siberian elm	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0
Norway maple	25.0	0.0	50.0	0.0	12.5	0.0	12.5	0.0	0.0
Eastern red cedar	12.5	87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Black walnut	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0
Black cherry	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Boxelder	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0	0.0
Black spruce	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0
American elm	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Citywide total	4.3	9.6	38.3	25.5	12.8	4.3	1.1	2.1	2.1

Figure 2: Relative Age Class

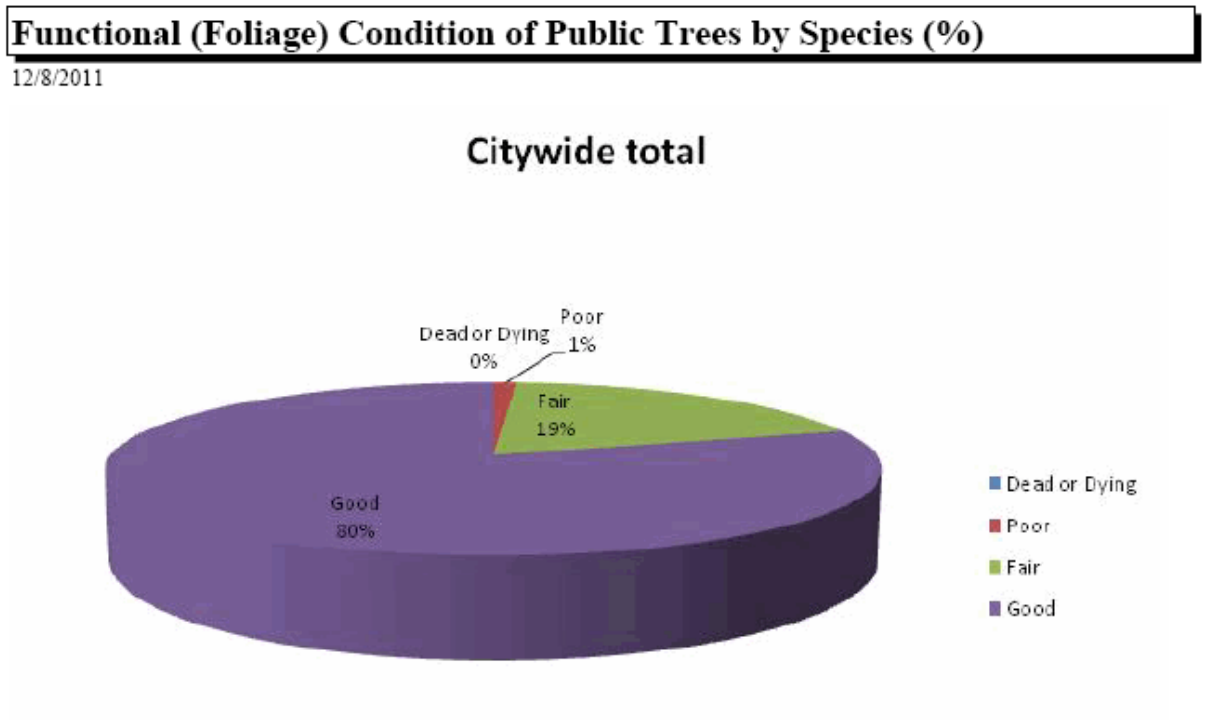


Figure 3: Foliage Condition

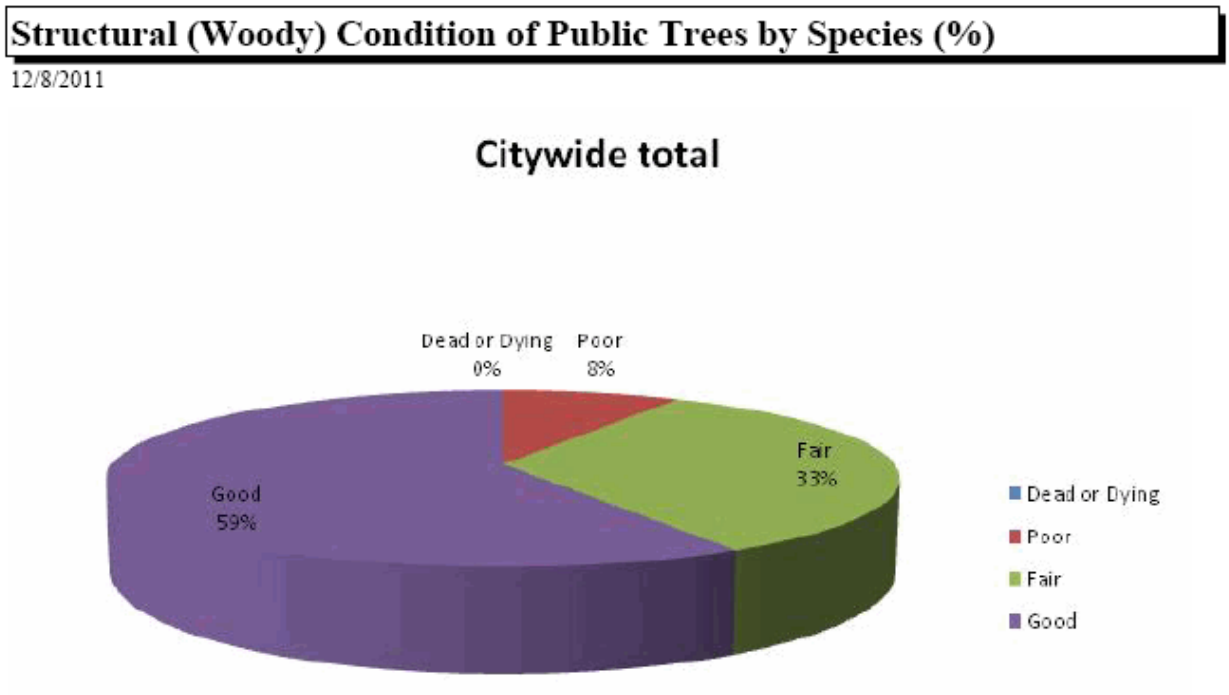
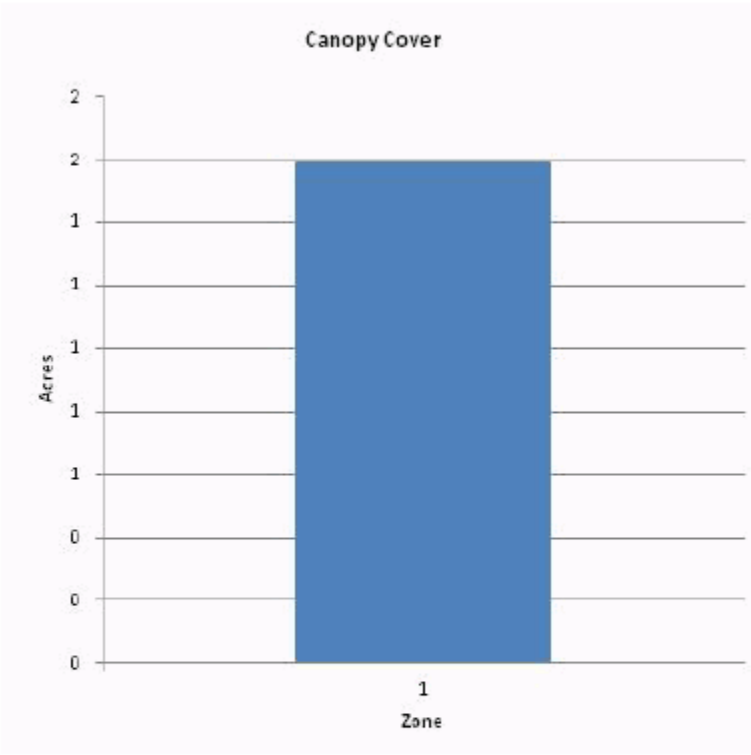


