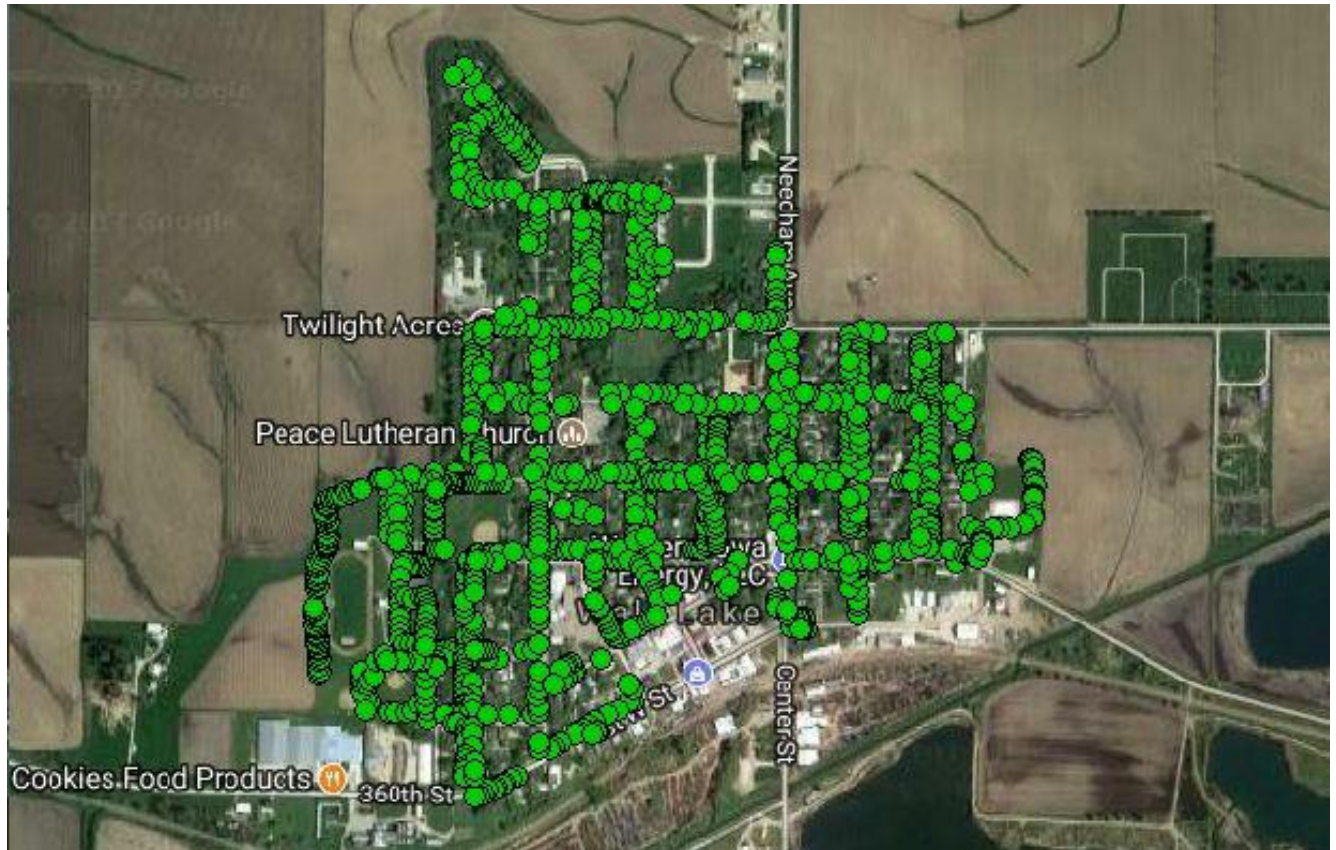


Community Tree Management Plan for Wall Lake, IA



2017 Urban Forest Management Plan
Prepared by ArborPro, Inc.
In Partnership with the Iowa DNR



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Executive Summary

Overview

This plan was developed to assist the City of Wall Lake 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 21.07% of Wall Lake's community, unless preventative treatment is used, will become infested and die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2017, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 1001 trees inventoried.

- Wall Lake's trees provide \$396,512 of benefits annually, an average of \$201.68 a tree
- There are over 41 species of trees
- The top three genera are: Maple 23.19%, Green Ash 21.46%, and Silver Maple 18.82%
- 75% of trees need some type of management or mitigation.
- 51 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 51 trees needing removal, 29 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*](#)
- 82 of the 211 ash trees should be carefully examined, as they present with some of the symptoms that could be related to an EAB infestation.
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: Ash, Maple, Cottonwood, Poplar, Box Elder, Bradford Pear, female Ginko, Chinese Elm, Scot's Pine, Austrian Pine, Willow or Black Walnut.
- Check ash trees with a visual survey yearly
- With the current budget it could take 43 years to remove ash – Suggestion: request a budget increase to \$20,000 annually and apply for grants to plant replacement trees

Introduction

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

Trees are an important component of Wall Lake'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, storm water 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 Wall Lake 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 Wall Lake's urban forestry goals.

Inventory

In 2017, a tree inventory was conducted that included 100% of the city owned street trees and park trees. The tree data was collected using a hand held Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 1001 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. Wall Lake's trees reduce energy related costs by approximately \$100,216 annually (Appendix A, Table 1). These savings are both in Electricity (479.58 MWh) and in Natural Gas (65,118.65 Therms).

Annual Stormwater Benefits

Wall Lake's trees intercept about 5,702,013.42 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$154,524.56 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 Wall Lake it is estimated that trees remove 6,296.40 lbs of air pollution (ozone (O₃), particulate matter less than 10 microns (PM₁₀), carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂)) per year with a net value of \$17,712.32 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Wall Lake, trees sequester about 1,262,581.38 lbs of carbon a year with an associated value of \$9,469.36 (Appendix A, Table 4). In addition, the trees store 22,069,959.64 lbs of carbon, with a yearly benefit of \$165,524.70 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Wall Lake receives \$109,379.25 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, Wall Lake's trees provide \$396,512 of benefits annually. Benefits of individual trees vary based on size, species, health

and location, but on average each of the 1001 trees in Wall Lake provide approximately \$201.68 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Wall Lake has over 44 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Green ash	211	21.07%
Silver maple	185	18.48%
Red maple	32	3.19%
Northern hackberry	35	3.49%
Pin oak	30	2.99%
Eastern cottonwood	18	1.79%
Northern red oak	9	0.89%
Sugar maple	9	0.89%
Black walnut	11	1.09%
American basswood	7	0.69%
Tulip tree	4	0.39%
American elm	2	0.19%
Black maple	2	0.19%
White oak	1	0.09%
American sycamore	1	0.09%
Kentucky coffeetree	1	0.09%
Bur oak	7	0.69%
Norway maple	203	20.79%
Littleleaf linden	19	1.89%
Swamp white oak	2	0.19%
River birch	2	0.19%
Siberian elm	2	0.19%
Apple/Crabapple	10	0.99%
Mulberry	1	0.09%
Eastern redbud	1	0.09%
Flowering dogwood	1	0.09%
Japanese tree lilac	1	0.09%
Norway spruce	1	0.09%
Blue spruce	105	10.48%
Austrian pine	21	2.09%

Age Class

Approximately one half (48.75%) of Wall Lake's trees are between 0 and 18 inches in diameter at 4.5 ft. (Appendix A, Figure 2). It is preferred that the highest number of trees are in the

smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Wall Lake's size curve is on the downward side, indicating a young to juvenile forest 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 Wall Lake indicate that 58.31% of the trees are in fair health, with 13.72% of the trees in good health, and only 27.96% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 73.35% of Wall Lake's trees are in fair health for wood condition, with 15.83% in good wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 10.81% of the population. This 10.81% is an estimate of trees that need management follow up.

Management Needs

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

Crown Cleaning	608	60.73%
Crown Raising	30	2.99%
Tree Staking	7	.69%
Tree Removal	51	5.09%
Crown Reduction	60	5.99%

Canopy Cover

The total canopy of public trees is 7.18%, of 787.20 acres. The canopy cover included in the Wall Lake inventory includes approximately 56.56 acres (Appendix A, Figure 4). The City's Canopy goal is 3%, in 30 years. To achieve this goal, it is estimated that 58 public and private trees need to be planted annually.

Land Use and Location

Much of Wall Lake's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure 7). The following describes the land use and locations for the street and park trees.

Land Use

Single family residential	73.65%
Park/vacant/other	22.08%
Industrial/Large commercial	0%
Small commercial	4.27%
Multifamily residential	0%

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

Wall Lake has 7 dead dying or 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 4 trees over 25 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six-year maintenance plan at the end of this section. After all the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There is a total of 705 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 51 removals, only 21 is an ash tree. There is a total of 211 ash trees, and 59 of those have signs and symptoms that have been associated with EAB. In addition, there are 22 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 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 removes 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 Wall Lake.

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 (47.65%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut. All trees planted must meet the restrictions in 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 decline 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 No Additional Funding: Will not meet 50 trees recommended for removal.

Year 1

Removal: 4 largest critical concern trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 3 critical concern trees and 4 additional ash trees with poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 6 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 5 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 6 trees to be planted in open locations and locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 5 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 7 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:

Visual Survey for signs and symptoms of EAB

Year 5

Removal: 5 trees - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment and/or future ash removal

Planting and Replacement: 9 trees to be planted in open locations and locations from previous removals

Young Tree Pruning & Maintenance:

Visual Survey for signs and symptoms of EAB

Year 6

Removal: 5 trees - removal of any new critical concern trees and ash in poor health

*Or saving for ash tree treatment and/or future ash removal

Planting and Replacement: 7 trees in open locations from previous removals

Routine trimming: Contract to trim 1/3 of the city trees

Young Tree Pruning & Maintenance:

Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: 18 ash trees removed (approximately 8.53% of ash). It will take approximately 43 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.

** To remove all ash trees within 10 years, the budget would need to be increased to \$30,000 a year. If the budget were increased by \$10,000 a year all ash could be removed in 15 years.

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

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. To stay ahead of this hard to detect

beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

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

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

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

Wood Disposal

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

Canopy Replacement

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

Postponed Work

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

Monitoring

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

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. An example of City Code could state “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.”

