2013 COMMUNITY TREE MANAGEMENT PLAN

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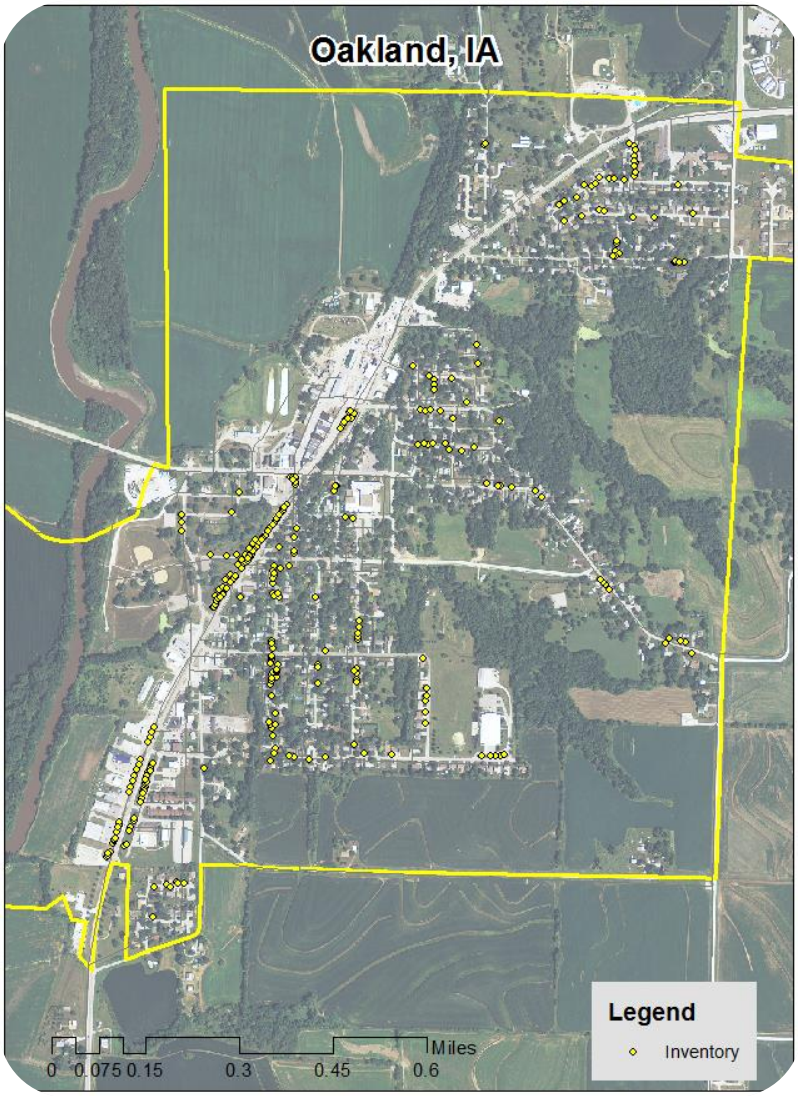

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Overview

This plan was developed to assist the City of Oakland 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 9% of Oakland's inventoried right of way trees (ash) will die once EAB becomes established in the community. Your District Forester can help your community members understand the cause and effects of EAB in addition to planning for removal trees and suitable replacements.

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 right of way trees. Below are some key findings of the 610 trees inventoried.

- Oakland's trees provide $81,888 of benefits annually, an average of $134 a tree
- There are over 37 species of trees
- The top three genus are: Apple 26.6%, Maple 18.5%, and Hackberry 10.8%
- 8% of trees are in need of some type of management
- 28 trees are recommended for removal

Recommendations

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

- Of the 28 trees needing removal, 8 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *Privately owned trees in the right of ways are the responsibility of the landowner in the city of Oakland.*
- 2 of the 54 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- All city managed 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, maple, cottonwood, poplar, box elder, Chinese or Siberian elm, elm, evergreen, willow, black walnut, tree of heaven, exotic mulberry trees (white mulberry is very common), and Bradford/Callery Pear. Please also be careful not to plant the following shrubs, as they are considered invasive species: autumn olive, honeysuckles, salt cedar, rhododendron, multiflora rose, buckthorn, Japanese Barberry, Burning Bush, and Oriental bittersweet (a vine).
- Tree of Heaven, an aggressive and incredibly invasive tree, is expanding from an epicenter near the school. If landowners are interested, their Forester can assist them

with control measures. In addition, the city should consider working with the landowners who have the original parent trees – to remove them (so they do not seed further).

- Check ash trees with a visual survey yearly
- Individual landowners are responsible for the care of their respective right of way trees. The community as a whole should be aware that if every right of way inventoried ash were to die of EAB, the replanting and replacement costs would total an estimated $36,750.

Introduction

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

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

Inventory

In 2013, a tree inventory was conducted that included 100% of the city owned street right of way trees. 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 610 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. Findings

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Oakland's trees reduce energy related costs by approximately $23,085 annually (Appendix A, Table 1). These savings are both in Electricity (107.4 MWh) and in Natural Gas (15,235.8 Therms).

Annual Stormwater Benefits

Oakland's trees intercept about 1,082,162 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $29,329 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 Oakland, it is estimated that trees remove 3,212 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 $3,863 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Oakland, trees sequester about 238,430 lbs of carbon a year with an associated value of $1,788 (Appendix A, Table 5). In addition, the trees store 3,605,211 lbs of carbon, with a yearly benefit of $27,039 (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. Oakland receives $22,603 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, Oakland's trees provide $81,888 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 610 trees in Oakland provide approximately $134 annually (Appendix A, Table 7).

Forest Structure

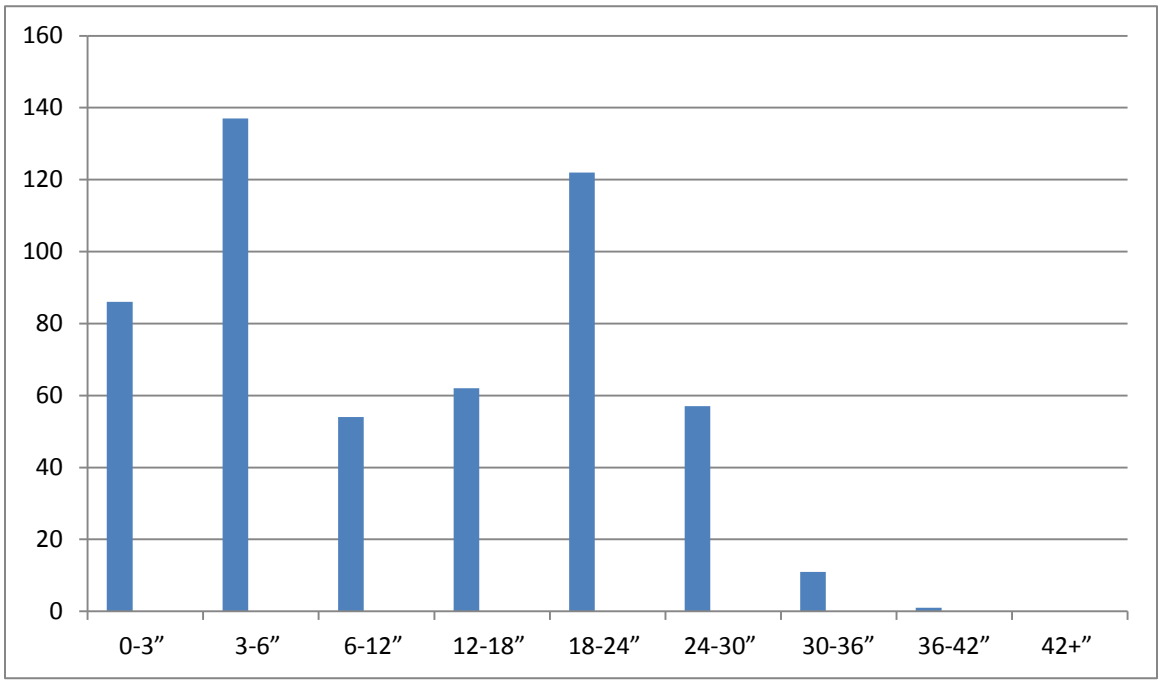
Species Distribution

Oakland has over 39 different tree species along city streets (Appendix A, Figure 1).
The distribution of trees by genus is as follows:

Genus	Count	Percentage
Apple	162	26.6%
Maple	113	18.5%
Hackberry	66	10.8%
Oak	63	10.3%
Ash	54	8.9%
Cherry/Plum	34	5.6%
Elm	30	4.9%
Spruce	24	3.9%
Linden	14	2.3%
Walnut	12	2.0%
Honeylocust	8	1.3%
Pear	6	1.0%
Broadleaf Deciduous	4	0.7%
Japanese Tree Lilac	4	0.7%
Ohio Buckeye	2	0.3%
Birch	2	0.3%
Hickory	2	0.3%
Redbud	2	0.3%
Ginkgo	2	0.3%
Juniper	2	0.3%
PHAM (broadleaf deciduous)	2	0.3%
White Cedar	2	0.3%
	610	100.0%

Age Class

Oakland's trees are fairly well distributed across all size classes. There are spikes in the 6-12" category (due to all of the young apple trees along highway 6) and the 24-30" category (which are maturing city right of way trees).



