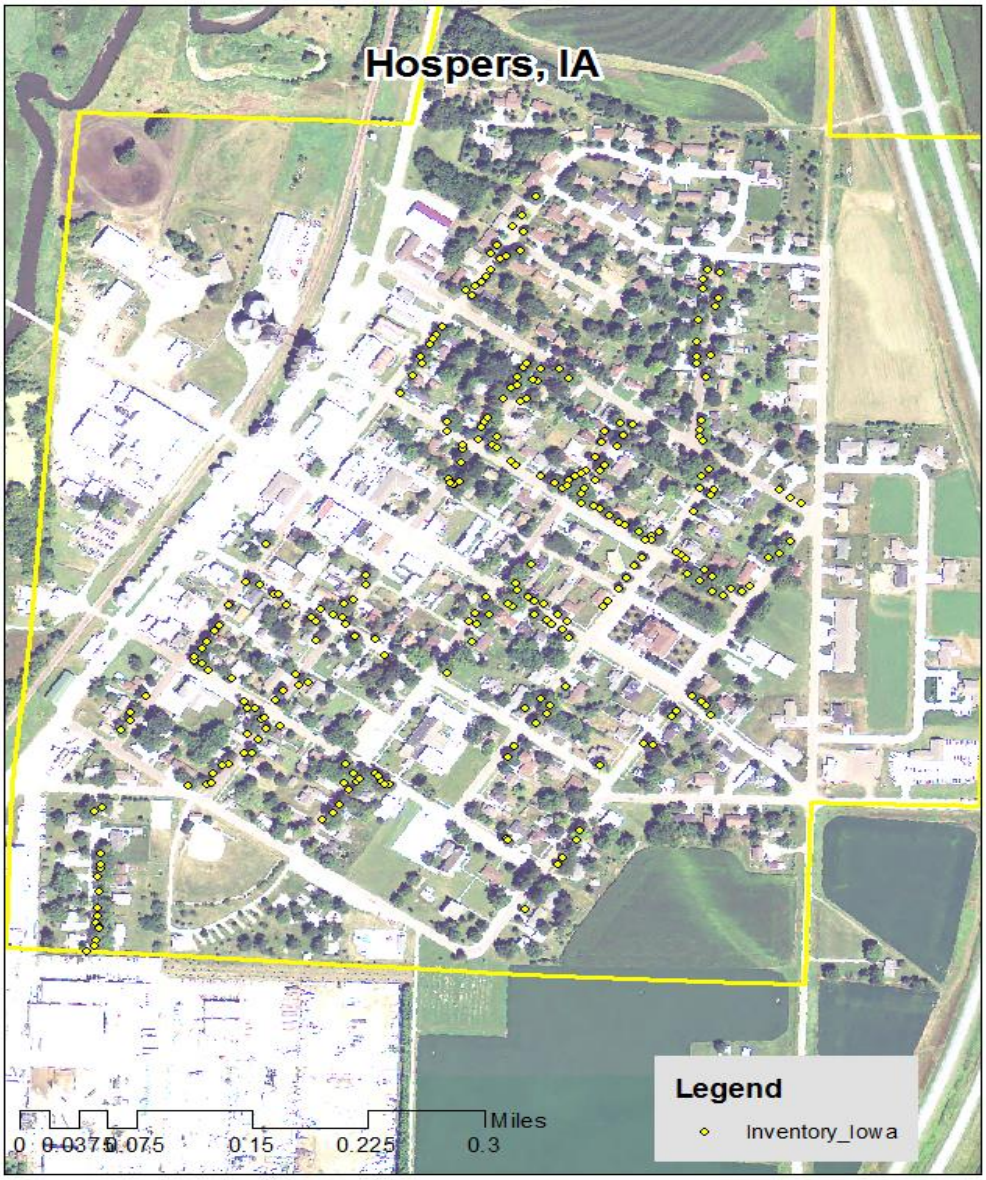
HOSPERS, IA



2013 Management Plan
Prepared by Joseph Schwartz
Bureau of Forestry, Iowa DNR

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Executive Summary

Overview

This plan was developed to assist the City of Hospers 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 24% of Hospers city-owned trees (ash) will die once EAB becomes established in the community. Of the 190 city-owned trees, 45 are ash trees. 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 2013, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street trees. Below are some key findings of the 263 trees inventoried.

- Hospers' trees provide $60,745 of benefits annually, an average of $230 a tree, see Appendix A, Table 7.
- There are over 23 species of trees.
- The top three genera are: Maple 54%, Ash 22%, and Basswood 7%.
- 24% of trees are in need of some type of management.
- 15 trees are recommended for removal.

Recommendations

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

- Of the 15 trees needing removal, 10 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately. *City ownership of the trees recommended for removal should be verified prior to any removal*.
- 18 of the 57 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB.
- 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 the 57 ash trees with a visual survey yearly.
- Hospers deals with trees and associated problems on an individual basis. Suggestion: initiate a budget increase or line item of $10,000 annually and apply for grants to plant replacement trees. At $10,000 annually, Hospers can remove all 57 ash trees in 3 to 6 years at an estimated cost of $550 to $1000 per tree.

Introduction

This plan was developed to assist Hospers 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 Hospers, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Hospers 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 Hospers 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 Hospers meet their urban forestry goals.

Inventory

In 2013, a tree inventory was conducted that included 100% of the city owned trees along streets. 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 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 263 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. Hospers' trees reduce energy related costs by approximately $14,866 annually (Appendix A, Table 1). These savings are both in Electricity (71.2 MWh) and in Natural Gas (9,657.7 Therms).

Annual Stormwater Benefits

Hospers' trees intercept about 856,159 gallons of rainfall or snowmelt a year (Appendix A, Table 2). This interception provides $23,204 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 Hospers, it is estimated that trees remove 940.9 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 $2,659 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Hospers, trees sequester about 312,957 lbs. of carbon a year with an associated value of $2,347 (Appendix A, Table 5). In addition, the trees store 3,398,703 lbs. of carbon, with a yearly benefit of $25,490 (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. Hospers receives $17,670 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, Hospers' trees provide $60,745 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 263 trees provide approximately $230 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Hospers has over 23 different tree species along city streets (Appendix A, Figure 1).
The distribution of trees by genus is as follows:

Maple	142	54%
Ash	57	27%
Linden/Basswood	19	7%
Oak	8	3%
Spruce	8	3%
Locust	6	2%
Cottonwood	5	2%
Apple (Crab)	3	1%
Mountain Ash	2	<1%
Hackberry	1	<1%
Japanese Tree lilac	1	<1%
Juniper	1	<1%
Ginkgo	1	<1%
Sycamore	1	<1%
Plum	1	<1%
Other	7	<3%

Five Most Abundant Tree Species

Silver maple	30.4%
Green ash	21.7%
Norway maple	19.4%
American Linden or Basswood	6.5%
Blue spruce	3.0%

The complete list of tree species is:

Silver maple	80	30.4%
Green ash	57	21.7%
Norway maple	51	19.4%
American Linden or Basswood	17	6.5%
Blue spruce	8	3.0%
Red maple	7	2.6%
Honeylocust	6	2.3%
Large Broadleaf	5	1.9%
Cottonwood	5	1.9%
Sugar maple	4	1.5%

Apple	3	1.1%
Swamp White oak	3	1.1%
Northern Pin oak	2	.7%
Northern Red oak	2	.7%
Mountain ash	2	.7%
Littleleaf linden	2	.7%
Unknown	2	.7%
Northern Hackberry	1	.4%
Ginkgo	1	.4%
Juniper	1	.4%
American sycamore	1	.4%
Plum	1	.4%
Pin oak	1	.4%
Japanese Tree lilac	1	.4%

Age Class

Most of Hospers' trees (59%) are between 12 and 30 inches in diameter at 4.5 ft. (Appendix A, Figure 2 and Appendix A, Table 8 and 9). And, 80% of your trees are between 6 and 36 inches in diameter when measured at 4.5 feet above ground (Appendix A Figure 2 and Appendix A, Table 9). With regard to age/size correlation, it is preferred that the highest number of trees be in the smaller diameters, so younger and smaller trees will replace natural mortality and to maintain canopy cover. Hospers' size curve is in the middle diameter range, indicating an average age 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 Hospers indicate that 66% of the trees are in good health, with only 6% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3 an aerial map). Similarly, 49% of Hospers trees are in good health for wood condition (Appendix A, Figure 4). **Wood** condition refers to those trees in poor health, dead or dying number about 18% of the population. Eighteen percent is an estimate of the number of trees that needing follow up.

Management Needs

The following outlines the specific management needs of the street trees by the number of trees and percent of canopy (Appendix A, Table 8 and Appendix B, Figure 5).

Crown Cleaning	38	14%
Crown Raising	7	2%
Tree Staking	0	0%
Tree Removal	15	6%
Crown Reduction	2	<1%

Canopy Cover

The canopy cover of Hospers is approximately 8.5 acres (Appendix A, Figure 5). According to the 2010 census, Hospers occupies 306 acres. Thus the canopy cover on city land is about 2.7%.

Land Use and Location

The majority of Hospers city 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	99%+
Park/vacant/other	<1%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

Location	
Planting strip	72%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	28%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Any tree that is dead or dying, or has large injures, such as, trunk cracks longer than 24 inches should be removed. A few trees have main trunks which are forked between 2 feet and 8 feet above the ground. Any of these forked trees, with open splits exposing interior wood, should be removed. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals should be removed.