Budget

Current Budget

Total \$9,852 over 6 years (\$1,642/year)

FY 2018 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Watering & Maintenance: \$500

FY 2019 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$300

Watering & Maintenance: \$150

FY 2020 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Watering & Maintenance: \$300

FY 2021 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$300

Watering & Maintenance: \$150

FY 2022 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Watering & Maintenance: \$300

FY 2023 Budget

Removal: \$800

*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$300

Watering & Maintenance: \$150

*Reduction of ash over 6 years 18 ash trees removed (approximately 8.53% of ash). It will take approximately 43 years to remove all ash with the current budget

Purposed Budget Increase

EAB could potentially kill all ash trees in Wall Lake within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$30,000 a year. If the budget were increased by \$10,000 a year all ash could be removed within 15 years. Additionally, it is

recommended that Wall Lake apply for grants to fund replacement trees. Utility Company grants are usually between \$500 and \$10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating several selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at \$15 per inch, about 2 trees could be treated per year (every other year treatment). This would be 8 trees selected for treatment, and Wall Lake would still need to find \$8,000 for removal. Alternatively, if there are 20 treatable trees, it would cost approximately \$6000 a year for treatment and leave \$0 for removal. These are alternatives to straight removal of ash trees. However, whether the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Wall Lake. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Wall Lake

3/6/2018

Annual Energy Benefits of Public Trees by Species

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Norway maple	92.53	7,022.75	13,369.81	13,102.41	20,125.16	(N/A)	23.19	20.08	44.13
Green ash	112.67	8,551.36	15,085.28	14,783.58	23,334.94	(N/A)	21.46	23.28	55.30
Silver maple	133.67	10,145.88	17,573.97	17,222.49	27,368.38	(N/A)	18.82	27.31	73.97
Blue spruce	21.51	1,632.84	2,833.92	2,777.24	4,410.08	(N/A)	11.19	4.40	20.05
Red maple	16.37	1,242.22	2,197.95	2,153.99	3,396.21	(N/A)	5.24	3.39	32.97
Northern hackberry	30.28	2,298.01	4,170.90	4,087.48	6,385.50	(N/A)	3.56	6.37	91.22
Pin oak	20.59	1,562.63	2,750.01	2,695.01	4,257.64	(N/A)	3.05	4.25	70.96
Austrian pine	5.33	404.49	637.76	625.01	1,029.50	(N/A)	2.14	1.03	24.51
Littleleaf linden	7.29	553.49	1,048.63	1,027.65	1,581.14	(N/A)	1.93	1.58	41.61
Eastern cottonwood	11.01	835.86	1,570.37	1,538.97	2,374.82	(N/A)	1.83	2.37	65.97
Northern red oak	3.53	268.30	493.03	483.17	751.47	(N/A)	1.12	0.75	34.16
Sugar maple	5.12	388.68	698.84	684.86	1,073.54	(N/A)	0.92	1.07	59.64
Black walnut	5.08	385.41	710.01	695.81	1,081.21	(N/A)	0.81	1.08	67.58
American basswood	2.39	181.20	348.13	341.16	522.37	(N/A)	0.71	0.52	37.31
Broadleaf Deciduous Medium	0.10	7.79	17.13	16.79	24.58	(N/A)	0.41	0.02	3.07
Apple	0.40	30.63	60.04	58.84	89.47	(N/A)	0.41	0.09	11.18
Tulip tree	0.98	74.37	128.08	125.52	199.88	(N/A)	0.31	0.20	33.31
Honeylocust	2.02	153.43	256.35	251.22	404.65	(N/A)	0.31	0.40	67.44
Broadleaf Deciduous Large	0.01	0.99	2.33	2.28	3.28	(N/A)	0.25	0.00	0.66
Swamp white oak	0.02	1.30	3.17	3.10	4.41	(N/A)	0.20	0.00	1.10
River birch	0.68	51.66	92.69	90.84	142.50	(N/A)	0.20	0.14	35.62
Siberian elm	1.68	127.72	223.05	218.59	346.31	(N/A)	0.20	0.35	86.58
American elm	2.09	158.32	264.55	259.26	417.58	(N/A)	0.20	0.42	104.40
Black maple	1.08	82.16	139.91	137.11	219.27	(N/A)	0.20	0.22	54.82
Broadleaf Deciduous Small	0.40	30.30	63.25	61.98	92.28	(N/A)	0.10	0.09	46.14
Oak	0.01	0.40	0.93	0.91	1.31	(N/A)	0.10	0.00	0.66
Maple	0.51	38.99	60.11	58.91	97.90	(N/A)	0.10	0.10	48.95
Mulberry	0.40	30.30	63.25	61.98	92.28	(N/A)	0.10	0.09	46.14
White oak	0.19	14.37	27.46	26.91	41.27	(N/A)	0.10	0.04	20.64
Flowering dogwood	0.01	0.51	1.25	1.22	1.73	(N/A)	0.10	0.00	0.87
Birch	0.64	48.74	94.83	92.94	141.68	(N/A)	0.10	0.14	70.84
Eastern redbud	0.01	0.51	1.25	1.22	1.73	(N/A)	0.10	0.00	0.87
Kentucky coffeetree	0.01	0.40	0.93	0.91	1.31	(N/A)	0.10	0.00	0.66
American sycamore	0.06	4.40	7.38	7.23	11.64	(N/A)	0.10	0.01	5.82
Norway spruce	0.26	19.59	29.26	28.68	48.27	(N/A)	0.10	0.05	24.14
Japanese tree lilac	0.01	0.51	1.25	1.22	1.73	(N/A)	0.10	0.00	0.87
Cottonwood	0.39	29.41	53.68	52.60	82.02	(N/A)	0.05	0.08	82.02
Bur oak	0.26	19.97	38.11	37.35	57.32	(N/A)	0.05	0.06	57.32
Total	479.58	36,399.87	65,118.85	63,816.47	100,216.34	(N/A)	100.00	100.00	50.97

Annual Energy Benefits of Public Trees by Zone

Zone	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/Tree
1	479.58	36,399.87	65,118.85	63,816.47	100,216.34	(N/A)	100.00	100.00	50.97
Total	479.58	36,399.87	65,118.85	63,816.47	100,216.34	(N/A)	100.00	100.00	50.97

Table 2: Annual Storm Water Benefits

Wall Lake

3/6/2018

Annual Stormwater Benefits of Public Trees by Species

Species	Total Rainfall Interception (Gal)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Norway maple	831,482.57	22,533.18	(N/A)	23.19	14.58	49.41
Green ash	1,220,375.54	33,072.18	(N/A)	21.46	21.40	78.37
Silver maple	2,067,237.62	56,022.14	(N/A)	18.82	36.25	151.41
Blue spruce	262,744.22	7,120.37	(N/A)	11.19	4.61	32.37
Red maple	129,845.02	3,518.80	(N/A)	5.24	2.28	34.16
Northern hackberry	363,706.79	9,856.45	(N/A)	3.56	6.38	140.81
Pin oak	252,971.27	6,855.52	(N/A)	3.05	4.44	114.26
Austrian pine	64,861.57	1,757.75	(N/A)	2.14	1.14	41.85
Littleleaf linden	78,229.15	2,120.01	(N/A)	1.93	1.37	55.79
Eastern cottonwood	126,890.89	3,438.74	(N/A)	1.83	2.23	95.52
Northern red oak	38,902.03	1,054.25	(N/A)	1.12	0.68	47.92
Sugar maple	57,377.43	1,554.93	(N/A)	0.92	1.01	86.38
Black walnut	58,132.45	1,575.39	(N/A)	0.81	1.02	98.46
American basswood	30,087.71	815.38	(N/A)	0.71	0.53	58.24
Broadleaf Deciduous Medi	398.64	10.80	(N/A)	0.41	0.01	1.35
Apple	1,885.26	51.09	(N/A)	0.41	0.03	6.39
Tulip tree	14,549.38	394.29	(N/A)	0.31	0.26	65.71
Honeylocust	21,852.89	592.21	(N/A)	0.31	0.38	98.70
Broadleaf Deciduous Large	89.42	2.42	(N/A)	0.25	0.00	0.48
Swamp white oak	48.82	1.32	(N/A)	0.20	0.00	0.33
River birch	3,990.11	108.13	(N/A)	0.20	0.07	27.03
Siberian elm	20,942.30	567.54	(N/A)	0.20	0.37	141.88
American elm	18,204.41	493.34	(N/A)	0.20	0.32	123.33
Black maple	8,941.70	242.32	(N/A)	0.20	0.16	60.58
Broadleaf Deciduous Small	2,348.07	63.63	(N/A)	0.10	0.04	31.82
Oak	35.77	0.97	(N/A)	0.10	0.00	0.48
Maple	3,207.74	86.93	(N/A)	0.10	0.06	43.46
Mulberry	2,348.07	63.63	(N/A)	0.10	0.04	31.82
White oak	1,215.72	32.95	(N/A)	0.10	0.02	16.47
Flowering dogwood	14.90	0.40	(N/A)	0.10	0.00	0.20
Birch	7,528.69	204.03	(N/A)	0.10	0.13	102.01
Eastern redbud	14.90	0.40	(N/A)	0.10	0.00	0.20
Kentucky coffeetree	35.77	0.97	(N/A)	0.10	0.00	0.48
American sycamore	343.27	9.30	(N/A)	0.10	0.01	4.65
Norway spruce	3,077.23	83.39	(N/A)	0.10	0.05	41.70
Japanese tree lilac	14.90	0.40	(N/A)	0.10	0.00	0.20
Cottonwood	5,490.53	148.79	(N/A)	0.05	0.10	148.79
Bur oak	2,590.68	70.21	(N/A)	0.05	0.05	70.21
Citywide total	5,702,013.42	154,524.56	(N/A)	100.00	100.00	78.60

Annual Stormwater Benefits of Public Trees by Zone

Zone	Total rainfall interception(Gal)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
1	5,702,013.42	154,524.56	(N/A)	100.00	100.00	78.60
Citywide total	5,702,013.42	154,524.56	(N/A)	100.00	100.00	78.60