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

12/8/2011



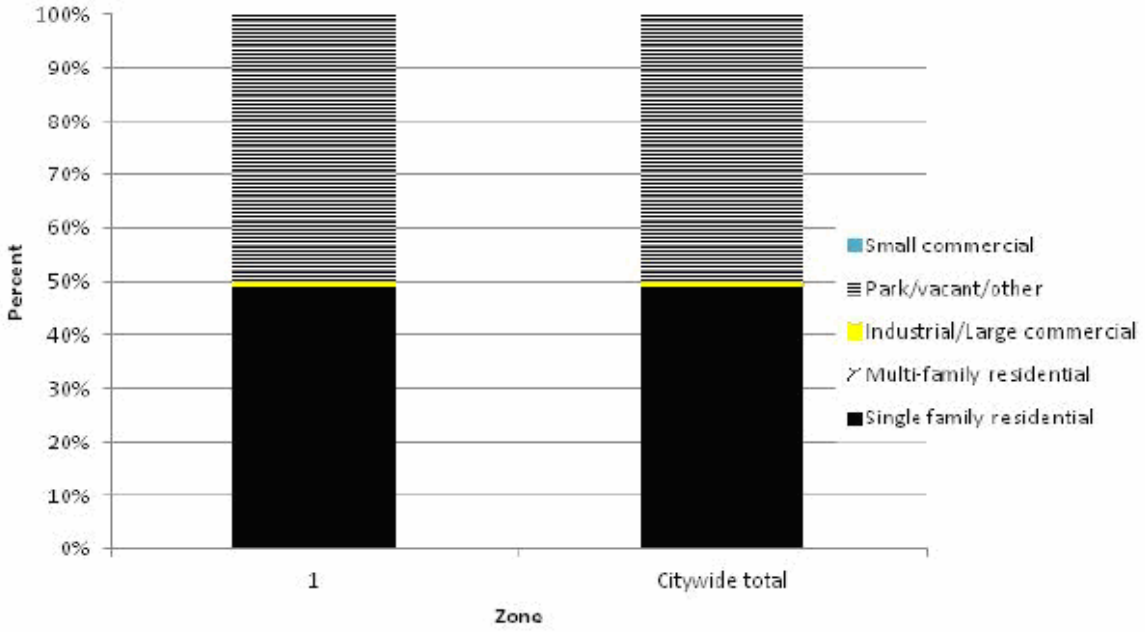
Zone	Acres	% of Total Canopy Cover
1	2	100.0
Citywide total	2	100.0

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

Figure 5: Canopy Cover in Acres

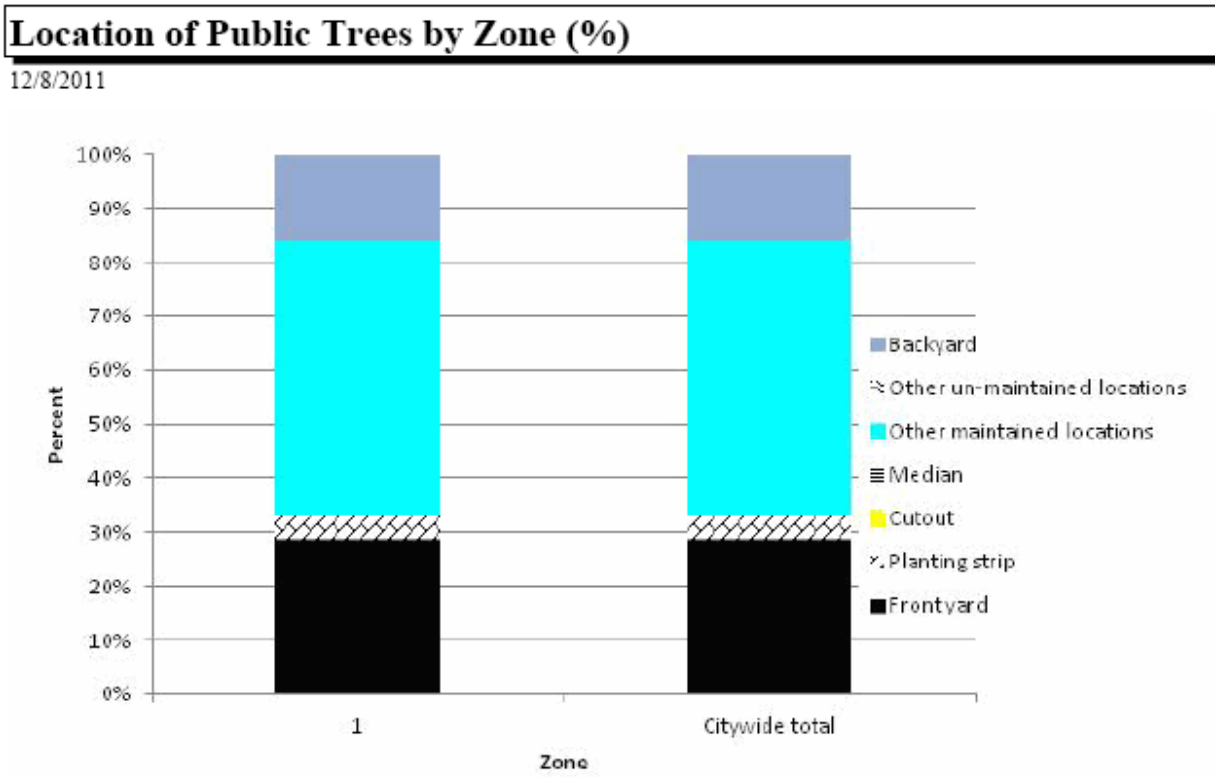
Land Use of Public Trees by Zone (%)