Hazardous trees

Hospers has 12 critical concern trees that need immediate removal. These trees can be seen on as dark purple diamonds on the map titled Location of Trees with Recommended Maintenance (Appendix B, Figure 4). See also Appendix B, Figure 5 titled Maintenance Tasks. By comparing Figures 4 & 5, you will notice that some of the 'critical concern' trees on Figure 4 are also 'removal' trees on Figure 5. It is recommended to start with the large diameter 'critical concern' trees first. There are 9 trees over 24 inches in diameter at 4.5 ft. that should be addressed immediately. After all 9 of the larger 'critical concern' trees are removed, continue removing the 3 smaller diameter 'critical concern' trees (where trimming is not needed). Please see Appendix A Table 9 for a complete breakdown of the city trees in

Hospers. After all of the critical concern trees are addressed, follow-up on the 28 trees needing 'immediate' maintenance and noted in red in Table 9. In Appendix B, Figure 5 shows the 'removal' trees in red circles on a city map.

Poor and Dead/Dying Trees

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figures 3 & 4). Of the 15 removals, 1 is a public ash trees. There are a total of 57 ash trees, and 18 of those have signs and symptoms that have been associated with EAB. In addition, there are 8 trees that are in poor health based on the condition of the wood and warrant some work. *City ownership of the trees recommended for removal should be verified prior to any removal*

Other Hazardous Green Ash trees with Decay

Ash trees are listed by their addresses, or house color if no address was found, or position on the city block. In some cases, the entire tree is recommended for removal by the District Forester; or the homeowner should remove the ash tree since the main trunk or the main forks are decaying. These trees are brought to your attention because decay caused by a fungus dissolves the cellulose portion of the wood fibers, resulting in weakened branches, limbs, or main trunks. Once weakened, the decayed portion simply breaks off without the benefit of winds, ice or snow, and fall onto anything below it.
Tree number:

1. 206 Elm Street, old tree, poor shape, branch hangs over sidewalk.
2. 205 Cedar Street, tree on east side, 2nd from corner.
3. No house #, corner house, SW of Elm and 3rd Street, white house and red window trim, fungus in tree next to driveway, ½ of top effected, and the main leader.
4. Same house as #3, corner tree, hangs over streets and sidewalk and power wires.
5. 400 Elm Street, Gray-green house, gray trim, ash at driveway on 4th Street south, branch over driveway and the next ash to the north, whole top infected by fungus, remove tree.

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 Hospers.

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 (54%) and ash (22%). (Appendix A, Figure 1). Maples and ashes should not be planted until this percentage can be lowered. 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. Your city code does not mention willows, Siberian elm, or Black walnut which should be listed in an amended city code. Appendix C shows your existing city code first and then Chapter 151.02 from the State code. All NEW trees planted must meet the restrictions in your city ordinance.

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.

Six Year Maintenance Plan with <u>No Additional Funding</u> **

Year 1

Removal: 6 largest critical concern trees (not always ash trees).
Planting and Replacement: 6 to 9 trees to be planted in open locations using the annual $1000 utility grant. *
Visual Survey for signs and symptoms of EAB.

Year 2

Removal: remove the 6 remaining critical concern trees and 4 additional ash trees with poor health. *
Planting and Replacement: 6 trees in open locations using grant funds.
Routine trimming: Contract to trim ¼ or 8 of the 28 trees needing immediate attention.
Visual Survey for signs and symptoms of EAB.

Year 3

Removal: 8 trees – remove or trim ash trees in poor health. *
Planting and Replacement: plant 9 trees in open locations using grant funds.
Visual Survey for signs and symptoms of EAB.

Year 4

Removal: 6 trees – remove or trim trees in poor health. *
Planting and Replacement: plant 7 trees in open locations using grant funds.
Routine trimming: Contract to trim ¼ or 8 of the 28 trees needing immediate attention.
Visual Survey for signs and symptoms of EAB.

Year 5

Removal: remove or trim 6 trees in poor health. *
Planting and Replacement: plant 9 trees to be planted in open locations using grant funds.

Routine trimming: Contract to trim ¼ or 8 of the 28 trees needing immediate attention.
Visual Survey for signs and symptoms of EAB.

Year 6

Removal: remove or trim 6 trees in poor health. *
Planting and Replacement: plant 7 trees in open locations using grant funds.
Routine trimming: Contract to trim the final ¼ or 8 of the 28 trees needing immediate attention.
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 36 ash trees removed or trimmed (or approximately 63% of the ash). It will take approximately 9 to 10 years to remove all ash with the proposed removal rate above. EAB could potentially kill all ash within 4 years of its arrival.
** To remove all ash trees within 4 years, Hospers might spend $7000 to $14000 per year based on a removal cost of $550 to $1000 per tree.

Emerald Ash Borer Plan

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, spreading removal costs out over several years while allowing trees to continue to provide benefits. Hospers has the benefit of not finding any actual infestations of EAB, so the yearly removal of the worst or unhealthy trees now can lower future costs. Chemical 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 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. In 2013, the entire State of Iowa was placed in quarantine to help combat the spread of Emerald Ash Borer.

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 it is necessary. At present, the entire State of Iowa is under quarantine for all of the items listed above.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines are designed to 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. Sample tree codes can be found in Appendix C for Hospers. All new trees will meet the restrictions in city ordinance if adopted. The new plantings will be a diverse mix and should not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, Siberian elm, 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 genus 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 the city code has not been updated to include trees on private property a sample City Code follows: "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."

Hospers current city code, Article 5, part 5.06 mentions in paraphrase 'the superintendent shall remove, on the order of the city council, any tree on city land which is diseased or constitutes a risk to the public.' Current code does not mention Iowa's new insect problems, such as, Emerald Ash Borer, Gypsy Moth and others, and what to do about them when they finally make their way into northwest Iowa. You can amend your current city code to cover these potential problems, or adopt Chapter 151 as shown in the back of the plan, Appendix C.

Budget

Current Budget

Hospers does not have a line item pertaining to trees, tree removal, tree planting or maintenance. In September 2012, the city paid to Schwebach Tree Service $5,718 for tree trimming. Tree removals are random.

Future Budgets

Proposal to spend $33,800 over 6 years ($5,600/year)

FY 2014 Budget *
- Removal: $3,000
- Planting: $1000 from utility grant
- Watering & Maintenance: $500

FY 2015 Budget *
- Removal: $3,000
- Planting: $1000 from utility grant
- Routine trimming: $1,700
- Watering & Maintenance: $500

FY 2016 Budget *
- Removal: $3,000
- Planting: $1000 from utility grant
- Watering & Maintenance: $500

FY 2017 Budget *
- Removal: $3,000
- Planting: $1000 from utility grant
- Routine trimming: $1,700
- Watering & Maintenance: $500

FY 2018 Budget *
- Removal: $3,000
- Planting: $1000 from utility grant
- Routine trimming: $1,700
- Watering & Maintenance: $500

FY 2019 Budget *
- Removal: $3,000

Planting: $1000 from utility grant
Routine trimming: $1,700
Watering & Maintenance: $500

*Reduction of ash over 6 years: approximately 30 to 38 ash trees removed (approximately 63% of the ash in town). **It will take approximately 10 years to remove all ash with the future budget.**

Purposed Budget Increase

EAB could potentially kill all ash trees in Hospers within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased from $5200 to $9500 per year. If the budget were increased to $10,000 a year all ash could be removed within 5 to 6 years. Additionally, it is recommended that Hospers 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.

Works Cited

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

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

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

Nowak, 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

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Hospers

Annual Energy Benefits of Public Trees by Species

3/5/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	27.9	2,121	3,665.6	3,592	5,713	(N/A)	30.4	38.4	71.41
Green ash	16.4	1,245	2,237.1	2,192	3,438	(N/A)	21.7	23.1	60.31
Norway maple	11.9	907	1,693.8	1,660	2,566	(N/A)	19.4	17.3	50.32
American basswood	4.6	353	682.5	669	1,022	(N/A)	6.5	6.9	60.10
Blue spruce	0.7	53	92.5	91	144	(N/A)	3.0	1.0	18.01
Red maple	0.7	53	100.6	99	151	(N/A)	2.7	1.0	21.59
Broadleaf Deciduous	1.9	141	246.2	241	382	(N/A)	2.3	2.6	63.66
Honeylocust	1.9	147	255.1	250	397	(N/A)	2.3	2.7	66.12
Cottonwood	1.4	110	208.1	204	314	(N/A)	1.9	2.1	62.76
Sugar maple	1.0	73	117.5	115	188	(N/A)	1.5	1.3	47.00
Apple	0.3	25	50.3	49	75	(N/A)	1.1	0.5	24.84
Swamp white oak	0.0	1	2.4	2	3	(N/A)	1.1	0.0	1.10
Other street trees	2.3	174	306.0	300	474	(N/A)	6.1	3.2	29.60
Citywide total	71.2	5,401	9,657.7	9,465	14,866	(N/A)	100.0	100.0	56.52