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 Oakland indicate that 98% of the trees are in good or fair health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 92% of Oakland's trees are in good or fair health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 8% of the population. This 8% is an estimate of trees that need management follow up.

Management Needs

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

Crown Cleaning	191	17.5%
Tree Removal	28	4.6%
Treat Pest/Disease	14	2.0%
Crown Reduction	2	<1%
Tree Staking	2	<1%

Canopy Cover

The canopy cover of Oakland is approximately 12.3 acres (Appendix A, Figure 4). According to the 2010 census, Oakland occupies 960 acres. Thus the canopy cover on city right of way areas is about 1.3%.

Land Use and Location

The majority of Oakland's city trees are in front yards and 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 trees.

Land Use	
Single family residential	56%
Park/vacant/other	23%
Small commercial	17%
Industrial/Large Commercial	5%

Location	
Front yard	45%
Planting strip	41%
Median	14%

Recommendations

Risk Management

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

Hazardous trees

Oakland has 10 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 8 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. After the 36 critical concern trees are addressed, there should be follow up on immediate concern trees (both mature and young). There are a total of 73 trees with these needs.

PRIORITY TASK	# BY TASK UNDER CRITICAL CONCERN	# BY TASK UNDER MATURE TREE IMMEDIATE	# BY TASK UNDER MATURE TREE ROUTINE	# BY TASK UNDER YOUNG TREE IMMEDIATE	# BY TASK UNDER YOUNG TREE ROUTINE	NONE	TOTAL
NONE: For immediate and critical concern activities, this means the tree needs follow-up by an arborist, for routine activities this means to treat the trees via routine maintenance	8	2	278		167	8	**457**
STAKE/TRAIN					2		**2**
CLEAN	14	45	46	2			**107**
RAISE							
REDUCE			4				**4**
REMOVE	10	12		6			**28**
TREAT PEST/DISEASE (For most this means address carpenter ant activity)	4	6	2				**12**
TOTAL	**36**	**65**	**330**	**8**	**169**	**2**	**610**

Poor tree species

After the removal of the critical concern and immediate concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 28 removals, none are ash trees. There are a total of 54 ash trees, and 2 of those have signs and symptoms that have been associated with EAB. In addition, there are 6 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are five main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, crown reduction, and treat pest/disease. 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. Treat pest/disease trees showed indications of foliar or structural decline due to insect, disease, or rot. These trees should be investigated further by a certified arborist who can look into the integrity of the tree. It is recommended that all trees be pruned on a routine schedule every five to seven years.

Planting

It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. It is not essential that the new trees be planted in the same location of the trees being

removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Oakland.

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 Apple (27%) (Appendix A, Figure 1). Apples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Recommended Species to plant in Western Iowa:

COMMON NAME	SCIENTIFIC NAME	CULTIVARS/SELECTIONS
LARGE SHADE TREES – Plant 35 feet apart and away from overhead power lines.		
Swamp White Oak	*Quercus bicolor*	
White Oak	*Quercus alba*	
Bur Oak	*Quercus macrocarpa*	
Red Oak	*Quercus rubra*	
Black Oak	*Quercus veluntina*	
Chinkapin Oak	*Quercus muehlenbergii*	
American Basswood (Linden)	*Tilia Americana*	Boulevard, Front Yard, Legend, Redmond
Thornless Honeylocust	*Gleditsia triacanthos var. inermis*	Shademaster, Skyline
American elm	*Ulmus Americana*	Independence, New harmony, Valley Forge
Cottonwood (seedless) - ***Not recommended for planting near any homes or structures	*Populous deltoides*	Siouxland
Sycamore	*Plantanus occidentalis*	
Yellowwood	*Cladrastis lutea*	
Kentucky coffeetree	*Gymnocladus diocius*	Expresso
Black Cherry	*Prunus serotina*	
Hackberry	*Celtis occidentalis*	Chicagoland, Prairie Pride, Windy City
LOW GROWING TREES (less than 30 feet tall) planted as close as 12 feet.		
Eastern redbud	*Cercis Canadensis*	
Thornless cockspur hawthorn or other native hawthorns	*Crataegus crusgalli var. inermis*	
Ironwood (hop hornbeam)	*Ostrya virginiana*	
American hornbeam	*Carpinus caroliniana*	
Serviceberry	*Amalanchier arborea*	Autumn brilliance, Cumulus, Princess Diana
Flowering crabapple	*Malus*	Prairiefire, Adams, Sentinel, Snowdrift
Red mulberry	*Morus rubra*	
American (wild) plum	*Prunus americana*	

EVERGREEN TREES – planted 25 feet apart and away from overhead power lines.

Eastern White Pine	*Pinus strobes*	
Jack pine	*Pinus banksiana*	
Junipers (Eastern red cedar)	*Juniperus virginiana*	
Norway spruce	*Picea abies*	
Concolor fir	*Abies concolor*	
Bald cypress	*Taxodium distichum*	
Arborvitae (Northern White cedar)	*Thuja occidentalis*	Techny, Brandon, Holmstrup

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 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*

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

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on 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. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Treating for EAB

Many landowners will want to treat their ash trees with insecticides to prolong the life of their ash trees. This is only recommended when EAB has been found within 15 miles of the tree in question. Insecticidal injections or drenches can have serious environmental side effects (on birds, bees, non-target insects, and can enter groundwater sources). Some insecticides have application limits – like only treating 3 trees per acre, for instance. Within a city scenario – it is likely that these chemicals will be over applied. Please contact me if you have any questions. I would be more than happy to host an informational meeting on EAB and its effects on community ash trees.

My suggestion would be to start increasing the city tree budget for removals and replacements now. I would place all efforts and finances on replanting trees – and removing tree casualties as they arise. Insecticidal treatments are expensive, environmentally hazardous, and are not a good solution to the potential issue across an entire community.

Maintenance Plan and Budget

The following tasks are placed in order of yearly priority. These tasks should be fulfilled as your budget or personnel time allows. Critical concern trees should be addressed immediately, and immediate mature tree tasks should be addressed within 2-3 years (which is their expected lifetime before they become critical concern trees). If you are interested in creating a scheduled maintenance and replanting plan, based on a set budget, please contact me. For now, a priority list looks like this:

2014: Address 36 critical concern trees. These trees fall on both private and publically managed land.

2014-2015: Complete any remaining immediate or routine tasks on public spaces. Consider notifying private landowners about remaining hazard trees that fall on privately managed land. Routine trimming is the responsibility of the individual landowner in Oakland. One possibility for completing the remaining cleaning (trimming) recommendations would be to let the citizens have access to the inventory data to see the recommendations given to their tree(s). A city-wide tree trimming contract (however that would be negotiated) would be much more affordable than single landowners contracting the jobs themselves.

Determine how the city of Oakland would like to proceed with EAB planning, outreach, and public assistance (if possible).

Monitor for suspicious ash trees.

2015-2017: Consider promoting routine trimming of the remaining city trees. Ideally, routine trimming should be done to 1/3 of the city's trees every 2 years. In other words, all public and right of way trees should be trimmed once every 6 years.

Also – consider evaluating Oakland's street trees again for hazards by 2017 (if not before).

Monitor for tree health issues – all species.