12/8/2011



Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	48.9	0.0	1.1	50.0	0.0
Citywide total	48.9	0.0	1.1	50.0	0.0

Figure 6: Land Use of city/park trees



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	28.7	4.3	0.0	0.0	51.1	0.0	16.0
Citywide total	28.7	4.3	0.0	0.0	51.1	0.0	16.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

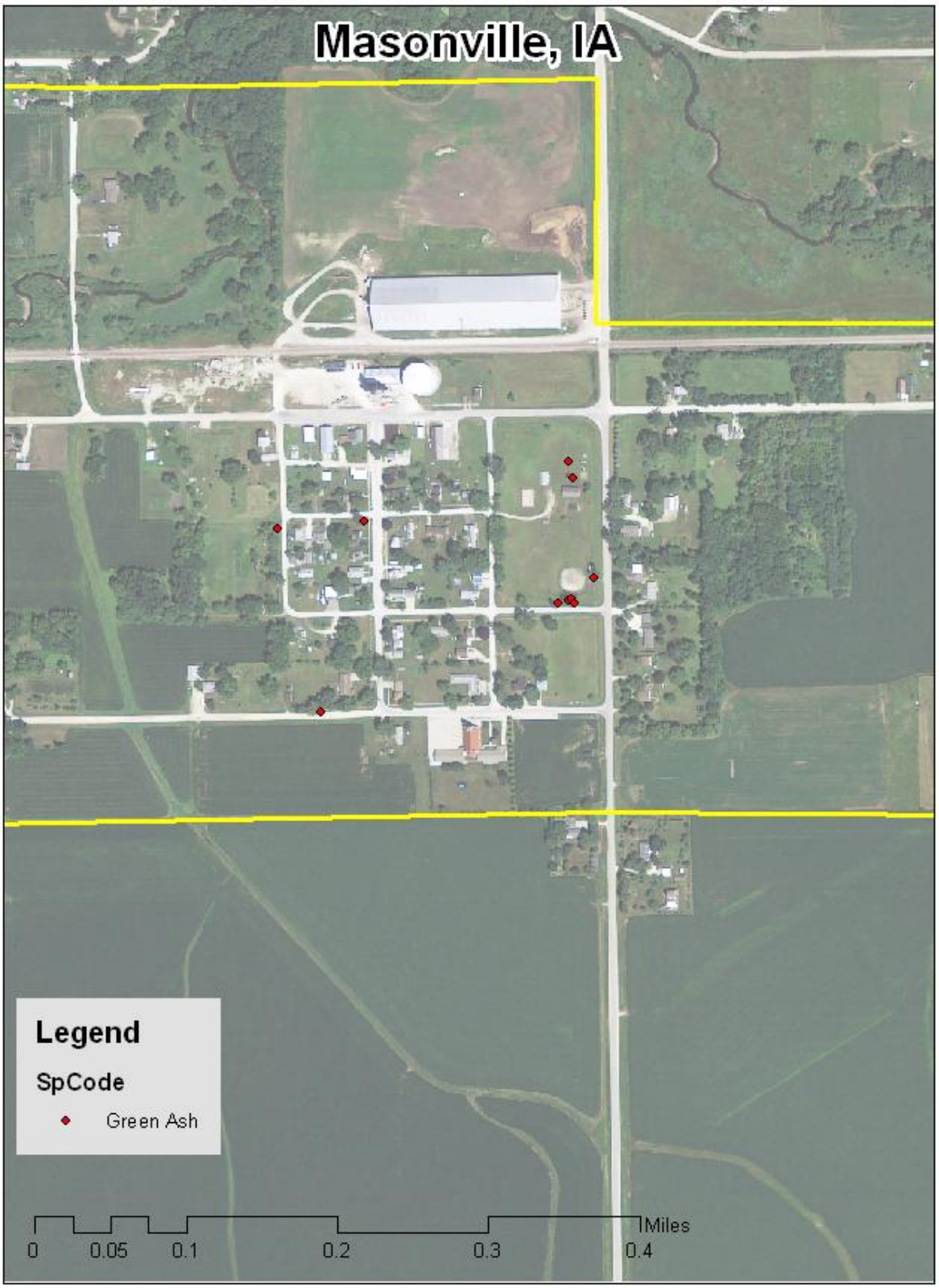


Figure 1: Location of Ash Trees

NO SIGNS OR SYMPTOMS OF EAB

Figure 2: Location of EAB symptoms

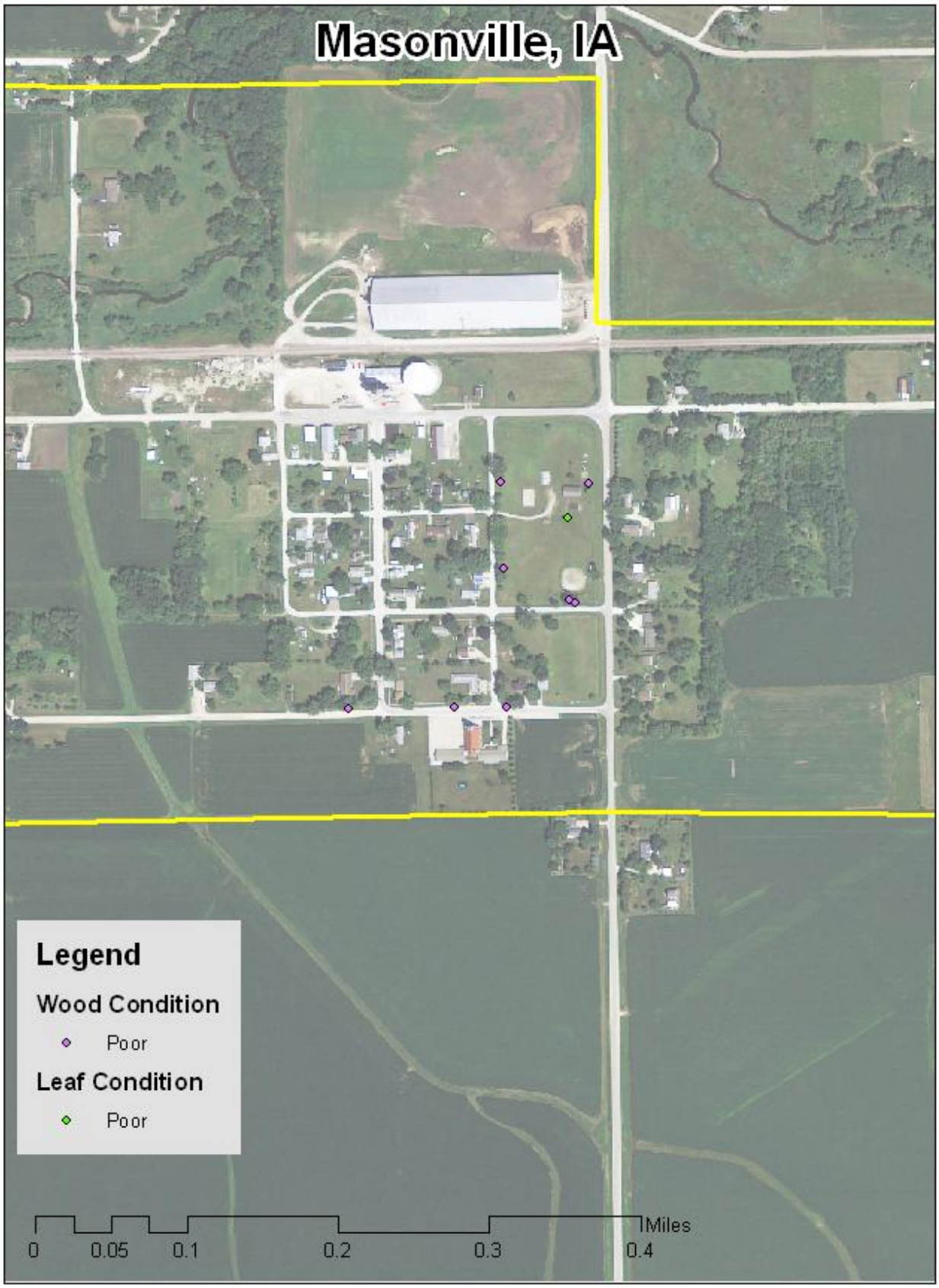


Figure 3: Location of Poor Condition Trees