Table 3: Annual Air Quality Benefits

Wall Lake

3/6/2018

Annual Air Quality Benefits of Public Trees by Species

Species	Total					Avoided					Total	BVOC	BVOC	% of Total		
	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Deposition n (\$)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Avoided (\$)	Total Emissions (lb)	BVOC Emissions (\$)	BVOC Emissions (\$)	Standard Error	Tree Numbers	Avg. \$/tree
Norway maple	165.90	28.61	82.34	7.35	898.65	448.85	64.87	61.74	419.83	2,779.77	-39.34	-147.51	1,240.15	3,530.91	(N/A)	7.74
Green ash	157.69	25.22	75.06	7.07	838.68	534.93	78.10	74.52	510.63	3,339.83	0.00	0.00	1,463.23	4,178.51	(N/A)	9.90
Silver maple	380.47	64.48	184.29	16.87	2,044.29	629.95	92.23	88.05	604.58	3,941.58	-197.07	-739.02	1,863.85	5,246.84	(N/A)	14.18
Blue spruce	30.71	6.09	26.79	3.77	206.76	101.43	14.85	14.18	97.39	634.76	-91.17	-341.87	204.05	499.65	(N/A)	2.27
Red maple	29.57	5.04	14.00	1.31	158.05	77.66	11.34	10.82	74.14	484.88	-10.11	-37.91	213.77	605.03	(N/A)	5.87
Northern hackberry	69.96	12.10	33.88	3.13	376.77	145.04	21.09	20.10	137.28	902.48	0.00	0.00	442.58	1,279.25	(N/A)	18.28
Pin oak	47.23	8.27	23.81	2.13	257.38	97.58	14.25	13.60	93.23	609.45	-86.71	-325.18	213.39	541.65	(N/A)	9.03
Austrian pine	8.04	1.60	6.78	0.99	53.49	24.56	3.64	3.48	24.13	155.13	-23.27	-87.26	49.95	121.36	(N/A)	2.89
Littleleaf linden	13.72	2.37	6.73	0.61	74.10	35.32	5.11	4.86	33.09	218.90	-6.56	-24.60	95.26	268.40	(N/A)	7.06
Eastern cottonwood	15.48	2.48	7.42	0.69	82.46	53.14	7.70	7.33	49.91	329.65	0.00	0.00	144.14	412.11	(N/A)	11.45
Northern red oak	8.50	1.47	4.08	0.38	45.63	16.94	2.46	2.35	16.01	105.34	-12.26	-45.96	39.92	105.01	(N/A)	4.77
Sugar maple	7.54	1.28	3.75	0.33	40.79	24.40	3.56	3.39	23.19	152.08	-5.90	-22.14	61.54	170.74	(N/A)	9.49
Black walnut	7.14	1.14	3.39	0.32	37.97	24.38	3.54	3.37	23.01	151.53	0.00	0.00	66.30	189.50	(N/A)	11.84
American basswood	4.43	0.75	2.12	0.20	23.75	11.61	1.68	1.59	10.83	71.82	-3.68	-13.81	29.53	81.76	(N/A)	5.84
Broadleaf Deciduous Medium	0.01	0.00	0.02	0.00	0.11	0.52	0.07	0.07	0.47	3.17	-0.01	-0.03	1.16	3.24	(N/A)	0.41
Apple	0.64	0.11	0.29	0.03	3.39	1.97	0.28	0.27	1.83	12.16	0.00	-0.01	5.42	15.54	(N/A)	1.94
Tulip tree	3.17	0.51	1.38	0.14	16.49	4.63	0.68	0.65	4.44	28.94	0.00	0.00	15.59	45.43	(N/A)	7.57
Honeylocust	4.27	0.70	1.94	0.19	22.51	9.45	1.39	1.33	9.15	59.33	-3.35	-12.55	25.08	69.30	(N/A)	11.55
Broadleaf Deciduous Large	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.01	0.06	0.41	0.00	0.00	0.15	0.41	(N/A)	0.08
Swamp white oak	0.00	0.00	0.00	0.00	0.01	0.09	0.01	0.01	0.08	0.54	0.00	0.00	0.19	0.55	(N/A)	0.14
River birch	0.55	0.09	0.31	0.02	3.08	3.25	0.47	0.45	3.09	20.27	-0.15	-0.58	8.09	22.77	(N/A)	5.69
Siberian elm	4.07	0.69	1.91	0.18	21.73	7.96	1.16	1.11	7.62	49.77	0.00	0.00	24.72	71.50	(N/A)	17.88
American elm	6.29	1.07	2.92	0.28	33.46	9.78	1.44	1.37	9.45	61.36	0.00	0.00	32.60	94.81	(N/A)	23.70
Black maple	2.14	0.37	1.00	0.09	11.40	5.09	0.75	0.71	4.90	31.90	-0.72	-2.71	14.33	40.59	(N/A)	10.15
Broadleaf Deciduous Small	0.87	0.14	0.39	0.04	4.57	1.98	0.28	0.27	1.81	12.15	0.00	-0.02	5.77	16.69	(N/A)	8.35
Oak	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.16	0.00	0.00	0.06	0.17	(N/A)	0.08
Maple	0.64	0.11	0.31	0.03	3.46	2.36	0.35	0.34	2.33	14.94	-0.24	-0.89	6.23	17.51	(N/A)	8.75
Mulberry	0.87	0.14	0.39	0.04	4.57	1.98	0.28	0.27	1.81	12.15	0.00	-0.02	5.77	16.69	(N/A)	8.35
White oak	0.05	0.01	0.04	0.00	0.31	0.92	0.13	0.13	0.86	5.67	0.00	0.00	2.13	5.99	(N/A)	2.99
Flowering dogwood	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.03	0.21	0.00	0.00	0.08	0.21	(N/A)	0.11
Birch	1.73	0.30	0.82	0.08	9.27	3.13	0.45	0.43	2.91	19.36	-0.39	-1.46	9.46	27.16	(N/A)	13.58
Eastern redbud	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.03	0.21	0.00	0.00	0.08	0.21	(N/A)	0.11
Kentucky coffeetree	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.16	0.00	0.00	0.06	0.17	(N/A)	0.08
American sycamore	0.00	0.00	0.01	0.00	0.04	0.27	0.04	0.04	0.26	1.70	0.00	0.00	0.62	1.74	(N/A)	0.87
Norway spruce	0.34	0.07	0.29	0.04	2.27	1.18	0.18	0.17	1.17	7.46	-1.09	-4.09	2.34	5.64	(N/A)	2.82
Japanese tree lilac	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.03	0.21	0.00	0.00	0.08	0.21	(N/A)	0.11
Cottonwood	0.79	0.13	0.36	0.04	4.16	1.86	0.27	0.26	1.76	11.55	0.00	0.00	5.45	15.71	(N/A)	15.71
Bur oak	0.27	0.04	0.14	0.01	1.44	1.27	0.18	0.18	1.19	7.90	0.00	0.00	3.28	9.34	(N/A)	9.34
Citywide Total	973.09	165.39	486.98	46.36	5,281.06	2,283.69	332.87	317.45	2,172.59	14,238.87	-482.03	-1,807.61	6,296.40	17,712.32	(N/A)	9.01

Annual Air Quality Benefits of Public Trees by Zone

Species	Total					Avoided					Total	BVOC	BVOC	% of Total		
	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Deposition n (\$)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Avoided (\$)	Total Emissions (lb)	BVOC Emissions (\$)	BVOC Emissions (\$)	Standard Error	Tree Numbers	Avg. \$/tree
1	973.09	165.39	486.98	46.36	5,281.06	2,283.69	332.87	317.45	2,172.59	14,238.87	-482.03	-1,807.61	6,296.40	17,712.32	(N/A)	9.01
Citywide Total	973.09	165.39	486.98	46.36	5,281.06	2,283.69	332.87	317.45	2,172.59	14,238.87	-482.03	-1,807.61	6,296.40	17,712.32	(N/A)	9.01

Table 4: Annual Carbon Stored

Wall Lake

3/6/2018

Stored CO2 Benefits of Public Trees by Species

Species	Total stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Norway maple	2,763,102.60	20,723.27	(N/A)	23.19	12.52	45.45
Green ash	5,230,122.39	39,225.92	(N/A)	21.46	23.70	92.95
Silver maple	8,985,424.72	67,390.69	(N/A)	18.82	40.71	182.14
Blue spruce	172,980.14	1,297.35	(N/A)	11.19	0.78	5.90
Red maple	326,151.71	2,446.14	(N/A)	5.24	1.48	23.75
Northern hackberry	1,148,408.70	8,613.07	(N/A)	3.56	5.20	123.04
Pin oak	1,271,260.64	9,534.45	(N/A)	3.05	5.76	158.91
Austrian pine	46,965.87	352.24	(N/A)	2.14	0.21	8.39
Littleleaf linden	293,166.61	2,198.75	(N/A)	1.93	1.33	57.86
Eastern cottonwood	497,170.33	3,728.78	(N/A)	1.83	2.25	103.58
Northern red oak	190,157.70	1,426.18	(N/A)	1.12	0.86	64.83
Sugar maple	213,753.30	1,603.15	(N/A)	0.92	0.97	89.06
Black walnut	228,162.34	1,711.22	(N/A)	0.81	1.03	106.95
American basswood	170,709.47	1,280.32	(N/A)	0.71	0.77	91.45
Broadleaf Deciduous Medi	537.96	4.03	(N/A)	0.41	0.00	0.50
Apple	9,862.58	73.97	(N/A)	0.41	0.04	9.25
Tulip tree	112,012.63	840.09	(N/A)	0.31	0.51	140.02
Honeylocust	55,053.68	412.90	(N/A)	0.31	0.25	68.82
Broadleaf Deciduous Large	60.82	0.46	(N/A)	0.25	0.00	0.09
Swamp white oak	67.35	0.51	(N/A)	0.20	0.00	0.13
River birch	9,449.66	70.87	(N/A)	0.20	0.04	17.72
Siberian elm	98,162.24	736.22	(N/A)	0.20	0.44	184.05
American elm	121,985.20	914.89	(N/A)	0.20	0.55	228.72
Black maple	23,138.89	173.54	(N/A)	0.20	0.10	43.39
Broadleaf Deciduous Small	13,485.43	101.14	(N/A)	0.10	0.06	50.57
Oak	24.33	0.18	(N/A)	0.10	0.00	0.09
Maple	7,248.32	54.36	(N/A)	0.10	0.03	27.18
Mulberry	13,485.43	101.14	(N/A)	0.10	0.06	50.57
White oak	2,069.06	15.52	(N/A)	0.10	0.01	7.76
Flowering dogwood	27.57	0.21	(N/A)	0.10	0.00	0.10
Birch	28,560.29	214.20	(N/A)	0.10	0.13	107.10
Eastern redbud	27.57	0.21	(N/A)	0.10	0.00	0.10
Kentucky coffeetree	24.33	0.18	(N/A)	0.10	0.00	0.09
American sycamore	370.92	2.78	(N/A)	0.10	0.00	1.39
Norway spruce	2,340.46	17.55	(N/A)	0.10	0.01	8.78
Japanese tree lilac	27.57	0.21	(N/A)	0.10	0.00	0.10
Cottonwood	25,943.15	194.57	(N/A)	0.05	0.12	194.57
Bur oak	8,457.68	63.43	(N/A)	0.05	0.04	63.43
Citywide total	22,069,959.64	165,524.70	(N/A)	100.00	100.00	84.19

Stored CO2 Benefits of Public Trees by Zone

Zone	Total stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
1	22,069,959.64	165,524.70	(N/A)	100.00	100.00	84.19
Citywide total	22,069,959.64	165,524.70	(N/A)	100.00	100.00	84.19