Table 2: Annual Stormwater Benefits

Hospers

Annual Stormwater Benefits of Public Trees by Species

3/5/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	415,875	11,271	(N/A)	30.4	48.6	140.89
Green ash	181,966	4,932	(N/A)	21.7	21.3	86.52
Norway maple	104,931	2,844	(N/A)	19.4	12.3	55.76
American basswood	50,583	1,371	(N/A)	6.5	5.9	80.64
Blue spruce	8,481	230	(N/A)	3.0	1.0	28.73
Red maple	5,029	136	(N/A)	2.7	0.6	19.47
Broadleaf Deciduous	27,549	747	(N/A)	2.3	3.2	124.44
Honeylocust	19,641	532	(N/A)	2.3	2.3	88.72
Cottonwood	15,657	424	(N/A)	1.9	1.8	84.87
Sugar maple	6,568	178	(N/A)	1.5	0.8	44.50
Apple	1,195	32	(N/A)	1.1	0.1	10.80
Swamp white oak	37	1	(N/A)	1.1	0.0	0.33
Other street trees	18,649	505	(N/A)	6.1	2.2	31.59
Citywide total	856,159	23,204	(N/A)	100.0	100.0	88.23

Table 3: Annual Air Quality Benefits

Hospers

Annual Air Quality Benefits of Public Trees by Species

3/5/2014

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	73.5	12.5	35.9	3.3	396	131.6	19.3	18.4	126.4	824	-37.9	-142	382.9	1,077	(N/A)	30.4	13.47
Green ash	22.9	3.7	11.0	1.0	122	78.3	11.4	10.9	74.4	488	0.0	0	213.5	610	(N/A)	21.7	10.70
Norway maple	20.8	3.6	10.3	0.9	113	57.7	8.4	8.0	54.2	358	-4.9	-18	158.8	452	(N/A)	19.4	8.86
American basswood	6.7	1.1	3.3	0.3	36	22.7	3.3	3.1	21.1	140	-5.7	-21	55.8	155	(N/A)	6.5	9.09
Blue spruce	1.0	0.2	0.9	0.1	7	3.3	0.5	0.5	3.2	21	-2.9	-11	6.7	16	(N/A)	3.0	2.04
Red maple	1.0	0.2	0.5	0.0	5	3.3	0.5	0.5	3.1	21	-0.4	-1	8.8	25	(N/A)	2.7	3.55
Broadleaf Deciduous	5.1	0.8	2.3	0.2	27	8.8	1.3	1.2	8.4	55	0.0	0	28.1	82	(N/A)	2.3	13.60
Honeylocust	3.8	0.6	1.7	0.2	20	9.1	1.3	1.3	8.7	57	-2.8	-11	24.0	66	(N/A)	2.3	11.08
Cottonwood	1.8	0.3	0.9	0.1	10	7.0	1.0	1.0	6.6	43	0.0	0	18.6	53	(N/A)	1.9	10.59
Sugar maple	0.7	0.1	0.4	0.0	4	4.5	0.7	0.6	4.3	28	-0.6	-2	10.7	30	(N/A)	1.5	7.42
Apple	0.3	0.0	0.2	0.0	2	1.6	0.2	0.2	1.5	10	0.0	0	4.1	12	(N/A)	1.1	3.88
Swamp white oak	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	0.0	0	0.1	0	(N/A)	1.1	0.14
Other street trees	3.1	0.5	1.6	0.1	17	10.9	1.6	1.5	10.4	68	-0.8	-3	28.9	82	(N/A)	6.1	5.10
Citywide total	140.6	23.6	68.7	6.3	757	338.8	49.4	47.1	322.4	2,112	-56.0	-210	940.9	2,659	(N/A)	100.0	10.11

Table 4: Annual Carbon Stored Benefits in Public Trees by Species.
Annual Carbon Stored

Hospers

Stored CO2 Benefits of Public Trees by Species

3/5/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	1,682,642	12,620	(N/A)	30.4	49.5	157.75
Green ash	753,601	5,652	(N/A)	21.7	22.2	99.16
Norway maple	342,638	2,570	(N/A)	19.4	10.1	50.39
American	240,269	1,802	(N/A)	6.5	7.1	106.00
Blue spruce	5,328	40	(N/A)	3.0	0.2	4.99
Red maple	11,701	88	(N/A)	2.7	0.3	12.54
Broadleaf	177,537	1,332	(N/A)	2.3	5.2	221.92
Honeylocust	47,755	358	(N/A)	2.3	1.4	59.69
Cottonwood	56,919	427	(N/A)	1.9	1.7	85.38
Sugar maple	18,818	141	(N/A)	1.5	0.6	35.28
Apple	4,853	36	(N/A)	1.1	0.1	12.13
Swamp white oak	51	0	(N/A)	1.1	0.0	0.13
Other street trees	25,670	424	(N/A)	6.1	1.7	26.53
Citywide total	3,398,703	25,490	(N/A)	100.0	100.0	96.92

Table 5: Annual Carbon Sequestered

Hospers

Annual CO_2 Benefits of Public Trees by Species

3/5/2014

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
Silver maple	120,626	905	-8,077	-16	-61	46,865	351	159,399	1,195	(N/A)	30.4	50.9	14.94
Green ash	38,007	285	-3,617	-11	-27	27,523	206	61,902	464	(N/A)	21.7	19.8	8.14
Norway maple	17,873	134	-1,645	-10	-12	20,036	150	36,254	272	(N/A)	19.4	11.6	5.33
American basswood	14,406	108	-1,153	-3	-9	7,799	58	21,049	158	(N/A)	6.5	6.7	9.29
Blue spruce	480	4	-26	-2	0	1,180	9	1,634	12	(N/A)	3.0	0.5	1.53
Red maple	1,499	11	-56	-1	0	1,161	9	2,603	20	(N/A)	2.7	0.8	2.79
Broadleaf Deciduous	2,978	22	-852	-1	-6	3,108	23	5,232	39	(N/A)	2.3	1.7	6.54
Honeylocust	4,769	36	-229	-1	-2	3,241	24	7,780	58	(N/A)	2.3	2.5	9.72
Cottonwood	3,693	28	-273	-1	-2	2,429	18	5,847	44	(N/A)	1.9	1.9	8.77
Sugar maple	1,479	11	-90	-1	-1	1,610	12	2,997	22	(N/A)	1.5	1.0	5.62
Apple	495	4	-23	-1	0	557	4	1,028	8	(N/A)	1.1	0.3	2.57
Swamp white oak	16	0	0	-1	0	22	0	37	0	(N/A)	1.1	0.0	0.09
Other street trees	3,631	27	-272	-3	-2	3,840	29	7,196	54	(N/A)	6.1	2.3	3.37
Citywide total	209,952	1,575	-16,314	-51	-123	119,370	895	312,957	2,347	(N/A)	100.0	100.0	8.92

Table 6: Annual Social and Aesthetic Benefits

Hospers

Annual Aesthetic/Other Benefits of Public Trees by Species

3/5/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Silver maple	9,171	(N/A)	30.4	51.9	114.63
Green ash	3,140	(N/A)	21.7	17.8	55.08
Norway maple	1,723	(N/A)	19.4	9.8	33.78
American basswood	1,073	(N/A)	6.5	6.1	63.13
Blue spruce	169	(N/A)	3.0	1.0	21.15
Red maple	213	(N/A)	2.7	1.2	30.46
Broadleaf Deciduous	212	(N/A)	2.3	1.2	35.26
Honeylocust	1,075	(N/A)	2.3	6.1	179.24
Cottonwood	304	(N/A)	1.9	1.7	60.85
Sugar maple	177	(N/A)	1.5	1.0	44.30
Apple	28	(N/A)	1.1	0.2	9.43
Swamp white oak	8	(N/A)	1.1	0.1	2.74
Other street trees	377	(N/A)	6.1	2.1	23.53
Citywide total	17,670	(N/A)	100.0	100.0	67.19

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 $
Silver maple	5,713	1,195	1,077	11,271	9,171	$28,427.29	(±0)	46.80
Green ash	3,438	464	610	4,932	3,140	$12,583.18	(±0)	20.71
Norway maple	2,566	272	452	2,844	1,723	$7,856.68	(±0)	12.93
American basswood	1,022	158	155	1,371	1,073	$3,778.32	(±0)	6.22
Blue spruce	144	12	16	230	169	$571.73	(±0)	0.94
Red maple	151	20	25	136	213	$544.98	(±0)	0.90
Broadleaf Deciduous Large	382	39	82	747	212	$1,460.93	(±0)	2.40
Honeylocust	397	58	66	532	1,075	$2,129.24	(±0)	3.51
Cottonwood	314	44	53	424	304	$1,139.19	(±0)	1.88
Sugar maple	188	22	30	178	177	$595.37	(±0)	0.98
Apple	75	8	12	32	28	$154.56	(±0)	0.25
Swamp white oak	3	0	0	1	8	$13.19	(±0)	0.02
Other street trees	474	54	82	505	377	$1,491.19	(±0)	2.45
Citywide total	14,866	2,347	2,659	23,204	17,670	$60,745.84	(±0)	100.00