NO ORDER OF MAITENANCE

Figure 4: Location of Trees with Recommended Maintenance

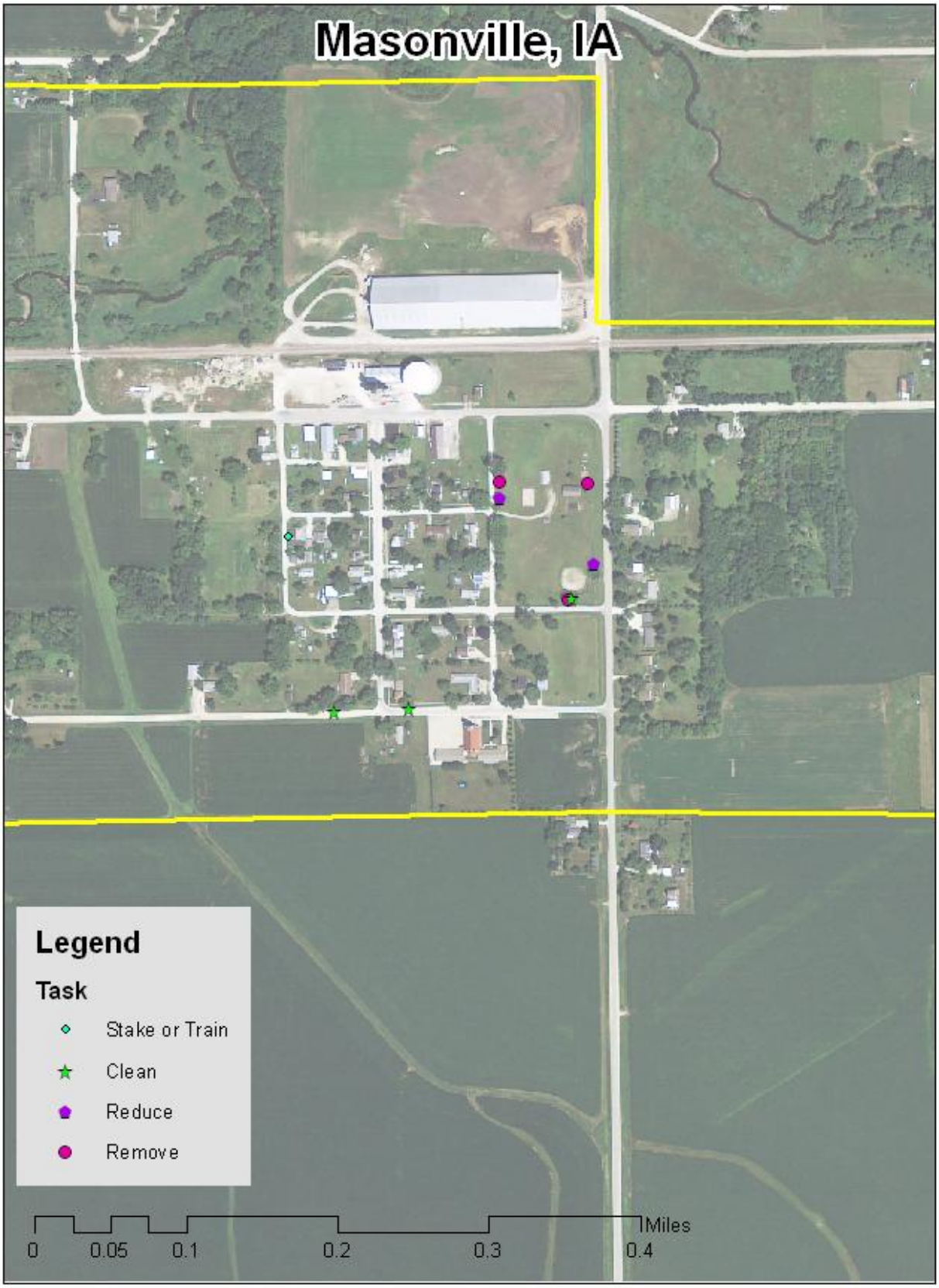


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal****

Appendix C: Masonville's Tree Ordinances

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 515-281-5918.