Table 5: Annual Carbon Sequestered

Wall Lake

3/6/2018

Annual CO2 Benefits of Public Trees by Species

Species	Sequestered (lb)	Sequestered (\$)	Total				Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	% of Total		
			Decomposition Release (lb)	Maintenance Release (lb)	Release (\$)	Standard Error					Tree Numbers	% of Total \$	Avg. \$/tree
Norway maple	129,363.71	970.23	- 13,278.17	- 975.79	- 106.90	155,200.85	1,164.01	270,310.60	2,027.33	(N/A)	23.19	13.82	4.45
Green ash	250,099.40	1,875.75	- 25,104.67	- 1,169.23	- 197.05	188,982.78	1,417.37	412,808.28	3,096.06	(N/A)	21.46	21.11	7.34
Silver maple	614,042.14	4,605.32	- 43,132.94	- 1,539.34	- 335.04	224,221.32	1,681.66	793,591.17	5,951.93	(N/A)	18.82	40.58	16.09
Blue spruce	14,946.16	112.10	- 830.30	- 352.56	- 8.87	36,085.24	270.64	49,848.54	373.86	(N/A)	11.19	2.55	1.70
Red maple	18,069.36	135.52	- 1,566.50	- 154.83	- 12.91	27,452.83	205.90	43,800.86	328.51	(N/A)	5.24	2.24	3.19
Northern hackberry	42,484.47	318.63	- 5,512.80	- 310.05	- 43.67	50,785.52	380.89	87,447.13	655.85	(N/A)	3.56	4.47	9.37
Pin oak	86,771.63	650.79	- 6,102.21	- 225.42	- 47.46	34,533.77	259.00	114,977.77	862.33	(N/A)	3.05	5.88	14.37
Austrian pine	3,809.68	28.57	- 225.44	- 81.90	- 2.31	8,939.18	67.04	12,441.52	93.31	(N/A)	2.14	0.64	2.22
Littleleaf linden	21,028.00	157.71	- 1,409.59	- 92.04	- 11.26	12,231.97	91.74	31,758.34	238.19	(N/A)	1.93	1.62	6.27
Eastern cottonwood	27,914.48	209.36	- 2,386.42	- 117.00	- 18.78	18,472.17	138.54	43,883.23	329.12	(N/A)	1.83	2.24	9.14
Northern red oak	2,081.37	15.61	- 913.08	- 47.58	- 7.20	5,929.27	44.47	7,049.99	52.87	(N/A)	1.12	0.36	2.40
Sugar maple	11,545.13	86.59	- 1,026.02	- 55.38	- 8.11	8,589.68	64.42	19,053.42	142.90	(N/A)	0.92	0.97	7.94
Black walnut	12,886.91	96.65	- 1,095.18	- 53.04	- 8.61	8,517.37	63.88	20,256.06	151.92	(N/A)	0.81	1.04	9.50
American basswood	9,226.90	69.20	- 819.49	- 30.81	- 6.38	4,004.53	30.03	12,381.13	92.86	(N/A)	0.71	0.63	6.63
Broadleaf Deciduous Medium	223.74	1.68	- 4.30	- 2.34	- 0.05	172.18	1.29	389.28	2.92	(N/A)	0.41	0.02	0.36
Apple	798.19	5.99	- 47.61	- 5.85	- 0.40	676.94	5.08	1,421.68	10.66	(N/A)	0.41	0.07	1.33
Tulip tree	968.10	7.26	- 537.82	- 12.48	- 4.13	1,643.46	12.33	2,061.27	15.46	(N/A)	0.31	0.11	2.58
Honeylocust	3,920.09	29.40	- 264.26	- 14.82	- 2.09	3,390.66	25.43	7,031.67	52.74	(N/A)	0.31	0.36	8.79
Broadleaf Deciduous Large	12.97	0.10	- 0.49	- 0.98	- 0.01	21.98	0.16	33.48	0.25	(N/A)	0.25	0.00	0.05
Swamp white oak	21.68	0.16	- 0.54	- 0.78	- 0.01	28.76	0.22	49.12	0.37	(N/A)	0.20	0.00	0.09
River birch	1,219.79	9.15	- 45.36	- 6.24	- 0.39	1,141.73	8.56	2,309.92	17.32	(N/A)	0.20	0.12	4.33
Siberian elm	3,414.87	25.61	- 471.18	- 18.72	- 3.67	2,822.47	21.17	5,747.44	43.11	(N/A)	0.20	0.29	10.78
American elm	2,580.92	19.36	- 585.53	- 20.28	- 4.54	3,498.79	26.24	5,473.90	41.05	(N/A)	0.20	0.28	10.26
Black maple	966.40	7.25	- 111.07	- 9.36	- 0.90	1,815.62	13.62	2,661.60	19.96	(N/A)	0.20	0.14	4.99
Broadleaf Deciduous Small	0.00	0.00	- 64.73	- 7.02	- 0.54	669.55	5.02	597.80	4.48	(N/A)	0.10	0.03	2.24
Oak	5.19	0.04	- 0.19	- 0.39	0.00	8.79	0.07	13.39	0.10	(N/A)	0.10	0.00	0.05
Maple	966.40	7.25	- 34.79	- 3.90	- 0.29	861.69	6.46	1,789.41	13.42	(N/A)	0.10	0.09	6.71
Mulberry	0.00	0.00	- 64.73	- 7.02	- 0.54	669.55	5.02	597.80	4.48	(N/A)	0.10	0.03	2.24
White oak	417.59	3.13	- 9.93	- 2.34	- 0.09	317.50	2.38	722.82	5.42	(N/A)	0.10	0.04	2.71
Flowering dogwood	17.37	0.13	- 0.22	- 0.39	0.00	11.23	0.08	27.98	0.21	(N/A)	0.10	0.00	0.10
Birch	740.09	5.55	- 137.09	- 7.02	- 1.08	1,077.18	8.08	1,673.16	12.55	(N/A)	0.10	0.09	6.27
Eastern redbud	17.37	0.13	- 0.22	- 0.39	0.00	11.23	0.08	27.98	0.21	(N/A)	0.10	0.00	0.10
Kentucky coffeetree	5.19	0.04	- 0.19	- 0.39	0.00	8.79	0.07	13.39	0.10	(N/A)	0.10	0.00	0.05
American sycamore	148.36	1.11	- 1.78	- 1.17	- 0.02	97.28	0.73	242.69	1.82	(N/A)	0.10	0.01	0.91
Norway spruce	231.09	1.73	- 11.23	- 3.90	- 0.11	432.98	3.25	648.94	4.87	(N/A)	0.10	0.03	2.43
Japanese tree lilac	17.37	0.13	- 0.22	- 0.39	0.00	11.23	0.08	27.98	0.21	(N/A)	0.10	0.00	0.10
Cottonwood	959.59	7.20	- 124.53	- 4.29	- 0.97	650.03	4.88	1,480.80	11.11	(N/A)	0.05	0.08	11.11
Bur oak	659.69	4.95	- 40.60	- 2.73	- 0.32	441.38	3.31	1,057.75	7.93	(N/A)	0.05	0.05	7.93
Citywide Total	1,262,581.38	9,469.36	- 105,961.40	- 5,338.17	- 834.75	804,427.49	6,033.21	1,955,709.29	14,667.82	(N/A)	100.00	100.00	7.46

Annual CO2 Benefits of Public Trees by Zone

Zone	Sequestered (lb)	Sequestered (\$)	Total					% of Total					
			Decomposition Release (lb)	Maintenance Release (lb)	Release (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	Standard Error	Tree Numbers	% of Total Avg. \$/tree	
1	1,262,581.38	9,469.36	- 105,961.40	- 5,338.17	- 834.75	804,427.49	6,033.21	1,955,709.29	14,667.82	(N/A)	100.00	100.00	7.46
Citywide Total	1,262,581.38	9,469.36	- 105,961.40	- 5,338.17	- 834.75	804,427.49	6,033.21	1,955,709.29	14,667.82	(N/A)	100.00	100.00	7.46

Table 6: Annual Social and Aesthetic Benefits**Wall Lake****3/6/2018****Annual Aesthetic/Other Benefit of Public Trees by Species**

Species	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Norway maple	12,891.58	(N/A)	23.19	11.78	28.27
Green ash	21,206.00	(N/A)	21.46	19.39	50.25
Silver maple	45,300.60	(N/A)	18.82	41.41	122.43
Blue spruce	5,038.48	(N/A)	11.19	4.61	22.90
Red maple	2,579.05	(N/A)	5.24	2.36	25.04
Northern hackberry	4,947.79	(N/A)	3.56	4.52	70.68
Pin oak	6,506.32	(N/A)	3.05	5.95	108.44
Austrian pine	1,059.55	(N/A)	2.14	0.97	25.23
Littleleaf linden	2,171.43	(N/A)	1.93	1.99	57.14
Eastern cottonwood	2,225.07	(N/A)	1.83	2.03	61.81
Northern red oak	155.86	(N/A)	1.12	0.14	7.08
Sugar maple	1,197.20	(N/A)	0.92	1.09	66.51
Black walnut	1,009.99	(N/A)	0.81	0.92	63.12
American basswood	632.34	(N/A)	0.71	0.58	45.17
Broadleaf Deciduous Medium	42.19	(N/A)	0.41	0.04	5.27
Apple	44.48	(N/A)	0.41	0.04	5.56
Tulip tree	78.19	(N/A)	0.31	0.07	13.03
Honeylocust	983.21	(N/A)	0.31	0.90	163.87
Broadleaf Deciduous Large	26.31	(N/A)	0.25	0.02	5.26
Swamp white oak	10.94	(N/A)	0.20	0.01	2.74
River birch	130.76	(N/A)	0.20	0.12	32.69
Siberian elm	208.36	(N/A)	0.20	0.19	52.09
American elm	322.33	(N/A)	0.20	0.29	80.58
Black maple	131.78	(N/A)	0.20	0.12	32.95
Broadleaf Deciduous Small	0.00	(N/A)	0.10	0.00	0.00
Oak	10.52	(N/A)	0.10	0.01	5.26
Maple	131.78	(N/A)	0.10	0.12	65.89
Mulberry	0.00	(N/A)	0.10	0.00	0.00
White oak	57.11	(N/A)	0.10	0.05	28.56
Flowering dogwood	0.07	(N/A)	0.10	0.00	0.03
Birch	62.92	(N/A)	0.10	0.06	31.46
Eastern redbud	0.07	(N/A)	0.10	0.00	0.03
Kentucky coffeetree	10.52	(N/A)	0.10	0.01	5.26
American sycamore	29.47	(N/A)	0.10	0.03	14.73
Norway spruce	64.63	(N/A)	0.10	0.06	32.32
Japanese tree lilac	0.07	(N/A)	0.10	0.00	0.03
Cottonwood	66.60	(N/A)	0.05	0.06	66.60
Bur oak	57.69	(N/A)	0.05	0.05	57.69
Citywide Total	109,391.25	(N/A)	100.00	100.00	55.64