Proposed Budget Increase

Planning and budgeting finances and/or city employee time for forest health threats will be a critical matter for your community to consider. Emerald Ash Borer is one of these threats, and could potentially kill all ash trees in Oakland within 4 years of its arrival. To remove and replace all 54 remaining ash trees (acknowledging some fall on privately managed land), Oakland would need to budget an estimated $36,750. Because the city of Oakland removes hazard trees on city managed land in house – this estimate serves as a figure of how much the city crews may save the long-term budget (providing they assisted private lands right of way Ash owners). Additionally, it is recommended that Oakland 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. The Trees for Kids Grant will continue to be a great option for your community to use for tree planting projects on public lands.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Oakland

Annual Energy Benefits of Public Trees by Species

1/9/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	6.7	512	1,105.4	1,083	1,595	(N/A)	26.6	6.9	9.85
Northern hackberry	24.7	1,877	3,551.6	3,481	5,357	(N/A)	10.8	23.2	81.17
Norway maple	6.0	457	861.6	844	1,301	(N/A)	6.6	5.6	32.52
Green ash	9.2	702	1,288.1	1,262	1,964	(N/A)	5.9	8.5	54.57
Silver maple	11.9	900	1,568.1	1,537	2,437	(N/A)	5.6	10.6	71.67
Northern red oak	4.4	335	633.6	621	956	(N/A)	5.4	4.1	28.96
Cherry plum	1.9	146	290.2	284	430	(N/A)	4.6	1.9	15.36
Siberian elm	5.3	404	744.9	730	1,134	(N/A)	3.3	4.9	56.71
Maple	3.9	297	495.9	486	783	(N/A)	3.1	3.4	41.20
Pin oak	5.8	438	787.4	772	1,210	(N/A)	3.0	5.2	67.20
Blue spruce	1.4	104	199.7	196	300	(N/A)	2.6	1.3	18.74
Sugar maple	2.2	164	293.2	287	452	(N/A)	2.3	2.0	32.27
Ash	1.6	124	254.4	249	373	(N/A)	2.3	1.6	26.67
Black walnut	2.9	220	403.8	396	615	(N/A)	2.0	2.7	51.29
Bur oak	3.5	268	495.9	486	754	(N/A)	1.6	3.3	75.35
Honeylocust	2.1	159	276.7	271	430	(N/A)	1.3	1.9	53.75
Littleleaf linden	1.9	146	286.8	281	427	(N/A)	1.3	1.9	53.43
Other street trees	11.9	902	1,698.6	1,665	2,566	(N/A)	11.8	11.1	35.64
Citywide total	107.4	8,154	15,235.8	14,931	23,085	(N/A)	100.0	100.0	37.84

Table 2: Annual Stormwater Benefits

Oakland

Annual Stormwater Benefits of Public Trees by Species

1/9/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	24,356	660	(N/A)	26.6	2.3	4.07
Northern hackberry	251,254	6,809	(N/A)	10.8	23.2	103.17
Norway maple	43,934	1,191	(N/A)	6.6	4.1	29.77
Green ash	104,078	2,821	(N/A)	5.9	9.6	78.35
Silver maple	177,366	4,807	(N/A)	5.6	16.4	141.38
Northern red oak	41,775	1,132	(N/A)	5.4	3.9	34.31
Cherry plum	6,855	186	(N/A)	4.6	0.6	6.64
Siberian elm	51,112	1,385	(N/A)	3.3	4.7	69.26
Maple	26,148	709	(N/A)	3.1	2.4	37.30
Pin oak	64,328	1,743	(N/A)	3.0	5.9	96.86
Blue spruce	18,893	512	(N/A)	2.6	1.8	32.00
Sugar maple	20,255	549	(N/A)	2.3	1.9	39.21
Ash	12,866	349	(N/A)	2.3	1.2	24.91
Black walnut	27,575	747	(N/A)	2.0	2.6	62.28
Bur oak	45,617	1,236	(N/A)	1.6	4.2	123.63
Honeylocust	24,587	666	(N/A)	1.3	2.3	83.29
Littleleaf linden	21,684	588	(N/A)	1.3	2.0	73.46
Other street trees	119,479	3,238	(N/A)	11.8	11.0	44.97
Citywide total	1,082,162	29,329	(N/A)	100.0	100.0	48.08

Table 3: Annual Air Quality Benefits

Oakland

Annual Air Quality Benefits of Public Trees by Species

1/9/2014

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
Apple	5.0	0.8	2.7	0.2	28	33.8	4.8	4.6	30.5	206	0.0	0	82.4	234	(N/A)	26.6	1.44
Northern hackberry	40.0	6.9	20.2	1.8	218	119.7	17.3	16.5	112.1	742	0.0	0	334.6	960	(N/A)	10.8	14.54
Norway maple	7.5	1.3	3.9	0.3	41	29.1	4.2	4.0	27.3	181	-1.9	-7	75.8	214	(N/A)	6.6	5.36
Green ash	12.7	2.0	6.1	0.6	68	44.4	6.4	6.1	41.9	276	0.0	0	120.2	343	(N/A)	5.9	9.54
Silver maple	30.8	5.2	15.1	1.4	166	55.9	8.2	7.8	53.6	350	-15.5	-58	162.5	458	(N/A)	5.6	13.46
Northern red oak	8.4	1.4	4.2	0.4	46	21.3	3.1	2.9	20.0	132	-12.2	-46	49.5	132	(N/A)	5.4	4.00
Cherry plum	1.7	0.3	0.9	0.1	9	9.4	1.4	1.3	8.7	58	0.0	0	23.7	67	(N/A)	4.6	2.40
Siberian elm	7.2	1.2	3.7	0.3	39	25.5	3.7	3.5	24.1	159	0.0	0	69.4	198	(N/A)	3.3	9.91
Maple	5.3	0.9	2.6	0.2	28	18.3	2.7	2.6	17.7	115	-1.9	-7	48.3	136	(N/A)	3.1	7.16
Pin oak	11.2	2.0	5.8	0.5	61	27.5	4.0	3.8	26.1	171	-20.8	-78	60.1	155	(N/A)	3.0	8.60
Blue spruce	2.4	0.5	2.0	0.3	16	6.6	1.0	0.9	6.2	41	-6.7	-25	13.2	32	(N/A)	2.6	2.00
Sugar maple	2.4	0.4	1.3	0.1	13	10.3	1.5	1.4	9.8	64	-1.9	-7	25.3	70	(N/A)	2.3	5.02
Ash	2.2	0.4	1.2	0.1	12	8.1	1.2	1.1	7.4	50	-0.6	-2	21.0	60	(N/A)	2.3	4.27
Black walnut	2.9	0.5	1.5	0.1	15	13.9	2.0	1.9	13.1	86	0.0	0	35.8	102	(N/A)	2.0	8.49
Bur oak	6.1	1.0	2.8	0.3	32	17.0	2.5	2.3	16.0	105	0.0	0	48.0	138	(N/A)	1.6	13.77
Honeylocust	4.9	0.8	2.2	0.2	26	9.9	1.4	1.4	9.5	62	-3.8	-14	26.5	73	(N/A)	1.3	9.14
Littleleaf linden	3.8	0.7	1.8	0.2	20	9.4	1.4	1.3	8.8	58	-1.8	-7	25.5	72	(N/A)	1.3	8.98
Other street trees	17.8	3.0	9.3	0.9	98	57.4	8.3	7.9	53.8	356	-9.3	-35	149.2	419	(N/A)	11.8	5.82
Citywide total	172.2	29.3	87.1	8.0	937	517.5	75.0	71.4	486.8	3,212	-76.4	-287	1,371.0	3,863	(N/A)	100.0	6.33

Table 4: Annual Carbon Stored

Oakland

Stored CO2 Benefits of Public Trees by Species

1/9/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	91,800	689	(N/A)	26.6	2.6	4.25
Northern	600,953	4,507	(N/A)	10.8	16.7	68.29
Norway maple	126,847	951	(N/A)	6.6	3.5	23.78
Green ash	409,188	3,069	(N/A)	5.9	11.4	85.25
Silver maple	672,332	5,042	(N/A)	5.6	18.7	148.31
Northern red oak	183,118	1,373	(N/A)	5.4	5.1	41.62
Cherry plum	27,795	208	(N/A)	4.6	0.8	7.45
Siberian elm	176,080	1,321	(N/A)	3.3	4.9	66.03
Maple	59,837	449	(N/A)	3.1	1.7	23.62
Pin oak	290,107	2,176	(N/A)	3.0	8.1	120.88
Blue spruce	15,241	114	(N/A)	2.6	0.4	7.14
Sugar maple	67,691	508	(N/A)	2.3	1.9	36.26
Ash	38,240	287	(N/A)	2.3	1.1	20.49
Black walnut	91,704	688	(N/A)	2.0	2.5	57.32
Bur oak	198,409	1,488	(N/A)	1.6	5.5	148.81
Honeylocust	62,492	469	(N/A)	1.3	1.7	58.59
Littleleaf linden	79,786	598	(N/A)	1.3	2.2	74.80
Other street trees	187,602	3,102	(N/A)	11.8	11.5	43.08
Citywide total	3,605,211	27,039	(N/A)	100.0	100.0	44.33