Table 8: Priority Task Summary for Public Trees

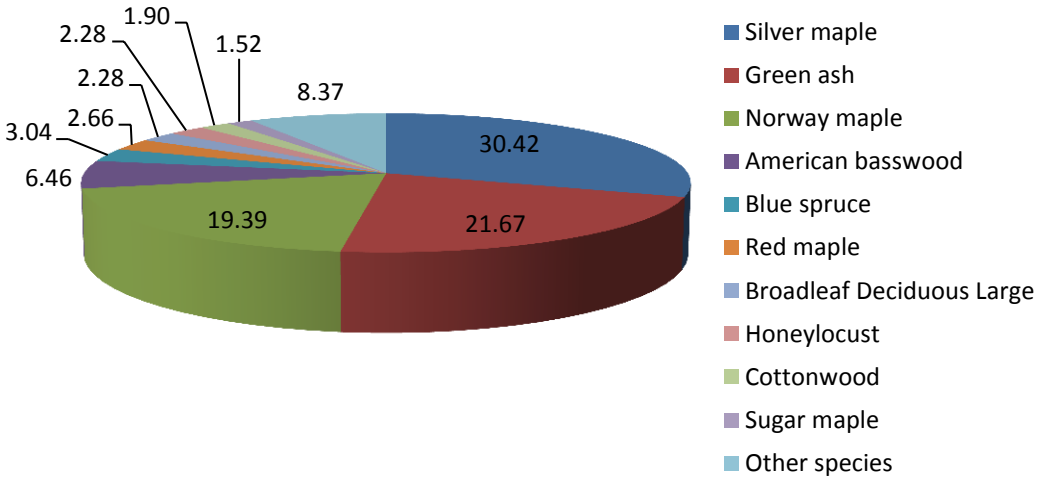
	DBH (diameter of breast height of 4.5 feet) Classes in Inches										
Maintenance Type	0 to 3 inches	3 to 6 inches	6 to 12 inches	12 to 18 inches	18 to 24 inches	24 to 30 inches	30 to 36 inches	36 to 42 inches	>42 inches	Total	% of Total
None	8	12	21	46	31	39	23	16	5	201	76.43
Stake/Train	0	0	0	0	0	0	0	0	0	0	0
Clean top	0	0	0	4	13	11	4	2	4	38	14.45
Raise top	0	0	0	1	2	1	2	1	0	7	2.66
Reduce top	0	0	1	0	0	0	1	0	0	2	0.76
Remove tree	0	1	0	1	3	4	2	2	2	15	5.7
Treat Pest/ disease	0	0	0	0	0	0	0	0	0	0	0
Total	8	13	22	52	49	55	32	21	11	263	100

Table 9. Recommended Maintenance for Public Trees

Maintenance	Diameter Classes in Inches (diameter of breast height, 4.5 feet)										
Type	0-3 inches	3to 6 inches	6 to 12 inches	12 to 18 inches	18 to 24 inches	24 to 30 inches	30 to 36 inches	36 to 42 inches	>42	total trees	% of total
none	0	0	0	0	0	0	0	0	0	0	0
Youngtree (routine)	8	9	17	26	1	0	0	0	0	61	23.19
Youngtree (immediate)	0	1	1	1	0	0	0	0	0	3	1.14
Maturetree (routine)	0	3	4	23	37	46	27	16	6	162	61.6
Maturetree (immediate)	0	0	0	2	8	5	4	2	4	25	9.51
Critical Concern Pub Safety	0	0	0	0	3	4	1	3	1	12	4.56
Totals	8	13	22	52	49	55	32	21	11	263	100

Appendix A, All figures:

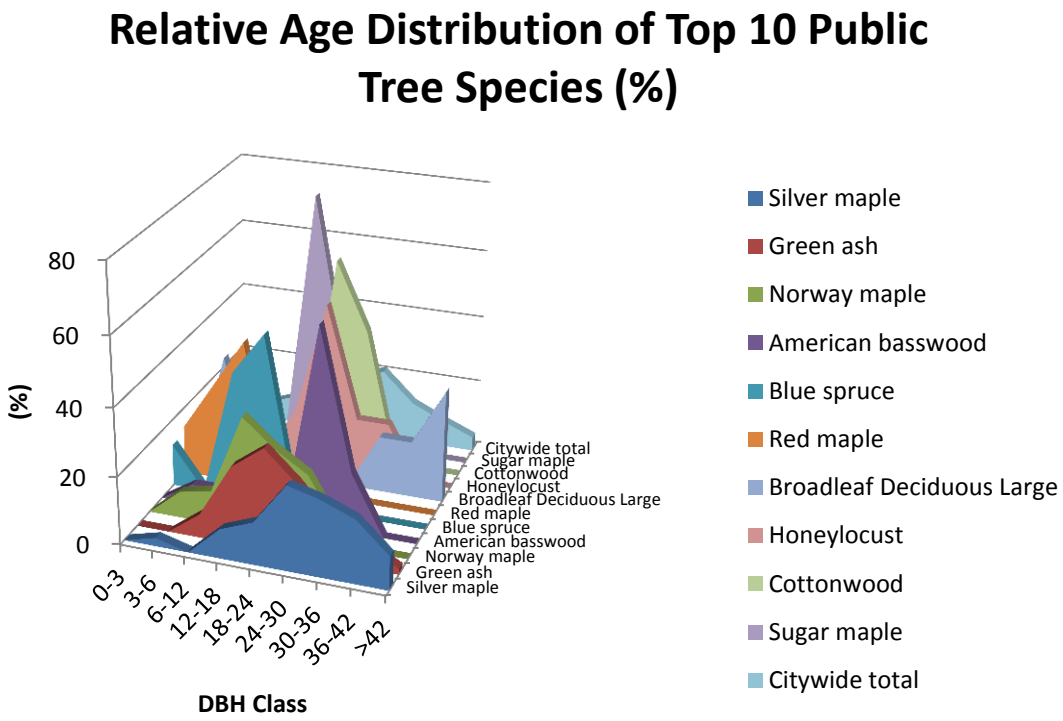
Figure 1: Species Distribution of Top 10 Public Tree Species (%)



Hospers
Species Distribution of Public Trees (%)
3/5/2014

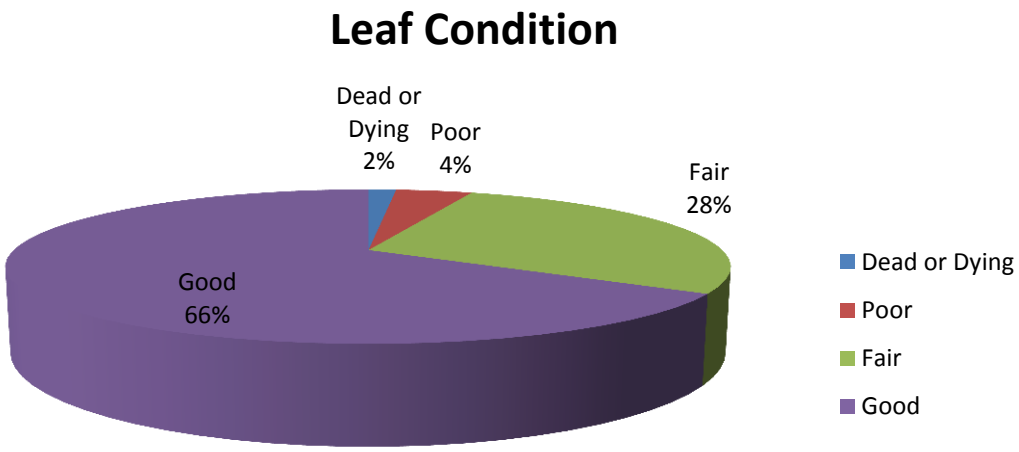
Species	Percent
Silver maple	30.42
Green ash	21.67
Norway maple	19.39
American basswood	6.46
Blue spruce	3.04
Red maple	2.66
Broadleaf Deciduous Large	2.28
Honeylocust	2.28
Cottonwood	1.90
Sugar maple	1.52
Other species	8.37
Total	100.00

Figure 2:



Hospers									
Relative Age Distribution of Top 10 Public Tree Species (%)									
3/5/2014									
	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Silver maple	0.00	2.50	0.00	8.75	12.50	25.00	22.50	18.75	10.00
Green ash	0.00	0.00	7.02	22.81	29.82	21.05	10.53	7.02	1.75
Norway maple	0.00	7.84	9.80	33.33	25.49	19.61	3.92	0.00	0.00
American basswood	0.00	5.88	5.88	5.88	5.88	58.82	17.65	0.00	0.00
Blue spruce	12.50	0.00	37.50	50.00	0.00	0.00	0.00	0.00	0.00
Red maple	14.29	28.57	42.86	0.00	14.29	0.00	0.00	0.00	0.00
Broadleaf Deciduous Large	0.00	33.33	0.00	0.00	0.00	0.00	16.67	16.67	33.33
Honeylocust	0.00	0.00	0.00	16.67	50.00	16.67	16.67	0.00	0.00
Cottonwood	0.00	0.00	0.00	0.00	60.00	40.00	0.00	0.00	0.00
Sugar maple	0.00	0.00	0.00	75.00	25.00	0.00	0.00	0.00	0.00
Citywide total	3.04	4.94	8.37	19.77	18.63	20.91	12.17	7.98	4.18