Annual Aesthetic/Other Benefit of Public Trees by Zone

Zone	Total (\$)	Standard Error	% of Total Tree Numbers	% of Total (\$)	Avg \$/tree
1	109,391.25	(N/A)	100.00	100.00	55.64
Citywide Total	109,391.25	(N/A)	100.00	100.00	55.64

Table 7: Summary of Benefits in Dollars

Wall Lake

3/6/2018

Average Annual Benefits of Public Trees by Species (\$/tree)

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Ot her	Total	Standard Error
Norway maple	44.13	4.45	7.74	49.41	28.27	134.01	(N/A)
Green ash	55.30	7.34	9.90	78.37	50.25	201.16	(N/A)
Silver maple	73.97	16.09	14.18	151.41	122.43	378.08	(N/A)
Blue spruce	20.05	1.70	2.27	32.37	22.90	79.28	(N/A)
Red maple	32.97	3.19	5.87	34.16	25.04	101.24	(N/A)
Northern hackberry	91.22	9.37	18.28	140.81	70.68	330.35	(N/A)
Pin oak	70.96	14.37	9.03	114.26	108.44	317.06	(N/A)
Austrian pine	24.51	2.22	2.89	41.85	25.23	96.70	(N/A)
Littleleaf linden	41.61	6.27	7.06	55.79	57.14	167.87	(N/A)
Eastern cottonwood	65.97	9.14	11.45	95.52	61.81	243.89	(N/A)
Northern red oak	34.16	2.40	4.77	47.92	7.08	96.34	(N/A)
Sugar maple	59.64	7.94	9.49	86.38	66.51	229.96	(N/A)
Black walnut	67.58	9.50	11.84	98.46	63.12	250.50	(N/A)
American basswood	37.31	6.63	5.84	58.24	45.17	153.19	(N/A)
Broadleaf Deciduous Medi	3.07	0.36	0.41	1.35	5.27	10.47	(N/A)
Apple	11.18	1.33	1.94	6.39	5.56	26.41	(N/A)
Tulip tree	33.31	2.58	7.57	65.71	13.03	122.21	(N/A)
Honeylocust	67.44	8.79	11.55	98.70	163.87	350.35	(N/A)
Broadleaf Deciduous Large	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
Swamp white oak	1.10	0.09	0.14	0.33	2.74	4.40	(N/A)
River birch	35.62	4.33	5.69	27.03	32.69	105.37	(N/A)
Siberian elm	86.58	10.78	17.88	141.88	52.09	309.20	(N/A)
American elm	104.40	10.26	23.70	123.33	80.58	342.28	(N/A)
Black maple	54.82	4.99	10.15	60.58	32.95	163.48	(N/A)
Broadleaf Deciduous Small	46.14	2.24	8.35	31.82	0.00	88.55	(N/A)
Oak	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
Maple	48.95	6.71	8.75	43.46	65.89	173.77	(N/A)
Mulberry	46.14	2.24	8.35	31.82	0.00	88.55	(N/A)
White oak	20.64	2.71	2.99	16.47	28.56	71.37	(N/A)
Flowering dogwood	0.87	0.10	0.11	0.20	0.03	1.31	(N/A)
Birch	70.84	6.27	13.58	102.01	31.46	224.17	(N/A)
Eastern redbud	0.87	0.10	0.11	0.20	0.03	1.31	(N/A)
Kentucky coffeetree	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
American sycamore	5.82	0.91	0.87	4.65	14.73	26.98	(N/A)
Norway spruce	24.14	2.43	2.82	41.70	32.32	103.40	(N/A)
Japanese tree lilac	0.87	0.10	0.11	0.20	0.03	1.31	(N/A)
Cottonwood	82.02	11.11	15.71	148.79	66.60	324.23	(N/A)
Bur oak	57.32	7.93	9.34	70.21	57.69	202.49	(N/A)
Citywide Total	50.97	7.46	9.01	78.60	55.64	201.68	(N/A)

Average Annual Benefits of Public Trees by Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Norway maple	20,125.16	2,027.33	3,530.91	22,533.18	12,891.58	61,108.17	(N/A)	15.41
Green ash	23,334.94	3,096.06	4,178.51	33,072.18	21,206.00	84,887.68	(N/A)	21.41
Silver maple	27,368.38	5,951.93	5,246.84	56,022.14	45,300.60	139,889.89	(N/A)	35.28
Blue spruce	4,410.08	373.86	499.65	7,120.37	5,038.48	17,442.44	(N/A)	4.40
Red maple	3,396.21	328.51	605.03	3,518.80	2,579.05	10,427.59	(N/A)	2.63
Northern hackberry	6,385.50	655.85	1,279.25	9,856.45	4,947.79	23,124.85	(N/A)	5.83
Pin oak	4,257.64	862.33	541.65	6,855.52	6,506.32	19,023.47	(N/A)	4.80
Austrian pine	1,029.50	93.31	121.36	1,757.75	1,059.55	4,061.47	(N/A)	1.02
Littleleaf linden	1,581.14	238.19	268.40	2,120.01	2,171.43	6,379.17	(N/A)	1.61
Eastern cottonwood	2,374.82	329.12	412.11	3,438.74	2,225.07	8,779.87	(N/A)	2.21
Northern red oak	751.47	52.87	105.01	1,054.25	155.86	2,119.45	(N/A)	0.53
Sugar maple	1,073.54	142.90	170.74	1,554.93	1,197.20	4,139.30	(N/A)	1.04
Black walnut	1,081.21	151.92	189.50	1,575.39	1,009.99	4,008.02	(N/A)	1.01
American basswood	522.37	92.86	81.76	815.38	632.34	2,144.70	(N/A)	0.54
Broadleaf Deciduous Medium	24.58	2.92	3.24	10.80	42.19	83.73	(N/A)	0.02
Apple	89.47	10.66	15.54	51.09	44.48	211.25	(N/A)	0.05
Tulip tree	199.88	15.46	45.43	394.29	78.19	733.25	(N/A)	0.18
Honeylocust	404.65	52.74	69.30	592.21	983.21	2,102.11	(N/A)	0.53
Broadleaf Deciduous Large	3.28	0.25	0.41	2.42	26.31	32.67	(N/A)	0.01
Swamp white oak	4.41	0.37	0.55	1.32	10.94	17.59	(N/A)	0.00
River birch	142.50	17.32	22.77	108.13	130.76	421.49	(N/A)	0.11
Siberian elm	346.31	43.11	71.50	567.54	208.36	1,236.81	(N/A)	0.31
American elm	417.58	41.05	94.81	493.34	322.33	1,369.12	(N/A)	0.35
Black maple	219.27	19.96	40.59	242.32	131.78	653.92	(N/A)	0.16
Broadleaf Deciduous Small	92.28	4.48	16.69	63.63	0.00	177.09	(N/A)	0.04
Oak	1.31	0.10	0.17	0.97	10.52	13.07	(N/A)	0.00
Maple	97.90	13.42	17.51	86.93	131.78	347.53	(N/A)	0.09
Mulberry	92.28	4.48	16.69	63.63	0.00	177.09	(N/A)	0.04
White oak	41.27	5.42	5.99	32.95	57.11	142.74	(N/A)	0.04
Flowering dogwood	1.73	0.21	0.21	0.40	0.07	2.63	(N/A)	0.00
Birch	141.68	12.55	27.16	204.03	62.92	448.34	(N/A)	0.11
Eastern redbud	1.73	0.21	0.21	0.40	0.07	2.63	(N/A)	0.00
Kentucky coffeetree	1.31	0.10	0.17	0.97	10.52	13.07	(N/A)	0.00
American sycamore	11.64	1.82	1.74	9.30	29.47	53.97	(N/A)	0.01
Norway spruce	48.27	4.87	5.64	83.39	64.63	206.80	(N/A)	0.05
Japanese tree lilac	1.73	0.21	0.21	0.40	0.07	2.63	(N/A)	0.00
Cottonwood	82.02	11.11	15.71	148.79	66.60	324.23	(N/A)	0.08
Bur oak	57.32	7.93	9.34	70.21	57.69	202.49	(N/A)	0.05
Citywide Total	100,216.34	14,667.82	17,712.32	154,524.56	109,391.25	396,512.30	(N/A)	100.00

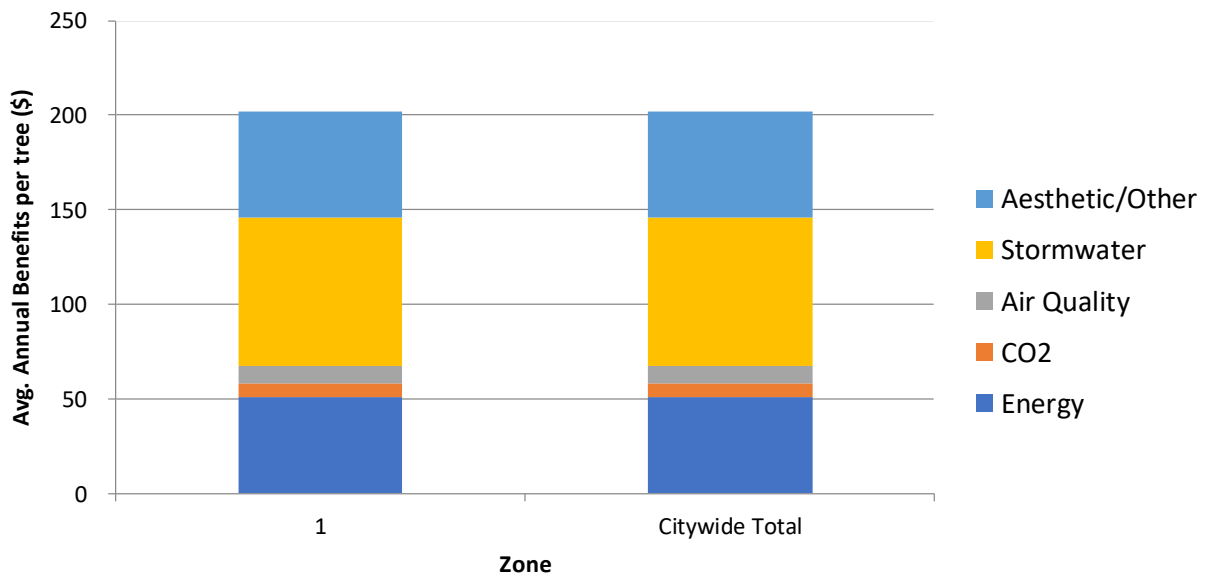
Average Annual Benefits of Public Trees by Zone (\$/tree)