Table 5: Annual Carbon Sequestered

Oakland

Annual CO_2 Benefits of Public Trees by Species

1/9/2014

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
Apple	10,008	75	-441	-32	-4	11,307	85	20,843	156	(N/A)	26.6	5.2	0.96
Northern hackberry	33,027	248	-2,885	-13	-22	41,470	311	71,600	537	(N/A)	10.8	17.9	8.14
Norway maple	10,371	78	-609	-8	-5	10,092	76	19,846	149	(N/A)	6.6	5.0	3.72
Green ash	22,957	172	-1,964	-7	-15	15,514	116	36,500	274	(N/A)	5.9	9.1	7.60
Silver maple	49,839	374	-3,227	-7	-24	19,892	149	66,497	499	(N/A)	5.6	16.6	14.67
Northern red oak	4,993	37	-879	-6	-7	7,401	56	11,508	86	(N/A)	5.4	2.9	2.62
Cherry plum	2,907	22	-133	-5	-1	3,223	24	5,991	45	(N/A)	4.6	1.5	1.60
Siberian elm	10,052	75	-845	-4	-6	8,932	67	18,135	136	(N/A)	3.3	4.5	6.80
Maple	7,836	59	-287	-4	-2	6,561	49	14,106	106	(N/A)	3.1	3.5	5.57
Pin oak	27,191	204	-1,393	-4	-10	9,681	73	35,476	266	(N/A)	3.0	8.8	14.78
Blue spruce	1,103	8	-73	-3	-1	2,302	17	3,329	25	(N/A)	2.6	0.8	1.56
Sugar maple	4,355	33	-325	-3	-2	3,634	27	7,662	57	(N/A)	2.3	1.9	4.10
Ash	2,914	22	-184	-3	-1	2,742	21	5,470	41	(N/A)	2.3	1.4	2.93
Black walnut	6,980	52	-440	-2	-3	4,856	36	11,394	85	(N/A)	2.0	2.8	7.12
Bur oak	8,980	67	-952	-2	-7	5,914	44	13,939	105	(N/A)	1.6	3.5	10.45
Honeylocust	4,866	36	-300	-2	-2	3,511	26	8,076	61	(N/A)	1.3	2.0	7.57
Littleleaf linden	6,972	52	-383	-2	-3	3,235	24	9,823	74	(N/A)	1.3	2.5	9.21
Other street trees	23,080	173	-1,985	-14	-15	19,925	149	41,006	308	(N/A)	11.8	10.2	4.27
Citywide total	238,430	1,788	-17,305	-119	-131	180,194	1,351	401,200	3,009	(N/A)	100.0	100.0	4.93

Table 6: Annual Social and Aesthetic Benefits

Oakland

Annual Aesthetic/Other Benefits of Public Trees by Species

1/9/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Apple	536	(N/A)	26.6	2.4	3.31
Northern hackberry	4,196	(N/A)	10.8	18.6	63.58
Norway maple	1,100	(N/A)	6.6	4.9	27.49
Green ash	1,884	(N/A)	5.9	8.3	52.34
Silver maple	3,860	(N/A)	5.6	17.1	113.54
Northern red oak	441	(N/A)	5.4	2.0	13.35
Cherry plum	161	(N/A)	4.6	0.7	5.76
Siberian elm	784	(N/A)	3.3	3.5	39.22
Maple	1,086	(N/A)	3.1	4.8	57.15
Pin oak	2,086	(N/A)	3.0	9.2	115.87
Blue spruce	324	(N/A)	2.6	1.4	20.23
Sugar maple	469	(N/A)	2.3	2.1	33.51
Ash	324	(N/A)	2.3	1.4	23.16
Black walnut	626	(N/A)	2.0	2.8	52.18
Bur oak	660	(N/A)	1.6	2.9	65.99
Honeylocust	1,168	(N/A)	1.3	5.2	145.97
Littleleaf linden	701	(N/A)	1.3	3.1	87.62
Other street trees	2,196	(N/A)	11.8	9.7	30.50
Citywide total	22,603	(N/A)	100.0	100.0	37.05

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 $
Apple	1,595	156	234	660	536	$3,181.73	(±0)	3.89
Northern hackberry	5,357	537	960	6,809	4,196	$17,859.36	(±0)	21.81
Norway maple	1,301	149	214	1,191	1,099	$3,954.49	(±0)	4.83
Green ash	1,964	274	343	2,821	1,884	$7,286.43	(±0)	8.90
Silver maple	2,437	499	458	4,807	3,860	$12,060.65	(±0)	14.73
Northern red oak	956	86	132	1,132	441	$2,746.86	(±0)	3.35
Cherry plum	430	45	67	186	161	$889.56	(±0)	1.09
Siberian elm	1,134	136	198	1,385	784	$3,637.98	(±0)	4.44
Maple	783	106	136	709	1,086	$2,819.33	(±0)	3.44
Pin oak	1,210	266	155	1,743	2,086	$5,459.54	(±0)	6.67
Blue spruce	300	25	32	512	324	$1,192.50	(±0)	1.46
Sugar maple	452	57	70	549	469	$1,597.70	(±0)	1.95
Ash	373	41	60	349	324	$1,147.11	(±0)	1.40
Black walnut	615	85	102	747	626	$2,176.22	(±0)	2.66
Bur oak	754	105	138	1,236	660	$2,892.03	(±0)	3.53
Honeylocust	430	61	73	666	1,168	$2,397.85	(±0)	2.93
Littleleaf linden	427	74	72	588	701	$1,861.51	(±0)	2.27
Other street trees	2,566	308	419	3,238	2,196	$8,727.14	(±0)	10.66
Citywide total	23,085	3,009	3,863	29,329	22,603	$81,888.00	(±0)	100.00

Table 8: Recommended Maintenance by diameter class

Oakland

Recommended Maintenance for Public Trees (None)

1/9/2014

	DBH Class (in)									
Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
1	0	0	0	0	0	1	0	1	0	2
Citywide total	0	0	0	0	0	1	0	1	0	2

	DBH Class (in)										
Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	0	0	0	0	0	1	0	1	0	2	0.33
Young tree (routine)	86	64	19	0	0	0	0	0	0	169	27.70
Young tree (immediate)	0	8	0	0	0	0	0	0	0	8	1.31
Mature tree (routine)	0	14	110	48	46	76	29	6	1	330	54.10
Mature tree (immediate)	0	0	8	6	14	21	12	4	0	65	10.66
Critical concern (public safety)	0	0	0	0	2	24	10	0	0	36	5.90
Citywide total	86	86	137	54	62	122	51	11	1	610	100.00

Table 9: Priority Task by diameter class

Oakland

Priority Task Summary for Public Trees (None)

1/9/2014

	DBH Class (in)									
Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
1	84	78	121	36	38	65	27	7	1	457
Citywide total	84	78	121	36	38	65	27	7	1	457

	DBH Class (in)										
Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	84	78	121	36	38	65	27	7	1	457	74.92
Stake/Train	2	0	0	0	0	0	0	0	0	2	0.33
Clean	0	2	10	14	18	43	16	4	0	107	17.54
Raise	0	0	0	0	0	0	0	0	0	0	0.00
Reduce	0	0	2	2	0	0	0	0	0	4	0.66
Remove	0	6	4	2	4	8	4	0	0	28	4.59
Treat pest/disease	0	0	0	0	2	6	4	0	0	12	1.97
Citywide total	86	86	137	54	62	122	51	11	1	610	100.00