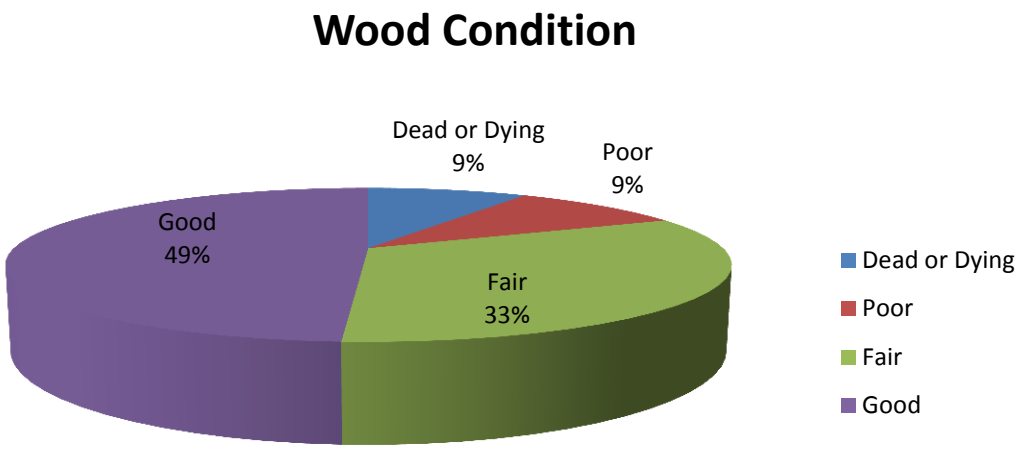
Figure 3:



Hospers
Condition (Foliage) of Public Trees by Species (%)
3/5/2014

Species Name	Dead or Dying	Poor	Fair	Good
Silver maple	0.00	3.75	21.25	75.00
Green ash	7.02	8.77	38.60	45.61
Norway maple	0.00	1.96	17.65	80.39
American basswood	0.00	0.00	11.76	88.24
Blue spruce	0.00	0.00	12.50	87.50
Red maple	0.00	0.00	42.86	57.14
Broadleaf Deciduous Large	0.00	0.00	66.67	33.33
Honeylocust	0.00	0.00	100.00	0.00
Cottonwood	0.00	40.00	40.00	20.00
Sugar maple	0.00	0.00	0.00	100.00
Apple	0.00	0.00	0.00	100.00
Swamp white oak	0.00	0.00	66.67	33.33
Citywide total	1.52	4.18	28.14	66.16

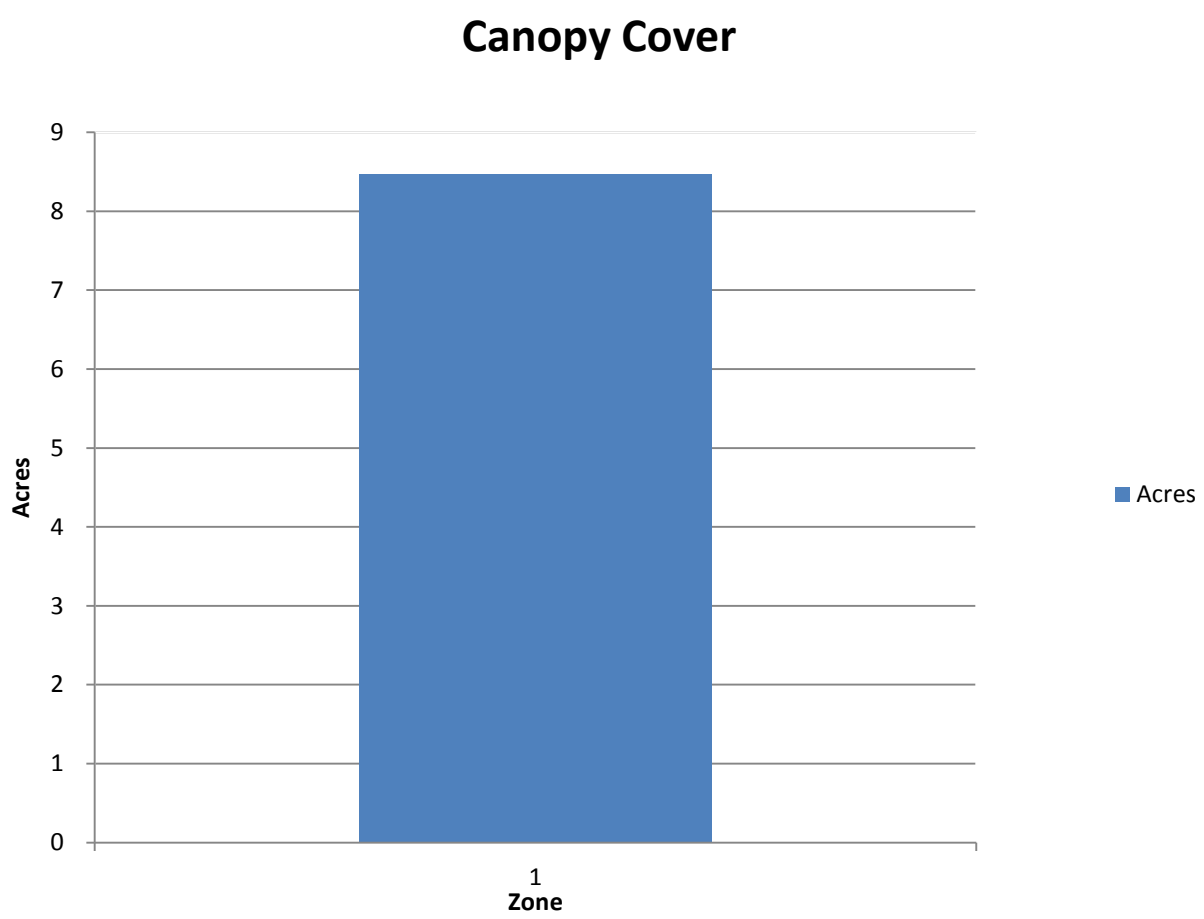
Figure 4:



Hospers
Condition (Woody) of Public Trees by Species (%)
3/5/2014

Species Name	Dead or Dying	Poor	Fair	Good
Silver maple	7.50	7.50	36.25	48.75
Green ash	10.53	14.04	26.32	49.12
Norway maple	11.76	13.73	43.14	31.37
American basswood	11.76	17.65	17.65	52.94
Blue spruce	0.00	0.00	12.50	87.50
Red maple	0.00	0.00	42.86	57.14
Broadleaf Deciduous Large	16.67	0.00	33.33	50.00
Honeylocust	0.00	0.00	0.00	100.00
Cottonwood	40.00	20.00	0.00	40.00
Sugar maple	0.00	0.00	50.00	50.00
Apple	0.00	0.00	33.33	66.67
Swamp white oak	0.00	0.00	33.33	66.67
Citywide total	8.75	9.51	32.70	49.05

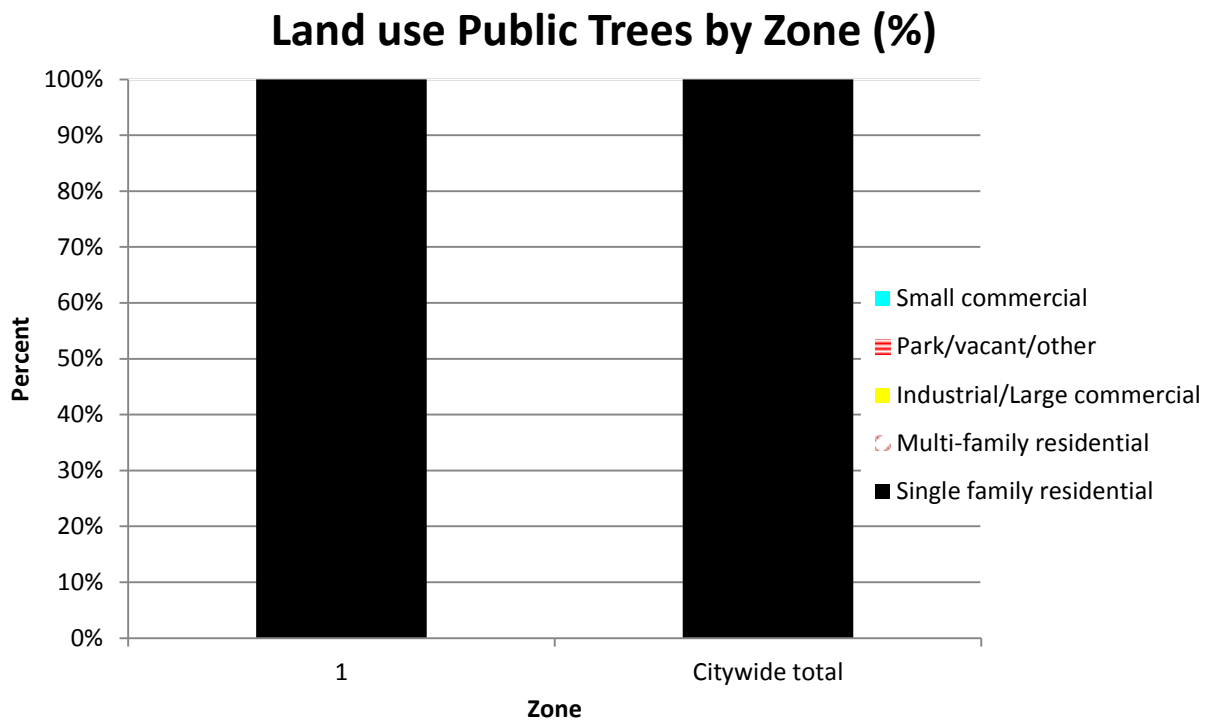
Figure 5: Canopy Cover in Acres



Canopy Cover of Public Trees (Acres)
3/5/2014

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area
Citywide total	0.00	0.00	8.47	65,535.00