Zone	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total	Standard Error
1	50.97	7.46	9.01	78.60	55.64	201.68	(N/A)
Citywide Total	50.97	7.46	9.01	78.60	55.64	201.68	(N/A)

Total Annual Benefits of Public Trees by Zone (\$)

Zone	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
1	100,216.34	14,667.82	17,712.32	154,524.56	109,391.25	396,512.30	(N/A)	100.00
Citywide Total	100,216.34	14,667.82	17,712.32	154,524.56	109,391.25	396,512.30	(N/A)	100.00

Average Annual Benefits of Public Trees by Zone (\$/tree)



Total Annual Benefits of Public Trees by Zone (\$)

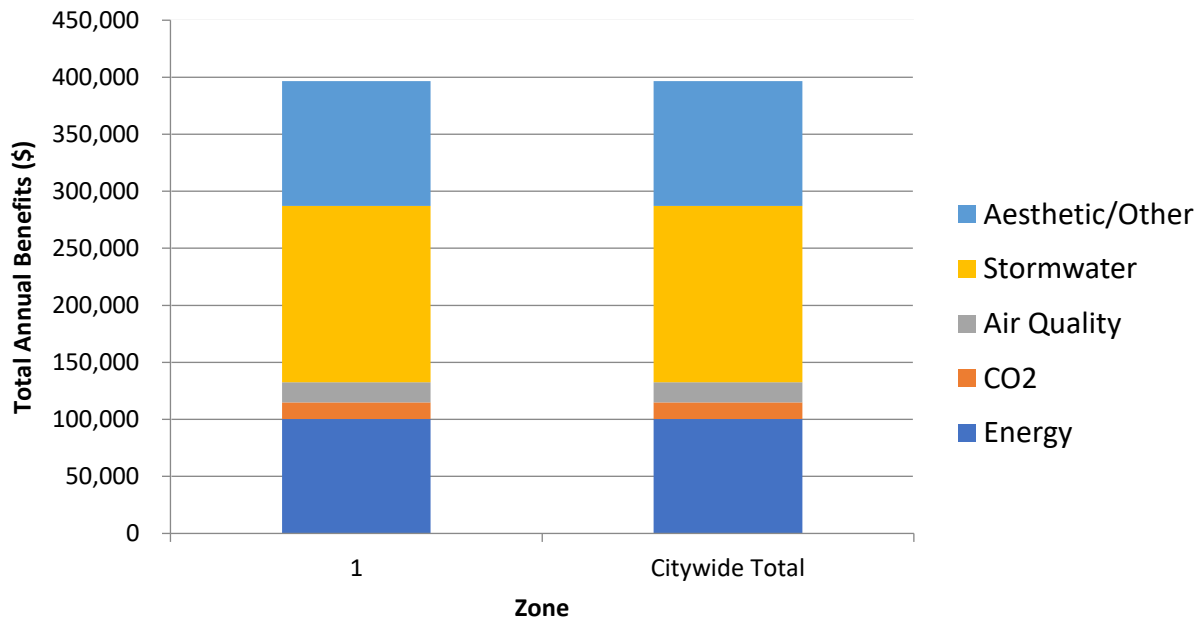


Figure 1: Species Distribution

Wall Lake

Population Summary of Public Trees

3/6/2018

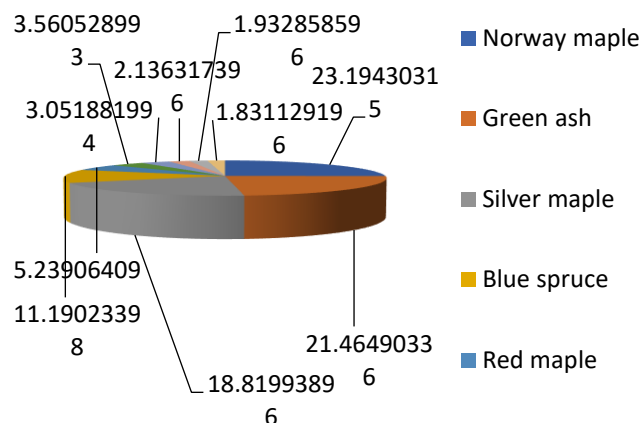
Species	DBH Class (in)									Total	SE
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
Broadleaf Deciduous Large (BDL)											
Green ash	2	10	62	122	54	96	38	22	16	422	(±0)
Silver maple	2	4	8	24	26	80	90	68	68	370	(±0)
Red maple	18	14	22	21	4	20	4	0	0	103	(±0)
Northern hackberry	0	2	0	4	4	4	20	26	10	70	(±0)
Pin oak	4	0	0	2	2	26	10	8	8	60	(±0)
Eastern cottonwood	0	0	0	0	18	12	6	0	0	36	(±0)
Northern red oak	8	0	0	2	0	4	6	2	0	22	(±0)
Sugar maple	0	0	2	2	2	10	2	0	0	18	(±0)
Black walnut	0	0	0	2	0	14	0	0	0	16	(±0)
American basswood	2	4	2	0	0	4	0	0	2	14	(±0)
Tulip tree	4	0	0	0	0	0	0	0	2	6	(±0)
Broadleaf Deciduous Large	5	0	0	0	0	0	0	0	0	5	(±0)
American elm	0	0	0	0	0	0	2	0	2	4	(±0)
Black maple	0	0	0	2	0	2	0	0	0	4	(±0)
White oak	0	0	2	0	0	0	0	0	0	2	(±0)
Maple	0	0	0	2	0	0	0	0	0	2	(±0)
American sycamore	0	2	0	0	0	0	0	0	0	2	(±0)
Kentucky coffeetree	2	0	0	0	0	0	0	0	0	2	(±0)
Oak	2	0	0	0	0	0	0	0	0	2	(±0)
Cottonwood	0	0	0	0	0	0	1	0	0	1	(±0)
Bur oak	0	0	0	0	1	0	0	0	0	1	(±0)
Total	49	36	98	183	111	272	179	126	108	1162	(±0)
Broadleaf Deciduous Medium (BDM)											
Norway maple	24	20	138	100	38	108	18	2	8	456	(±0)
Littleleaf linden	0	4	8	6	6	10	4	0	0	38	(±0)
Broadleaf Deciduous Medium	6	2	0	0	0	0	0	0	0	8	(±0)
Honeylocust	0	0	0	2	0	2	2	0	0	6	(±0)
Swamp white oak	4	0	0	0	0	0	0	0	0	4	(±0)
River birch	0	0	2	2	0	0	0	0	0	4	(±0)
Siberian elm	0	0	0	0	0	0	2	2	0	4	(±0)
Birch	0	0	0	0	0	2	0	0	0	2	(±0)
Total	34	26	148	110	44	122	26	4	8	522	(±0)
Broadleaf Deciduous Small (BDS)											
Apple	6	0	0	1	1	0	0	0	0	8	(±0)
Mulberry	0	0	0	0	0	2	0	0	0	2	(±0)
Eastern redbud	2	0	0	0	0	0	0	0	0	2	(±0)
Flowering dogwood	2	0	0	0	0	0	0	0	0	2	(±0)
Japanese tree lilac	2	0	0	0	0	0	0	0	0	2	(±0)
Broadleaf Deciduous Small	0	0	0	0	0	2	0	0	0	2	(±0)
Total	12	0	0	1	1	4	0	0	0	18	(±0)
Conifer Evergreen Large (CEL)											
Norway spruce	0	0	0	2	0	0	0	0	0	2	(±0)
Total	0	0	0	2	0	0	0	0	0	2	(±0)
Conifer Evergreen Medium (CEM)											
Blue spruce	0	8	90	118	2	2	0	0	0	220	(±0)
Austrian pine	0	0	0	42	0	0	0	0	0	42	(±0)
Total	0	8	90	160	2	2	0	0	0	262	(±0)
Grand Total	95	70	336	456	158	400	205	130	116	1966	(±0)

Figure 2: Relative Age Distribution

Wall Lake

Species Distribution of Public Trees for 1
3/6/2018

Species	Percent
Norway maple	23.19
Green ash	21.46
Silver maple	18.82
Blue spruce	11.19
Red maple	5.24
Northern hackberry	3.56
Pin oak	3.05
Austrian pine	2.14
Littleleaf linden	1.93
Eastern cottonwood	1.83
Other Species	7.58



Wall Lake

Relative Age Distribution of Top 10 Public Tree Species (%)
3/6/2018

DBH class (in)

Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	> 42
Norway maple	5.26	4.39	30.26	21.93	8.33	23.68	3.95	0.44	1.75
Green ash	0.47	2.37	14.69	28.91	12.80	22.75	9.00	5.21	3.79
Silver maple	0.54	1.08	2.16	6.49	7.03	21.62	24.32	18.38	18.38
Blue spruce	0.00	3.64	40.91	53.64	0.91	0.91	0.00	0.00	0.00
Red maple	17.48	13.59	21.36	20.39	3.88	19.42	3.88	0.00	0.00
Northern hackberry	0.00	2.86	0.00	5.71	5.71	5.71	28.57	37.14	14.29
Pin oak	6.67	0.00	0.00	3.33	3.33	43.33	16.67	13.33	13.33
Austrian pine	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00
Littleleaf linden	0.00	10.53	21.05	15.79	15.79	26.32	10.53	0.00	0.00
Eastern cottonwood	0.00	0.00	0.00	0.00	50.00	33.33	16.67	0.00	0.00
Citywide Total	4.83	3.56	17.09	23.19	8.04	20.35	10.43	6.61	5.90