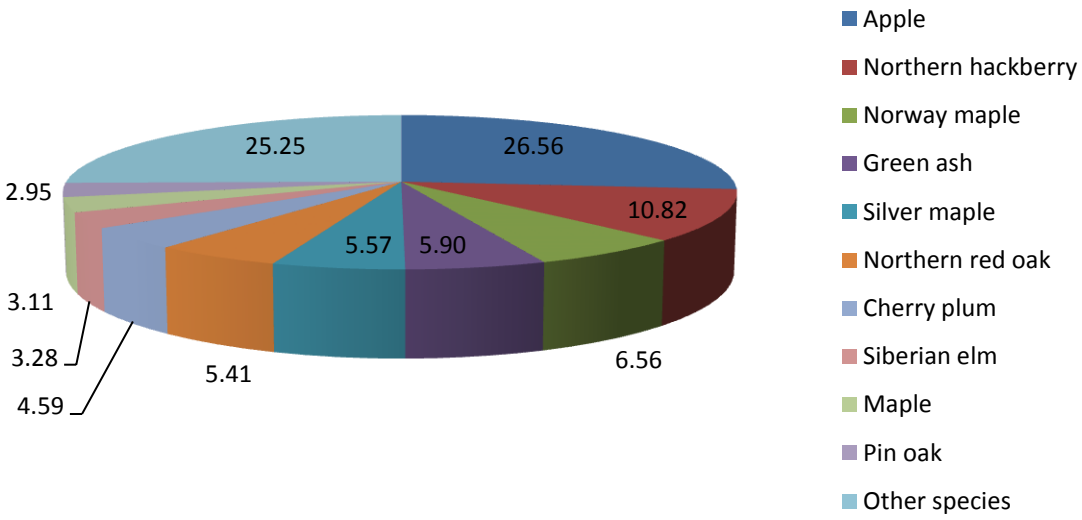

Figure 1: Species Distribution

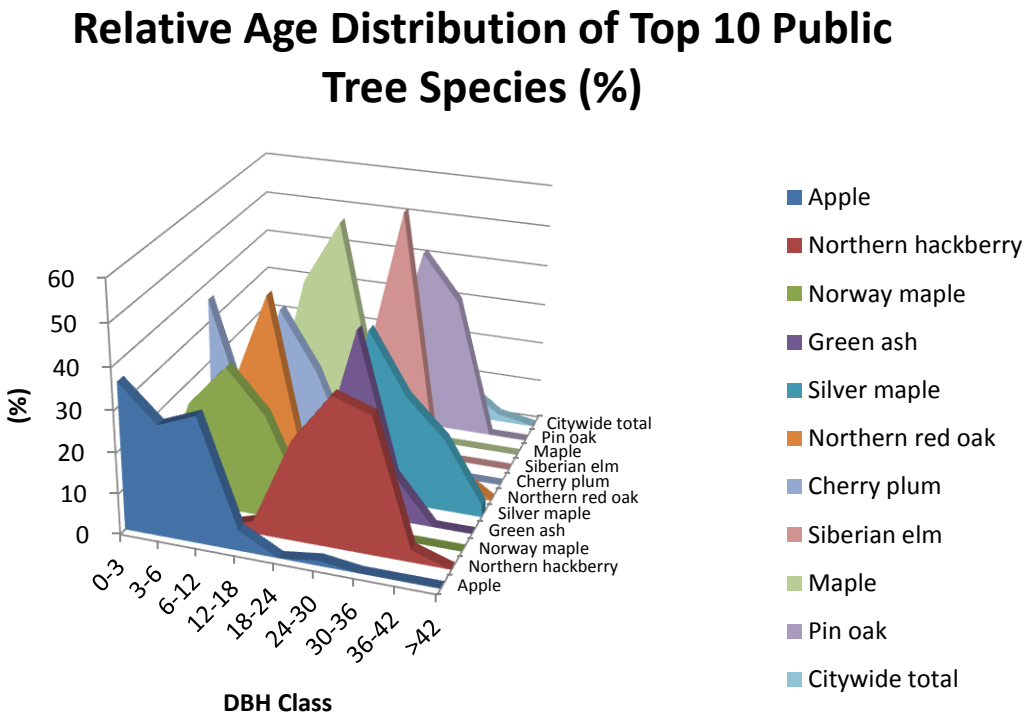

Figure 2: Relative Age Class

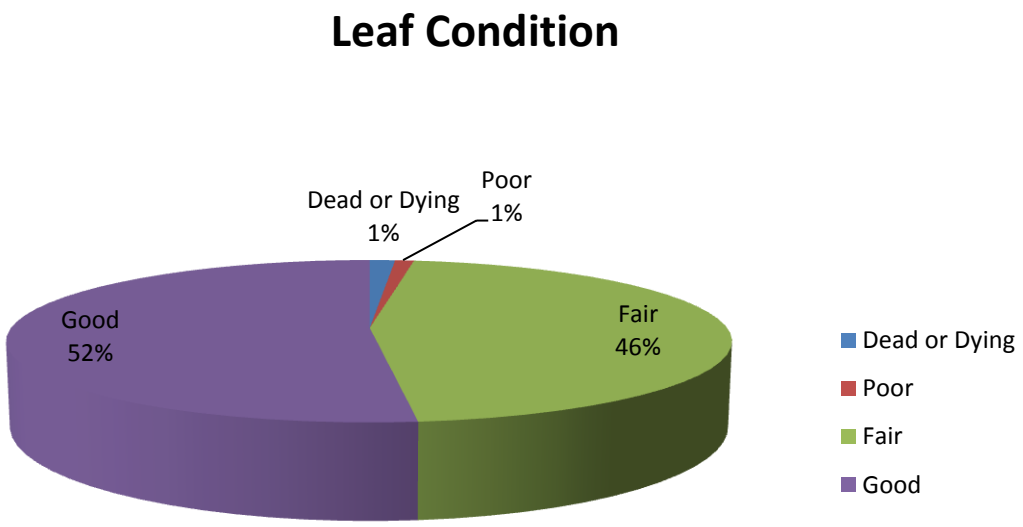

Figure 3: Foliage Condition

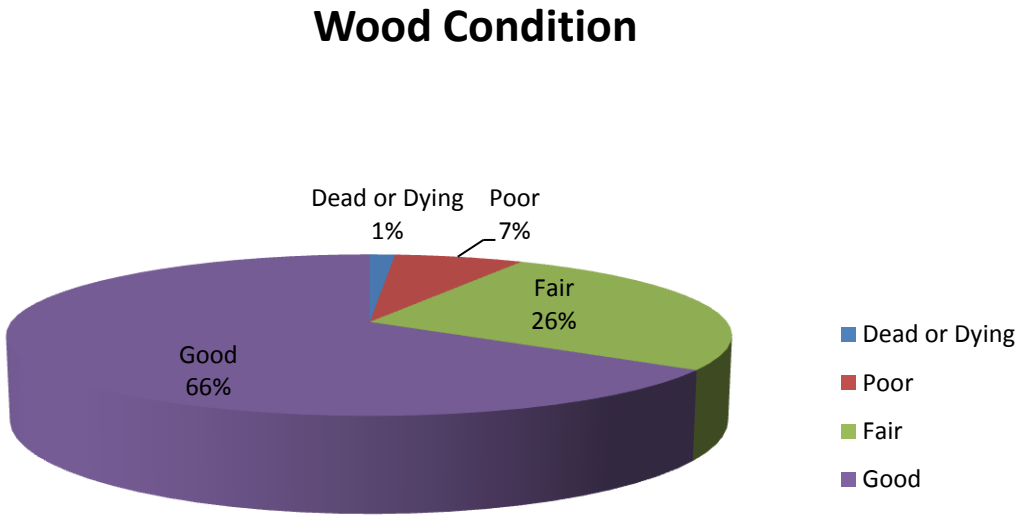

Figure 4: Wood Condition

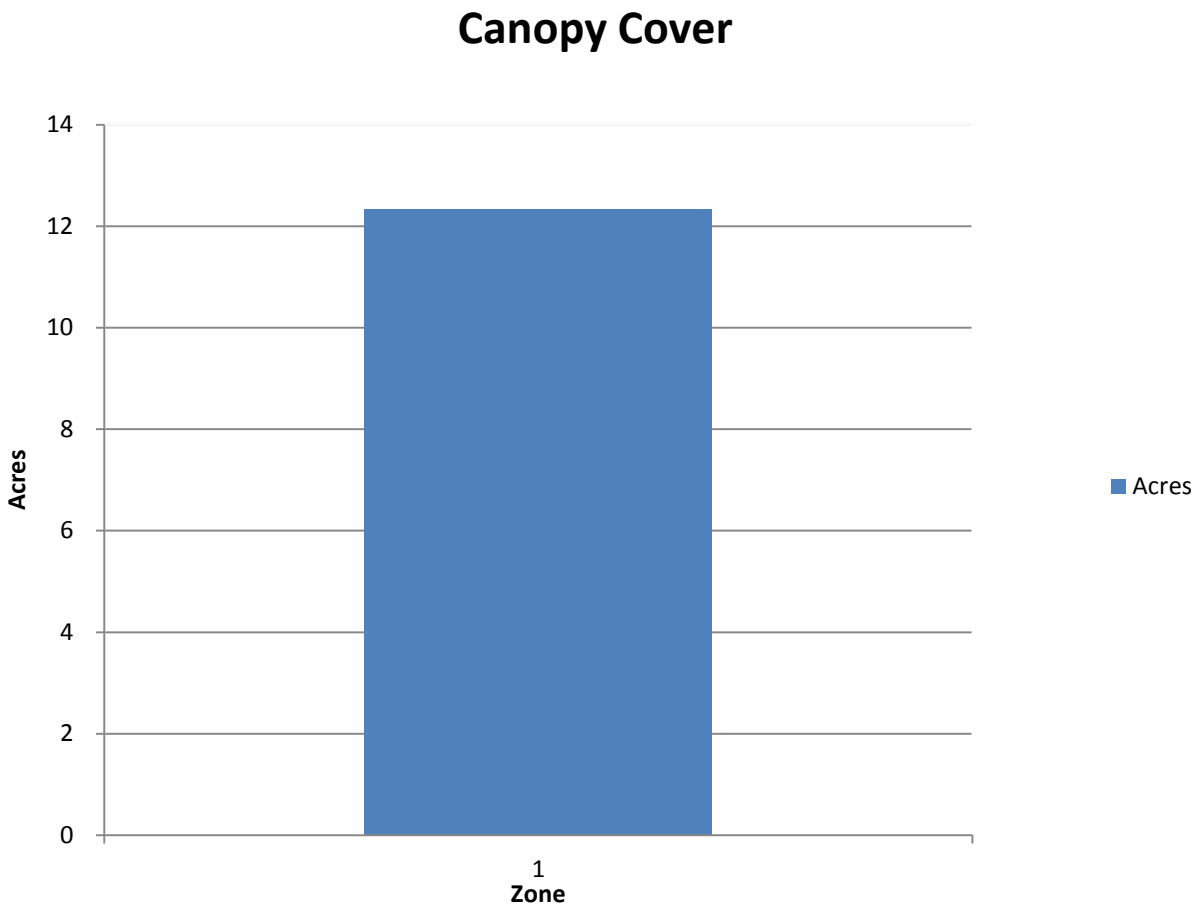

Figure 5: Canopy Cover in Acres

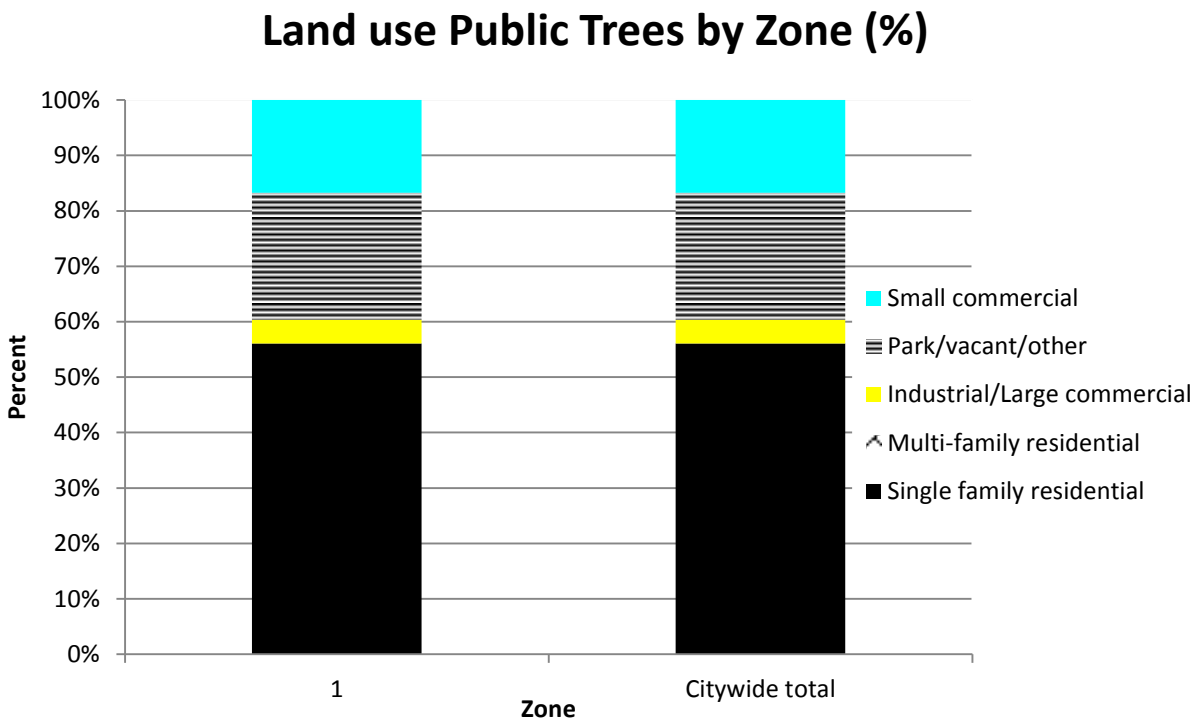

Figure 6: Land Use of city/park trees

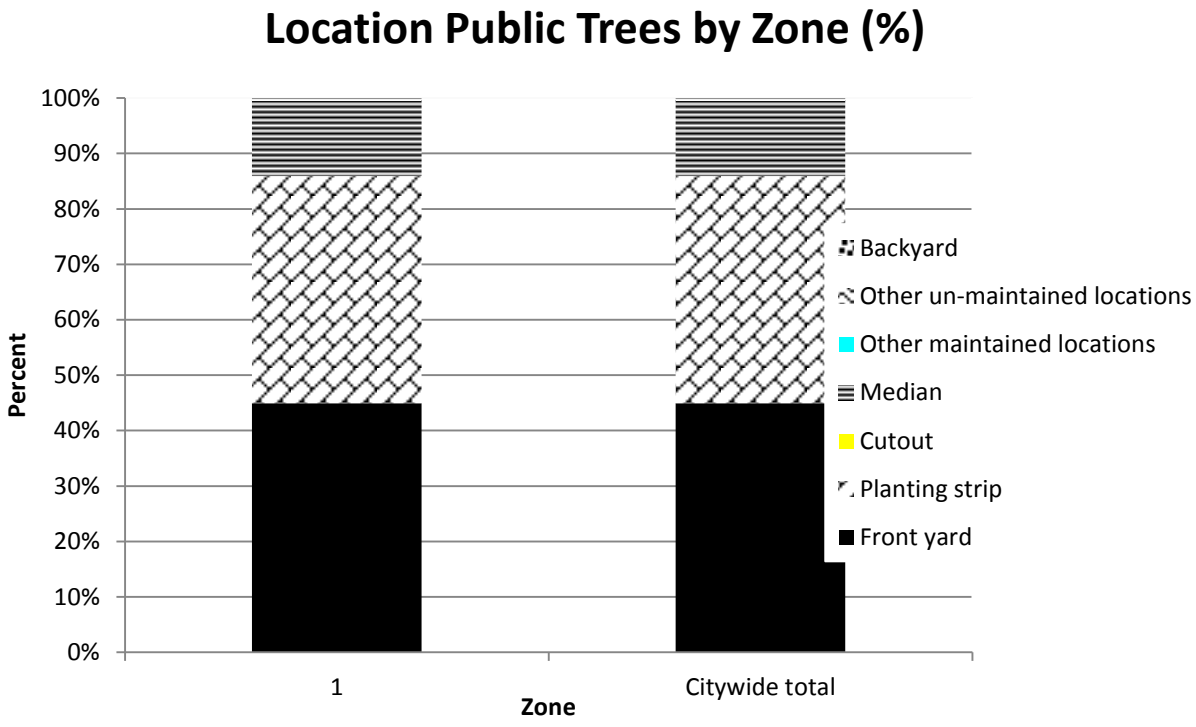

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

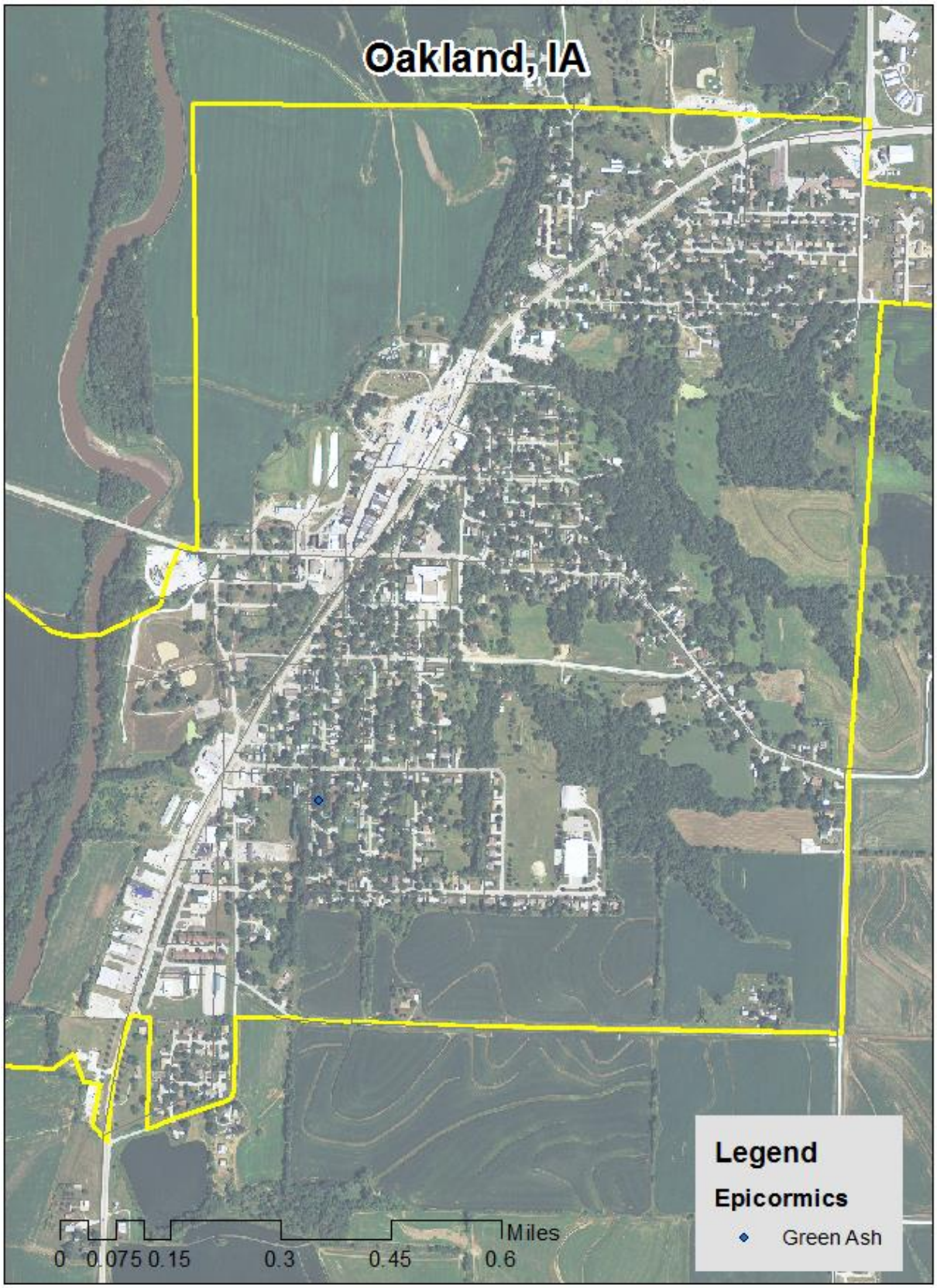

Figure 2: Location of EAB symptoms

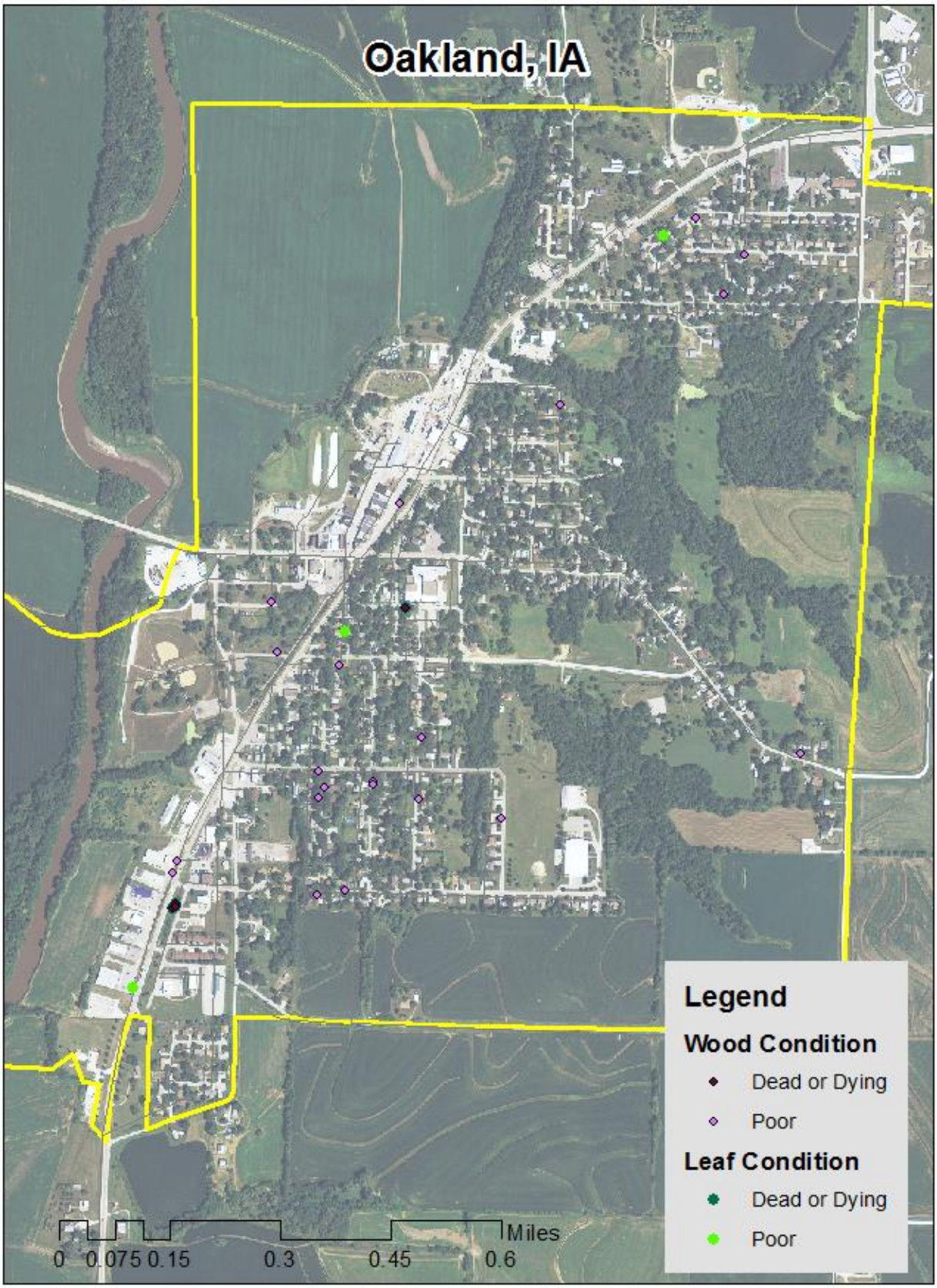

Figure 3: Location of Poor Condition Trees

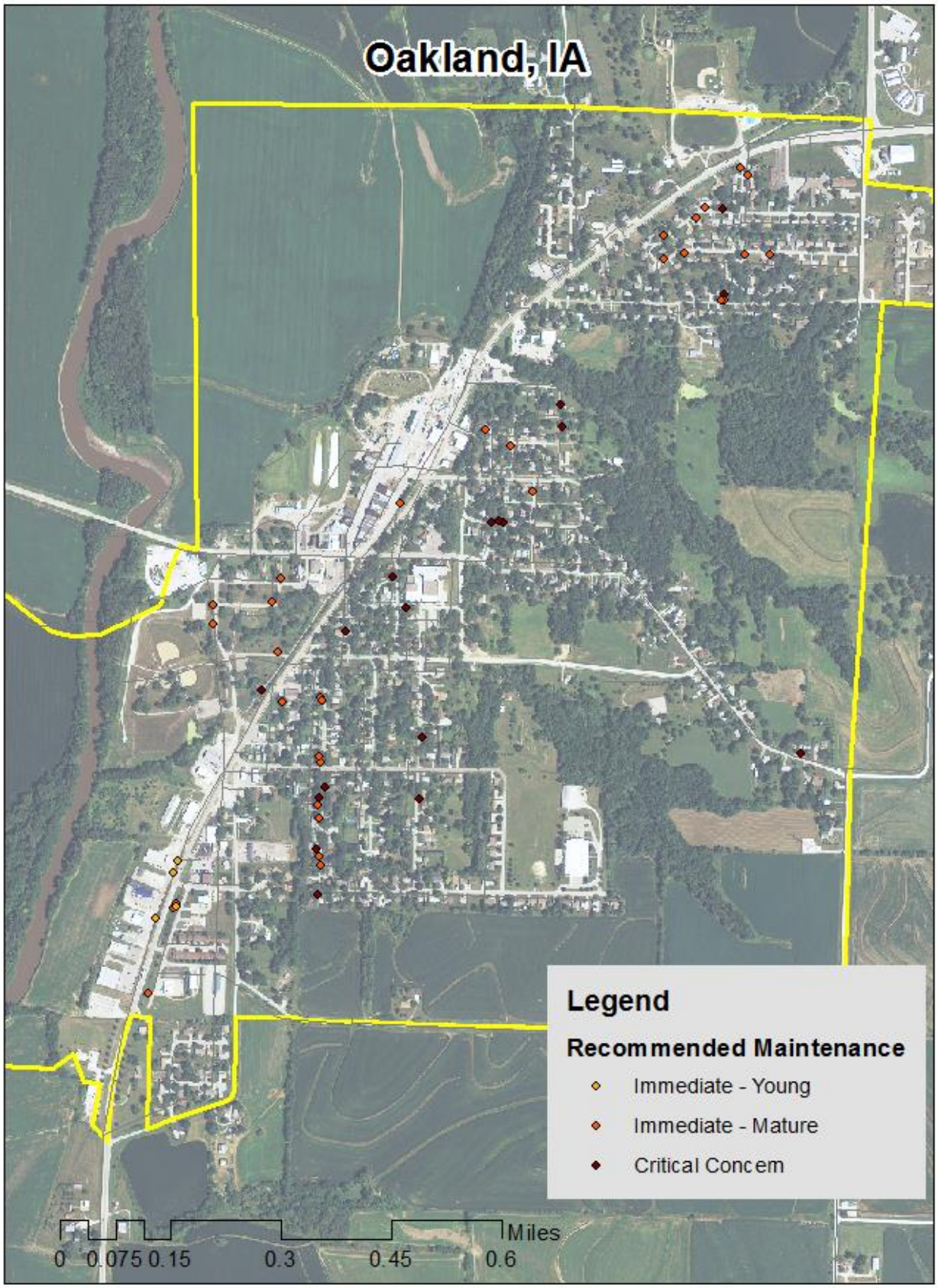