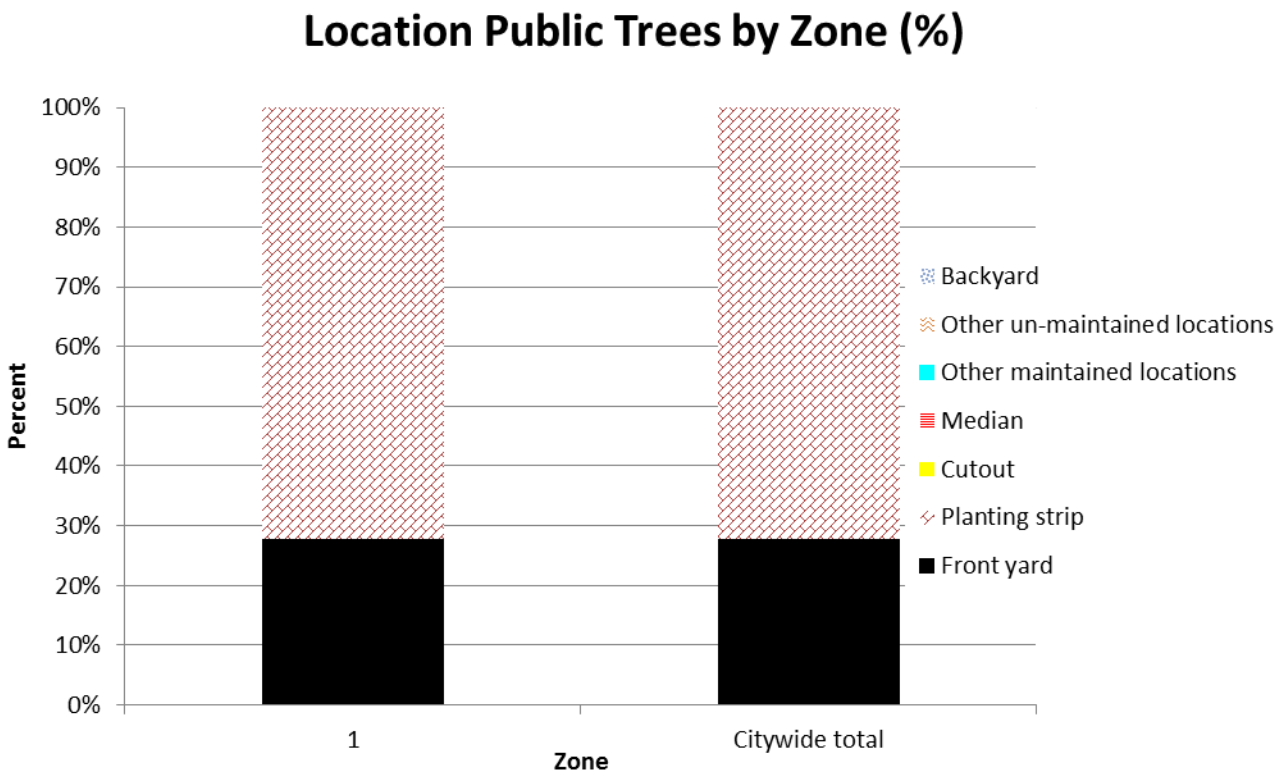
Figure 6: Land Use of City trees



Land use Public Trees by Zone (%)
3/5/2014

Zone	Single family residential	Multi-family residential	Industrial/Large commercial	Park/vacant/other	Small commercial
1	100.00	0.00	0.00	0.00	0.00
Citywide total	100.00	0.00	0.00	0.00	0.00

Figure 7: Location of city trees



Location Public Trees by Zone (%)
3/5/2014

Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	27.76	72.24	0.00	0.00	0.00	0.00	0.00
Citywide total	27.76	72.24	0.00	0.00	0.00	0.00	0.00

Appendix B: ArcGIS Mapping Only Ash Trees:

Figure 1: Location of Ash Trees

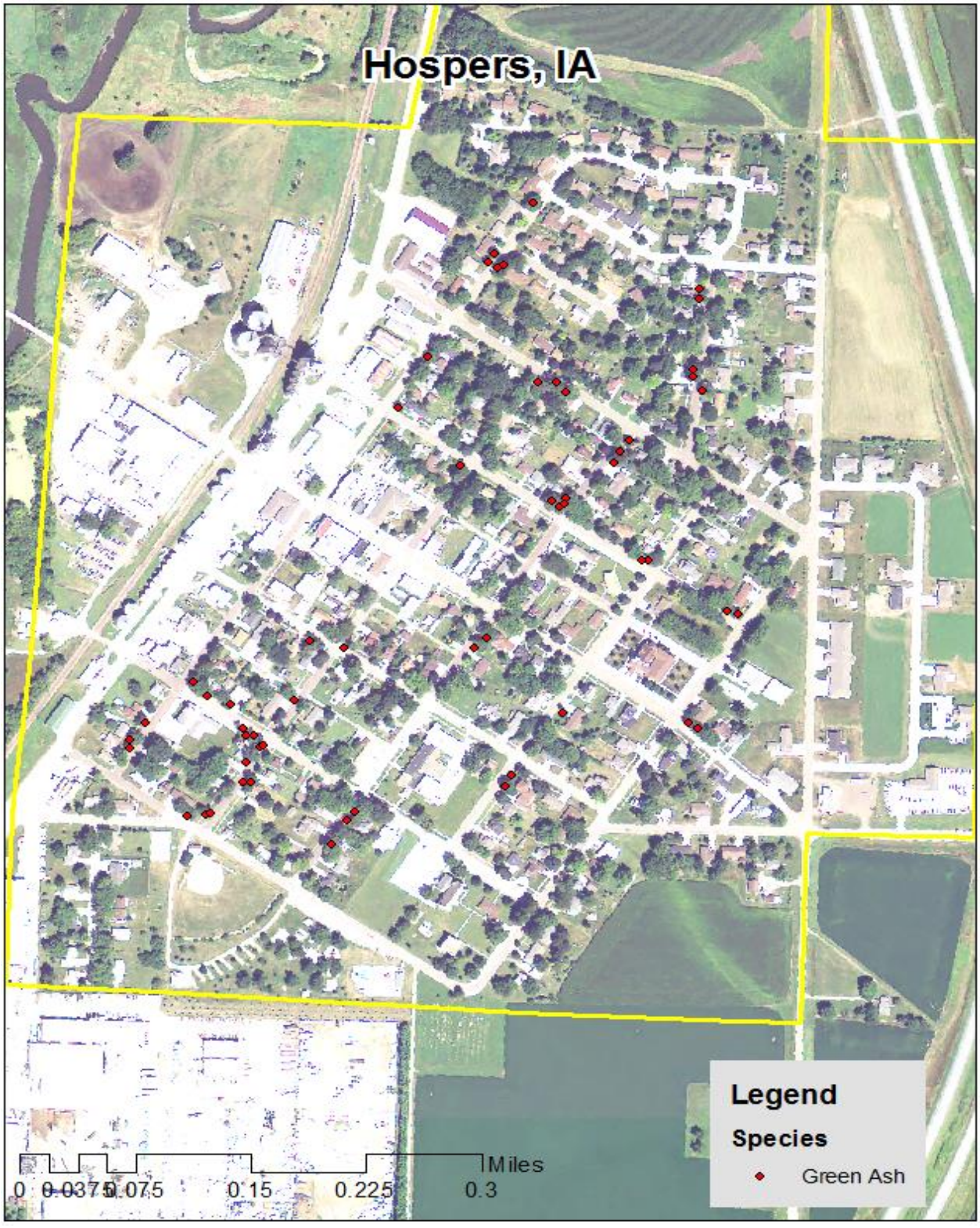


Figure 2: Location of EAB symptoms

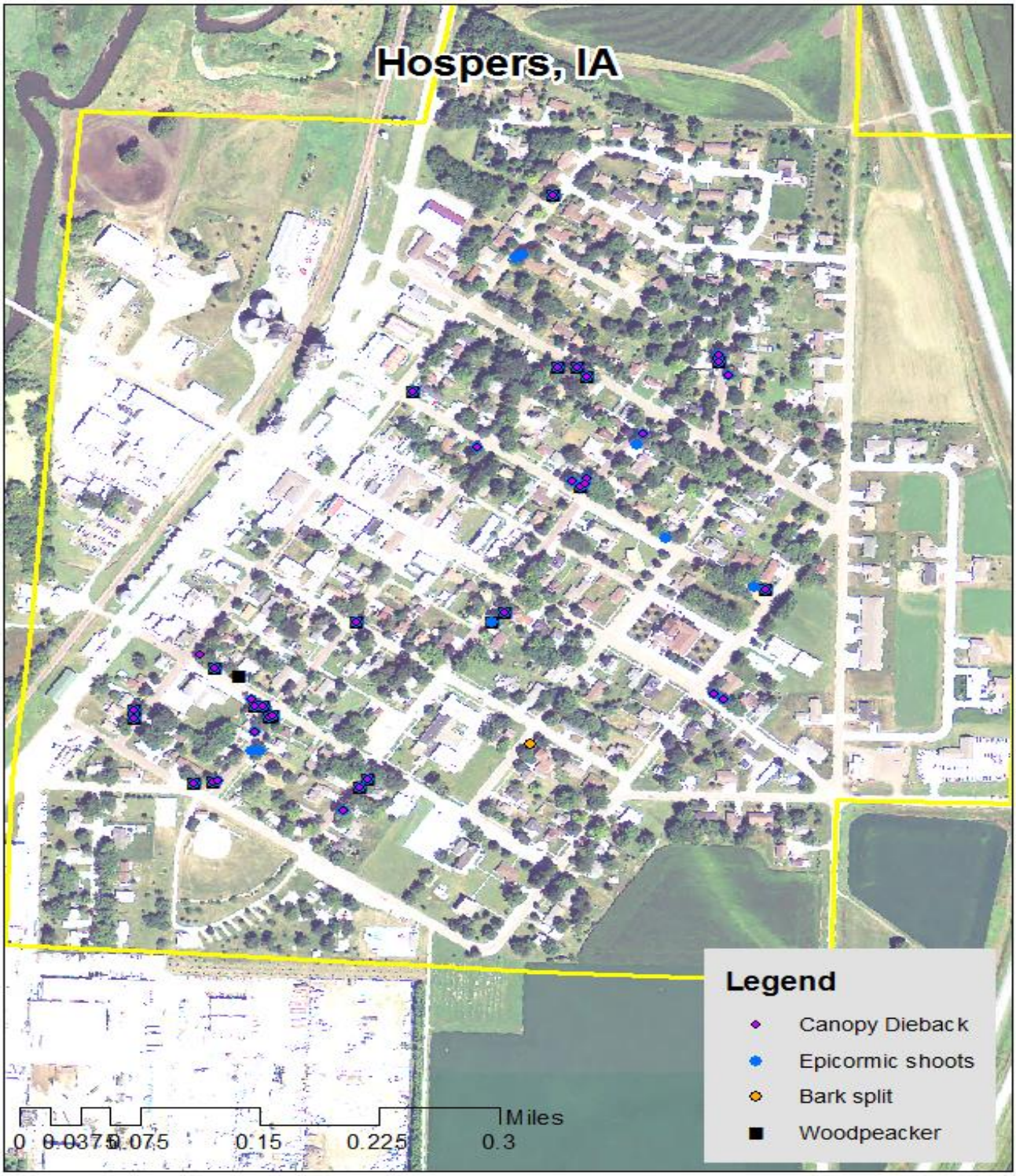


Figure 3: Location of Poor Condition Trees

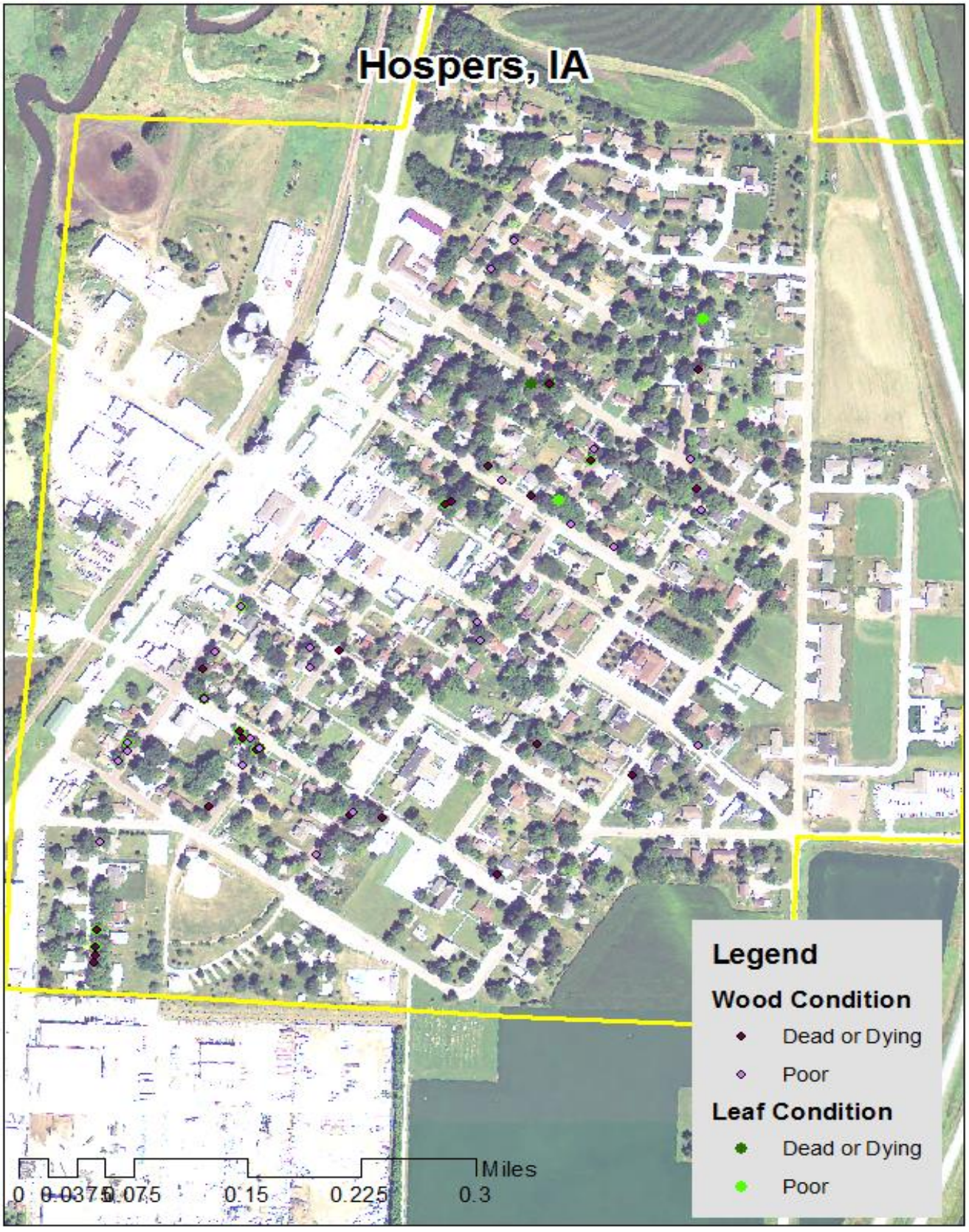


Figure 4: Location of Trees with Recommended Maintenance

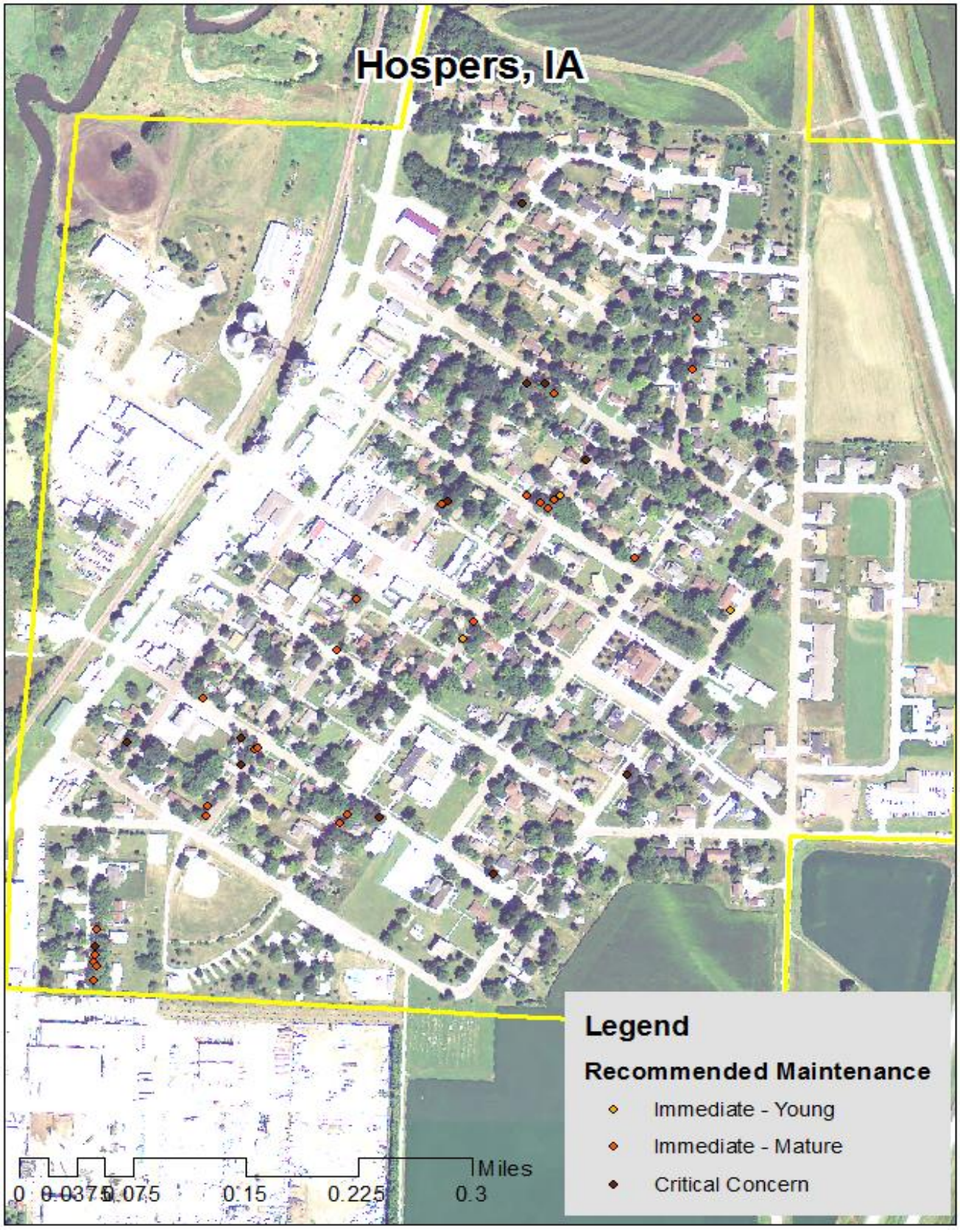
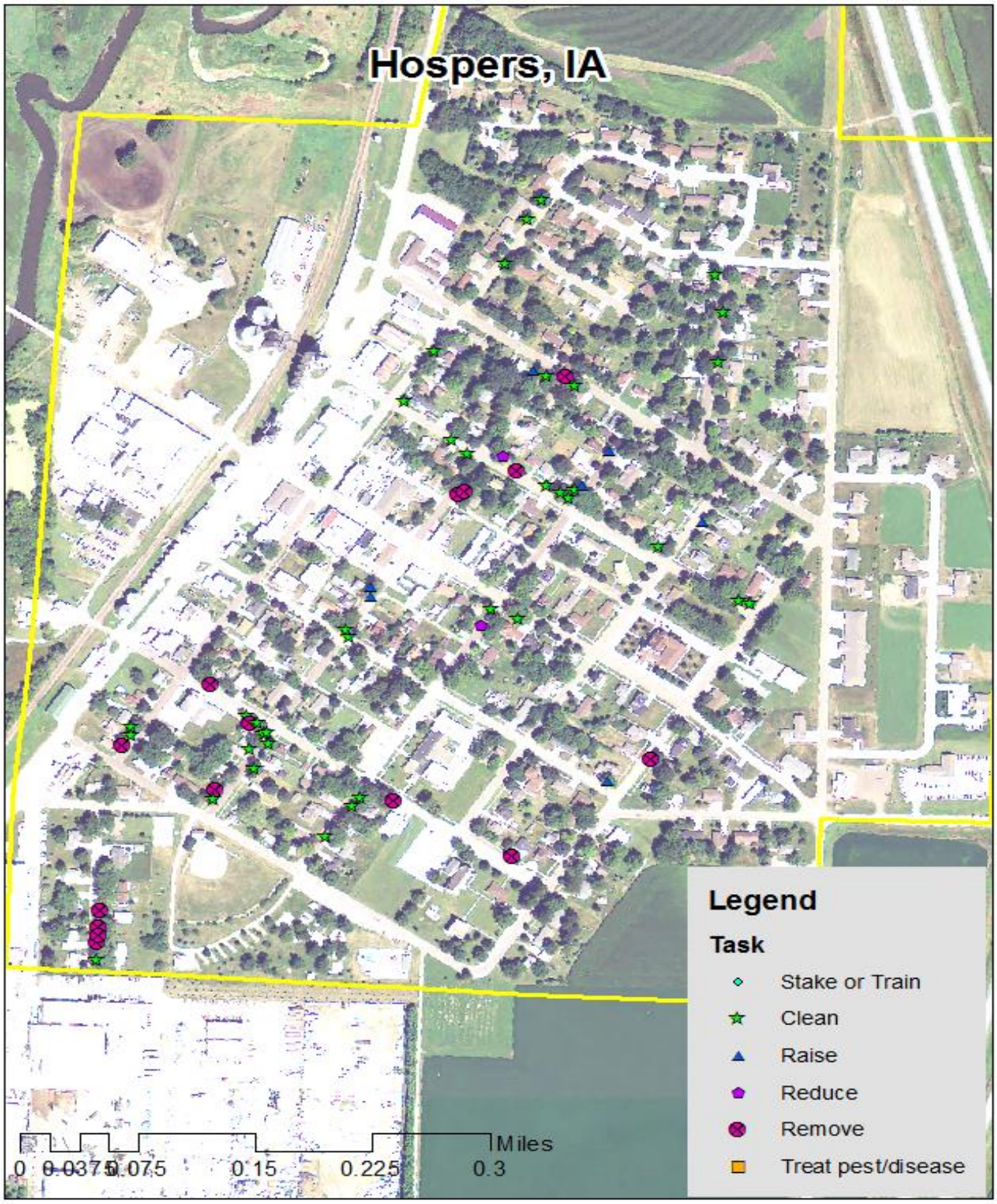


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*



Appendix C: Hospers Tree Ordinances

This section contains your current city code, shown just below, under TITLE VI. It was used years ago and covers risk trees, road clearances for vehicle traffic, elm trees infected with Dutch Elm disease, and nuisance trees. It does not cover any of Iowa's newest insect or disease problems which can be as devastating as Dutch Elm disease from the 1960's. The city council is urged to make some changes to their current city code to cover our newest problems, or adopt a new or revised city code taking current and future problems into account. After Hosper's code is a sample city code, Chapter 151, taken from the State Code Book. Please consider the new Code and our current tree problems and making changes to your current City Code.

TITLE VI

CHAPTER 3: TREES

ARTICLE 5 - GENERAL PROVISIONS

5.01 DEFINITIONS. For use in this chapter, the following term is defined:

1. "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.

2. "Superintendent" means the superintendent of streets or such as may be designated by the council.

5.02 PLANTING RESTRICTIONS

1. ALIGNMENT. All trees hereafter 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 the parking if it is less than nine (9) feet in width.

3. PROHIBITED TREES. No person shall hereinafter plant in any street, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, chinese elm or evergreens.

5.03 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.
(Code of Iowa, Sec. 364.12(2c))

5.04 ASSESSMENT. If the abutting property owner fails to trim the trees as required in this chapter, the city may serve notice on the abutting property owner requiring him to do so within five days (5) days. If he fails to trim the trees within that time, the city may be perform the required action and assess the costs against the abutting property for collection i the same manner as a property tax.
(Code of Iowa, Sec. 364.12(2d & e))

5.05 TRIMMING TREES TO BE SUPERVISED. It shall be 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.

5.06 REMOVAL OF TREES. The superintendent shall remove, on the order of the council, any tree on the streets of the city which interferes with the making of improvements or with travel thereon. He shall additionally remove any trees on the street, not on private property, which have become diseased, or which constitute a danger to the public, or which may otherwise be declared a nuisance.

(Code of Iowa, Sec. 364.12(2c) & 372.13 (4))

TITLE VI

CHAPTER 3: TREES

ARTICLE 6 - DUTCH ELM DISEASE CONTROL