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

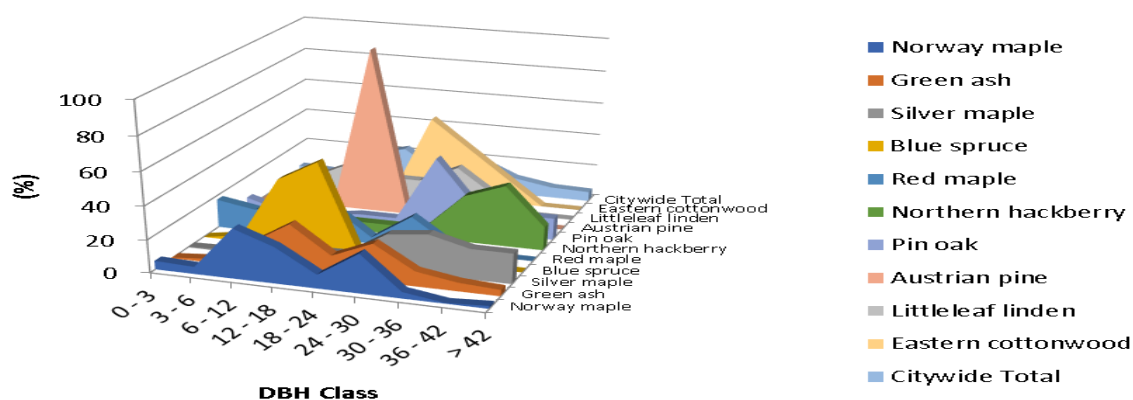


Figure 3: Functional Foliage Condition of all Trees

Wall Lake

Functional (Foliage) Condition of Public Trees by Zone

3/6/2018

Zone	Condition	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Dead or Dying	22 (N/A)		1.12	1.12
	Poor	312 (N/A)		15.87	15.87
	Fair	1316 (N/A)		66.94	66.94
	Good	316 (N/A)		16.07	16.07
	Total	1966 (N/A)		100.00	100.00
Citywide	Dead or Dying	22 (N/A)		1.12	1.12
	Poor	312 (N/A)		15.87	15.87
	Fair	1316 (N/A)		66.94	66.94
	Good	316 (N/A)		16.07	16.07
	Total	1966 (N/A)		100.00	100.00

Figure 3: Foliage Condition

Wall Lake

Functional (Foliage) Condition of Public Trees by Species

3/6/2018

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
American basswood	Dead or Dying	0 (N/A)		0.00	0.00
	Poor	2 (N/A)		14.29	0.10
	Fair	6 (N/A)		42.86	0.31
	Good	6 (N/A)		42.86	0.31
	Total	14 (N/A)		100.00	0.71
American elm	Dead or Dying	0 (N/A)		0.00	0.00
	Poor	0 (N/A)		0.00	0.00
	Fair	4 (N/A)		100.00	0.20
	Good	0 (N/A)		0.00	0.00
	Total	4 (N/A)		100.00	0.20
American sycamore	Dead or Dying	0 (N/A)		0.00	0.00
	Poor	0 (N/A)		0.00	0.00
	Fair	0 (N/A)		0.00	0.00
	Good	2 (N/A)		100.00	0.10

	Total	2	(N/A)	100.00	0.10
Apple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	5	(N/A)	62.50	0.25
	Good	3	(N/A)	37.50	0.15
	Total	8	(N/A)	100.00	0.41
Austrian pine	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	42	(N/A)	100.00	2.14
	Good	0	(N/A)	0.00	0.00
	Total	42	(N/A)	100.00	2.14
Birch	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10
Black maple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	2	(N/A)	50.00	0.10
	Fair	2	(N/A)	50.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.20
Black walnut	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	6	(N/A)	37.50	0.31
	Fair	10	(N/A)	62.50	0.51
	Good	0	(N/A)	0.00	0.00
	Total	16	(N/A)	100.00	0.81
Blue spruce	Dead or Dying	14	(N/A)	6.36	0.71
	Poor	2	(N/A)	0.91	0.10
	Fair	176	(N/A)	80.00	8.95
	Good	28	(N/A)	12.73	1.42
	Total	220	(N/A)	100.00	11.19

Broadleaf Deciduous Large	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	5	(N/A)	100.00	0.25
	Total	5	(N/A)	100.00	0.25
Broadleaf Deciduous Me- dium	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	25.00	0.10
	Good	6	(N/A)	75.00	0.31
	Total	8	(N/A)	100.00	0.41
Broadleaf Deciduous Small	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Bur oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	1	(N/A)	100.00	0.05
	Good	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.05
Cottonwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	1	(N/A)	100.00	0.05
	Good	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.05
Eastern cottonwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	36	(N/A)	100.00	1.83
	Good	0	(N/A)	0.00	0.00
	Total	36	(N/A)	100.00	1.83
Eastern redbud	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00

	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Flowering Dogwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Green Ash	Dead or Dy- ing	8	(N/A)	1.90	0.41
	Poor	102	(N/A)	24.17	5.19
	Fair	304	(N/A)	72.04	15.46
	Good	8	(N/A)	1.90	0.41
	Total	422	(N/A)	100.00	21.46
Honey Locust	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	6	(N/A)	100.00	0.31
	Good	0	(N/A)	0.00	0.00
	Total	6	(N/A)	100.00	0.31
Japanese tree lilac	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Kentucky Coffee tree	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Little leaf linden	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	8	(N/A)	21.05	0.41
	Fair	20	(N/A)	52.63	1.02
	Good	10	(N/A)	26.32	0.51
	Total	38	(N/A)	100.00	1.93

Maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Mulberry	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10
Northern hackberry	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	14	(N/A)	20.00	0.71
	Fair	56	(N/A)	80.00	2.85
	Good	0	(N/A)	0.00	0.00
	Total	70	(N/A)	100.00	3.56
Northern red oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	4	(N/A)	18.18	0.20
	Fair	4	(N/A)	18.18	0.20
	Good	14	(N/A)	63.64	0.71
	Total	22	(N/A)	100.00	1.12
Norway maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	66	(N/A)	14.47	3.36
	Fair	254	(N/A)	55.70	12.92
	Good	136	(N/A)	29.82	6.92
	Total	456	(N/A)	100.00	23.19
Norway spruce	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10
Oak	Dead or Dy- ing	0	(N/A)	0.00	0.00

	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Pin oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	24	(N/A)	40.00	1.22
	Fair	34	(N/A)	56.67	1.73
	Good	2	(N/A)	3.33	0.10
	Total	60	(N/A)	100.00	3.05
Red maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	8	(N/A)	7.77	0.41
	Fair	37	(N/A)	35.92	1.88
	Good	58	(N/A)	56.31	2.95
	Total	103	(N/A)	100.00	5.24
River birch	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	50.00	0.10
	Good	2	(N/A)	50.00	0.10
	Total	4	(N/A)	100.00	0.20
Siberian elm	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	2	(N/A)	50.00	0.10
	Fair	2	(N/A)	50.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.20
Silver maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	70	(N/A)	18.92	3.56
	Fair	288	(N/A)	77.84	14.65
	Good	12	(N/A)	3.24	0.61
	Total	370	(N/A)	100.00	18.82
Sugar maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	2	(N/A)	11.11	0.10
	Fair	16	(N/A)	88.89	0.81
	Good	0	(N/A)	0.00	0.00

	Total	18	(N/A)	100.00	0.92
Swamp white oak	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	4	(N/A)	100.00	0.20
	Total	4	(N/A)	100.00	0.20
Tulip tree	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	6	(N/A)	100.00	0.31
	Total	6	(N/A)	100.00	0.31
White oak	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10

Wall Lake Functional (Foliage) Condition of Public Trees by Zone 3/6/2018 % of Zone



- 1 Dead or Dying 22 (N/A)
- 1 Fair 1316 (N/A)
- 1 Total 1966 (N/A)
- Citywide Dead or Dying 22 (N/A)
- Citywide Fair 1316 (N/A)
- 1 Poor 312 (N/A)
- 1 Good 316 (N/A)
- Citywide Poor 312 (N/A)
- Citywide Good 316 (N/A)

Figure 4: Structural Condition of all Trees

Wall Lake

Structural (Woody) Condition of Public Trees by Species

3/6/2018

Species	Condition	Tree Count	Standard Error	% of Species	% of Public Trees
American basswood	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	8	(N/A)	57.14	0.41
	Good	6	(N/A)	42.86	0.31
	Total	14	(N/A)	100.00	0.71
American elm	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	4	(N/A)	100.00	0.20
	Good	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.20
American sycamore	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Apple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	1	(N/A)	12.50	0.05
	Fair	4	(N/A)	50.00	0.20
	Good	3	(N/A)	37.50	0.15
	Total	8	(N/A)	100.00	0.41
Austrian pine	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	42	(N/A)	100.00	2.14
	Good	0	(N/A)	0.00	0.00
	Total	42	(N/A)	100.00	2.14

Birch	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10
Black maple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	2	(N/A)	50.00	0.10
	Fair	2	(N/A)	50.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.20
Black walnut	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	6	(N/A)	37.50	0.31
	Fair	10	(N/A)	62.50	0.51
	Good	0	(N/A)	0.00	0.00
	Total	16	(N/A)	100.00	0.81
Blue spruce	Dead or Dying	14	(N/A)	6.36	0.71
	Poor	14	(N/A)	6.36	0.71
	Fair	166	(N/A)	75.45	8.44
	Good	26	(N/A)	11.82	1.32
	Total	220	(N/A)	100.00	11.19
Broadleaf Deciduous Large	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	5	(N/A)	100.00	0.25
	Total	5	(N/A)	100.00	0.25
Broadleaf Deciduous Medium	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	8	(N/A)	100.00	0.41
	Total	8	(N/A)	100.00	0.41
Broadleaf Deciduous Small	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00

	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Bur oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	1	(N/A)	100.00	0.05
	Good	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.05
Cottonwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	1	(N/A)	100.00	0.05
	Good	0	(N/A)	0.00	0.00
	Total	1	(N/A)	100.00	0.05
Eastern cottonwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	36	(N/A)	100.00	1.83
	Good	0	(N/A)	0.00	0.00
	Total	36	(N/A)	100.00	1.83
Eastern redbud	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Flowering dogwood	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Green ash	Dead or Dy- ing	6	(N/A)	1.42	0.31
	Poor	54	(N/A)	12.80	2.75
	Fair	350	(N/A)	82.94	17.80
	Good	12	(N/A)	2.84	0.61
	Total	422	(N/A)	100.00	21.46

Honeylocust	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	0 (N/A)	0.00	0.00
	Fair	6 (N/A)	100.00	0.31
	Good	0 (N/A)	0.00	0.00
	Total	6 (N/A)	100.00	0.31
Japanese tree lilac	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	0 (N/A)	0.00	0.00
	Fair	0 (N/A)	0.00	0.00
	Good	2 (N/A)	100.00	0.10
	Total	2 (N/A)	100.00	0.10
Kentucky coffeetree	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	0 (N/A)	0.00	0.00
	Fair	0 (N/A)	0.00	0.00
	Good	2 (N/A)	100.00	0.10
	Total	2 (N/A)	100.00	0.10
Littleleaf linden	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	4 (N/A)	10.53	0.20
	Fair	24 (N/A)	63.16	1.22
	Good	10 (N/A)	26.32	0.51
	Total	38 (N/A)	100.00	1.93
Maple	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	0 (N/A)	0.00	0.00
	Fair	0 (N/A)	0.00	0.00
	Good	2 (N/A)	100.00	0.10
	Total	2 (N/A)	100.00	0.10
Mulberry	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00
	Poor	0 (N/A)	0.00	0.00
	Fair	2 (N/A)	100.00	0.10
	Good	0 (N/A)	0.00	0.00
	Total	2 (N/A)	100.00	0.10
Northern hackberry	Dead or Dy-			
	ing	0 (N/A)	0.00	0.00