Figure 4: Location of Trees with Recommended Maintenance

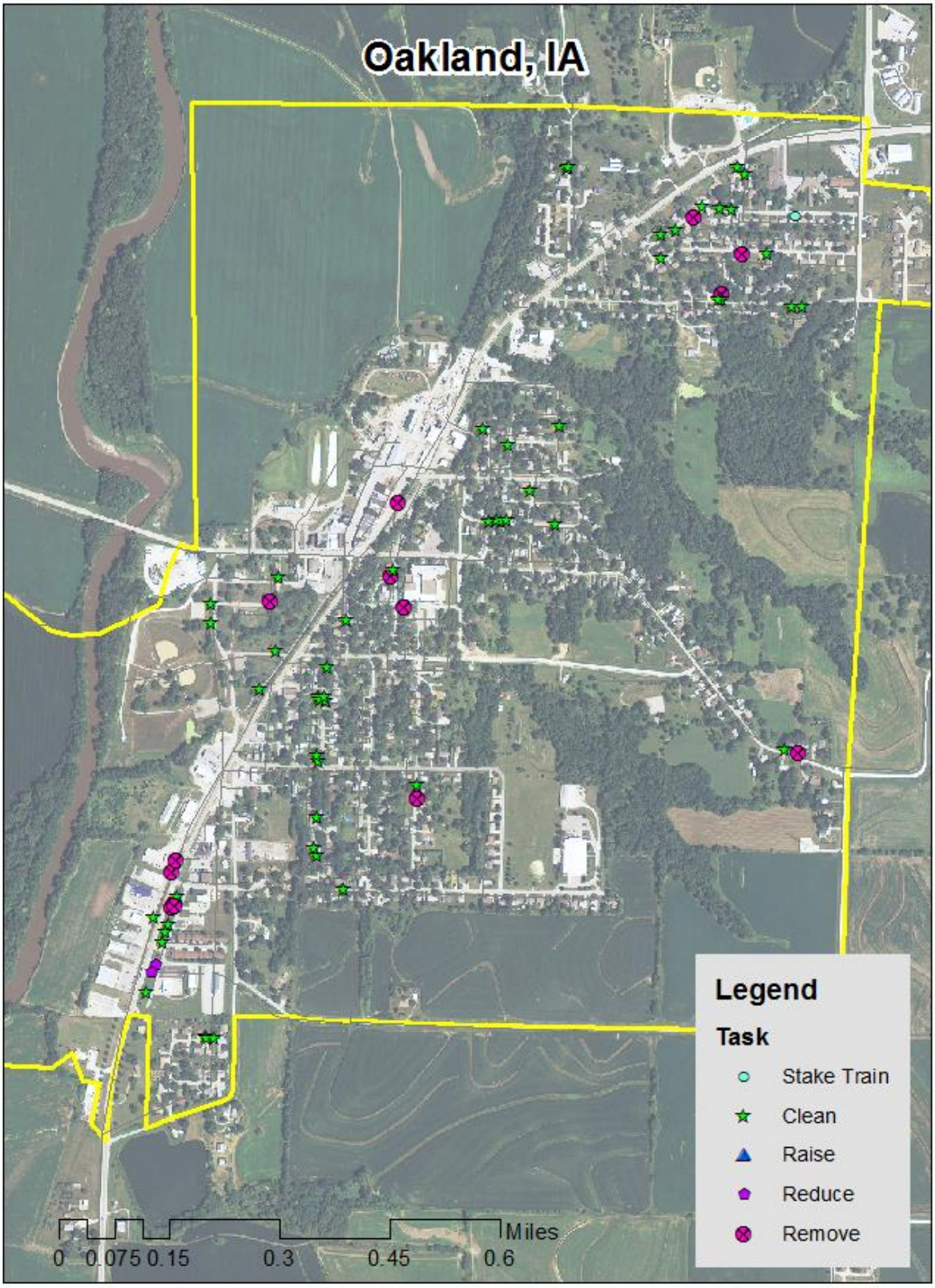

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Oakland Tree Ordinances

CHAPTER 151
TREES AND GRASS

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

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any boulevard or street except in accordance with the following:
1. Alignment. All tress planted in any street shall be planted in the boulevard midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.
2. Spacing. Trees shall not be planted on any boulevard which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.
3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least eighteen (18) feet above the surface of a street, twenty (20) feet above the surface of a primary highway, and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the
City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12[2c, d, & e])

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

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

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests, and such trees and shrubs shall be subject to removal as follows:
1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.
2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that 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.
(Code of Iowa, Sec. 364.12[3b & h])

151.07 CUTTING OR MOWING OF GRASS.
1. Duty to Cut and Mow Lawns and Lots. The owner of any property shall cut and mow all lawns and lots so that such growth shall be less than four (4) inches at all times.
2. Cutting and Mowing by City. If a property owner refuses or fails to cut and mow lawns and lots within forty-eight (48) hours after being delivered a notice from the City to perform such action, the Council may require said work to be done and the cost and expenses thereof shall be assessed to the property owner after due notice is given. The amount of such assessment shall be certified to the County Auditor as provided by law and the same shall be collected with and in the same manner as general property taxes.

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 Chuck Gipp at 515-281-5918.