6.01 TREES SUBJECT TO REMOVAL. The council having determined that the health of the elm trees within the city is threatened by a fatal disease known as the Dutch elm disease hereby declares the following shall be removed:

1. LIVING OR STANDING TREES. Any living or standing elm tree or part thereof infected with the Dutch elm disease fungus or which harbors any of the elm bark beetles, that is scolytus multistriatus (eichb.) or hylurgopinus rufipes (marsh.).

2. DEAD TREES. Any dead elm tree or part thereof including logs, branches, stumps, firewood or other elm material from which the bark has not be removed and burned or sprayed with an effective elm bark beetle destroying insecticide.

6.02 DUTY TO REMOVE. No person, firm or corporation shall permit any tree or material infected with Dutch elm disease to remain on the premises owned, controlled or occupied by him within the city.

(Code of Iowa, Sec, 364.12(3b))

6.03 INSPECTION. The city shall inspect or cause to be inspected all premises and places within the city to determine whether any condition as defined in Article 7.01 of this ordinance exists thereon, and shall also inspect or cause to be inspected any elm trees reported or suspected to be infected with the Dutch elm disease or any elm bark bearing material reported or suspected to be infected with the elm bark beetles.

6.04 REMOVAL FROM CITY PROPERTY. If the city, upon inspection or examination, in person or by some qualified person acting for the city, shall determine that any condition as herein defined exists in or upon any public street, alley, park or any public place, including the strip between the curb and the lot line of private property within the city, and that the danger of other elm trees within the city is imminent, he shall immediately cause it to be removed and burned or otherwise correct the same in such manner as to destroy or prevent as fully as possible the spread of Dutch elm disease or the insect pests or vectors known to carry such disease fungus.

6.05 REMOVAL FROM PRIVATE PROPERTY. If the city upon inspection or examination, in person or by some qualified person acting for the city, shall determine with reasonable certainty that any condition as herein defined exists in or upon private premises, and that the danger to other elm trees within the city is imminent, he shall immediately notify by certified mail the occupant or person in charge of such property, to correct such condition

within 14 days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt thereof, the council may cause the nuisance to be removed and the cost assessed against the property for collection in the same manner as a property tax.

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

6.06 REASONABLE CERTAINTY. If the city is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected with Dutch elm disease, a city representative is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens.

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 Director Charles Gipp at 515-281-5918.