	Poor	2	(N/A)	2.86	0.10
	Fair	66	(N/A)	94.29	3.36
	Good	2	(N/A)	2.86	0.10
	Total	70	(N/A)	100.00	3.56
Northern red oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	6	(N/A)	27.27	0.31
	Good	16	(N/A)	72.73	0.81
	Total	22	(N/A)	100.00	1.12
Norway maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	10	(N/A)	2.19	0.51
	Fair	272	(N/A)	59.65	13.84
	Good	174	(N/A)	38.16	8.85
	Total	456	(N/A)	100.00	23.19
Norway spruce	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10
Oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	2	(N/A)	100.00	0.10
	Total	2	(N/A)	100.00	0.10
Pin oak	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	24	(N/A)	40.00	1.22
	Fair	34	(N/A)	56.67	1.73
	Good	2	(N/A)	3.33	0.10
	Total	60	(N/A)	100.00	3.05
Red maple	Dead or Dy- ing	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	43	(N/A)	41.75	2.19
	Good	60	(N/A)	58.25	3.05

	Total	103	(N/A)	100.00	5.24
River birch	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	4	(N/A)	100.00	0.20
	Total	4	(N/A)	100.00	0.20
Siberian elm	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	4	(N/A)	100.00	0.20
	Good	0	(N/A)	0.00	0.00
	Total	4	(N/A)	100.00	0.20
Silver maple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	10	(N/A)	2.70	0.51
	Fair	348	(N/A)	94.05	17.70
	Good	12	(N/A)	3.24	0.61
	Total	370	(N/A)	100.00	18.82
Sugar maple	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	18	(N/A)	100.00	0.92
	Good	0	(N/A)	0.00	0.00
	Total	18	(N/A)	100.00	0.92
Swamp white oak	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	4	(N/A)	100.00	0.20
	Total	4	(N/A)	100.00	0.20
Tulip tree	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	0	(N/A)	0.00	0.00
	Good	6	(N/A)	100.00	0.31
	Total	6	(N/A)	100.00	0.31

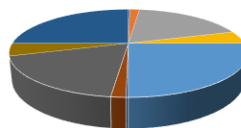
White oak	Dead or Dying	0	(N/A)	0.00	0.00
	Poor	0	(N/A)	0.00	0.00
	Fair	2	(N/A)	100.00	0.10
	Good	0	(N/A)	0.00	0.00
	Total	2	(N/A)	100.00	0.10

Wall Lake

Structural (Woody) Condition of Public Trees by Zone 3/6/2018

Zone	Condition	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Dead or Dying	20	(N/A)	1.02	1.02
	Poor	127	(N/A)	6.46	6.46
	Fair	1453	(N/A)	73.91	73.91
	Good	366	(N/A)	18.62	18.62
	Total	1966	(N/A)	100.00	100.00
Citywide	Dead or Dying	20	(N/A)	1.02	1.02
	Poor	127	(N/A)	6.46	6.46
	Fair	1453	(N/A)	73.91	73.91
	Good	366	(N/A)	18.62	18.62
	Total	1966	(N/A)	100.00	100.00

Wall Lake Structural (Woody) Condition of Public Trees by Zone
3/6/2018 % of Zone



- 1 Dead or Dying 20 (N/A)
- 1 Poor 127 (N/A)
- 1 Fair 1453 (N/A)
- 1 Good 366 (N/A)
- 1 Total 1966 (N/A)
- Citywide Dead or Dying 20 (N/A)
- Citywide Poor 127 (N/A)
- Citywide Fair 1453 (N/A)
- Citywide Good 366 (N/A)
- Citywide Total 1966 (N/A)

Figure 5: Canopy Cover in Acres

Wall Lake

Canopy Cover of Public Trees (Acres)

3/6/2018

Zone	Acres	% of Total Canopy
1	56.56	100.00
Citywide Total	56.56	100.00

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide Total	787.20	0.00	56.56	7.18	0.00

Canopy Cover of Public Trees (Acres)

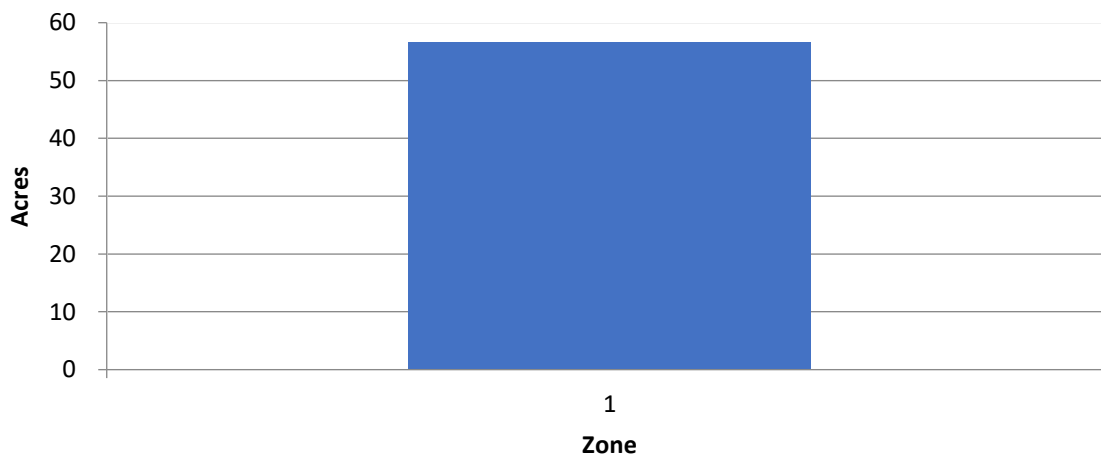


Figure 6: Land Use of city/park trees

Wall

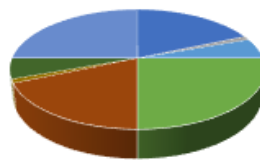
Lake

Land Use of Public Trees by Zone

3/6/2018

Zone	Land Use	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Single family residential	1448	(N/A)	73.65	73.65
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	84	(N/A)	4.27	4.27
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	434	(N/A)	22.08	22.08
	Total	1966	(N/A)	100.00	100.00
Citywide	Single family residential	1448	(N/A)	73.65	73.65
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	84	(N/A)	4.27	4.27
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	434	(N/A)	22.08	22.08
	Total	1966	(N/A)	100.00	100.00

Wall Lake Land Use of Public Trees by Zone 3/6/2018 % of Zone



- 1 Single family residential 1448 (N/A)
- 1 Multi-family residential 0 (N/A)
- 1 Small commercial 84 (N/A)
- 1 Industrial/Large commercial 0 (N/A)
- 1 Park/vacant/other 434 (N/A)

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

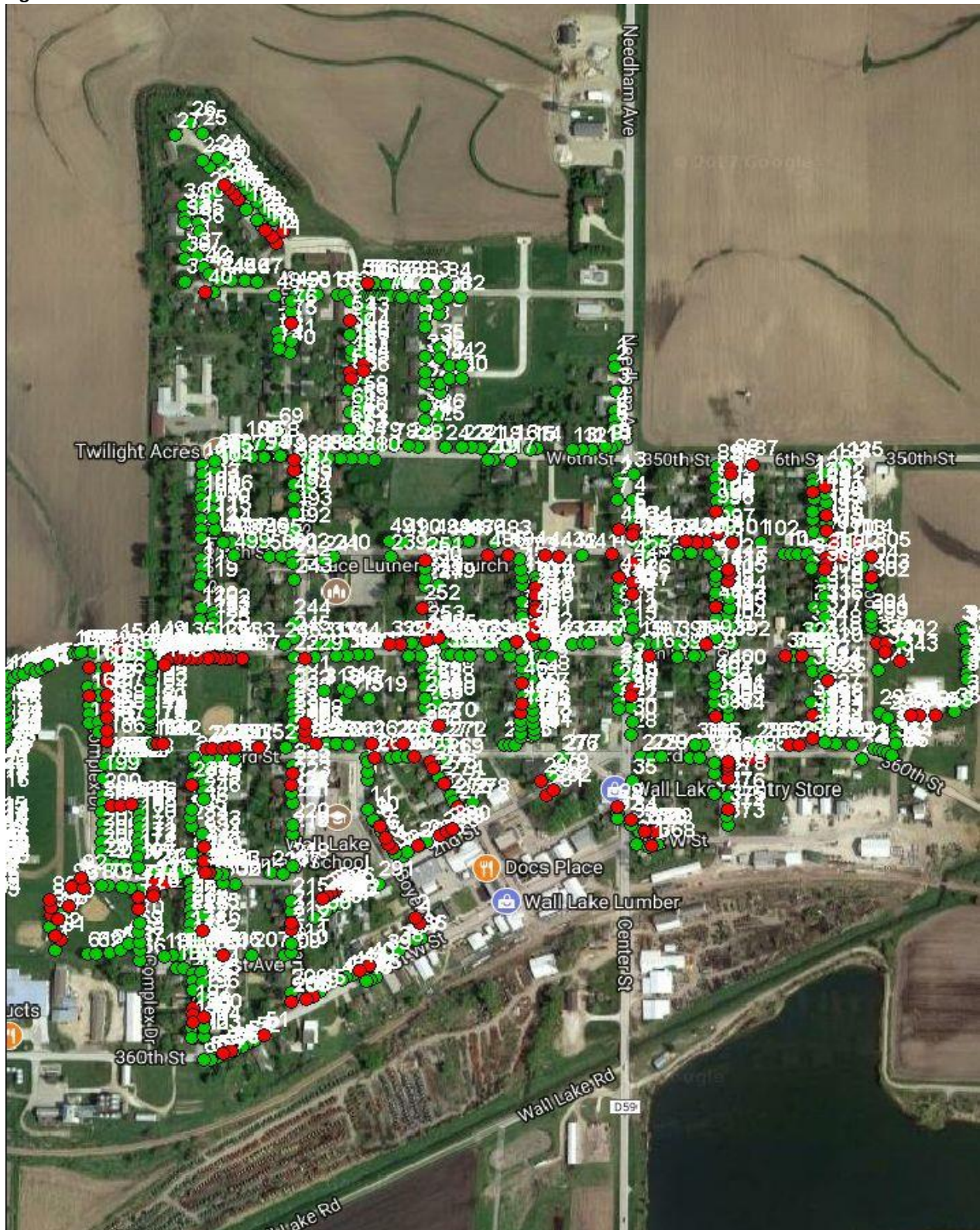


Figure 2: Location of EAB symptoms

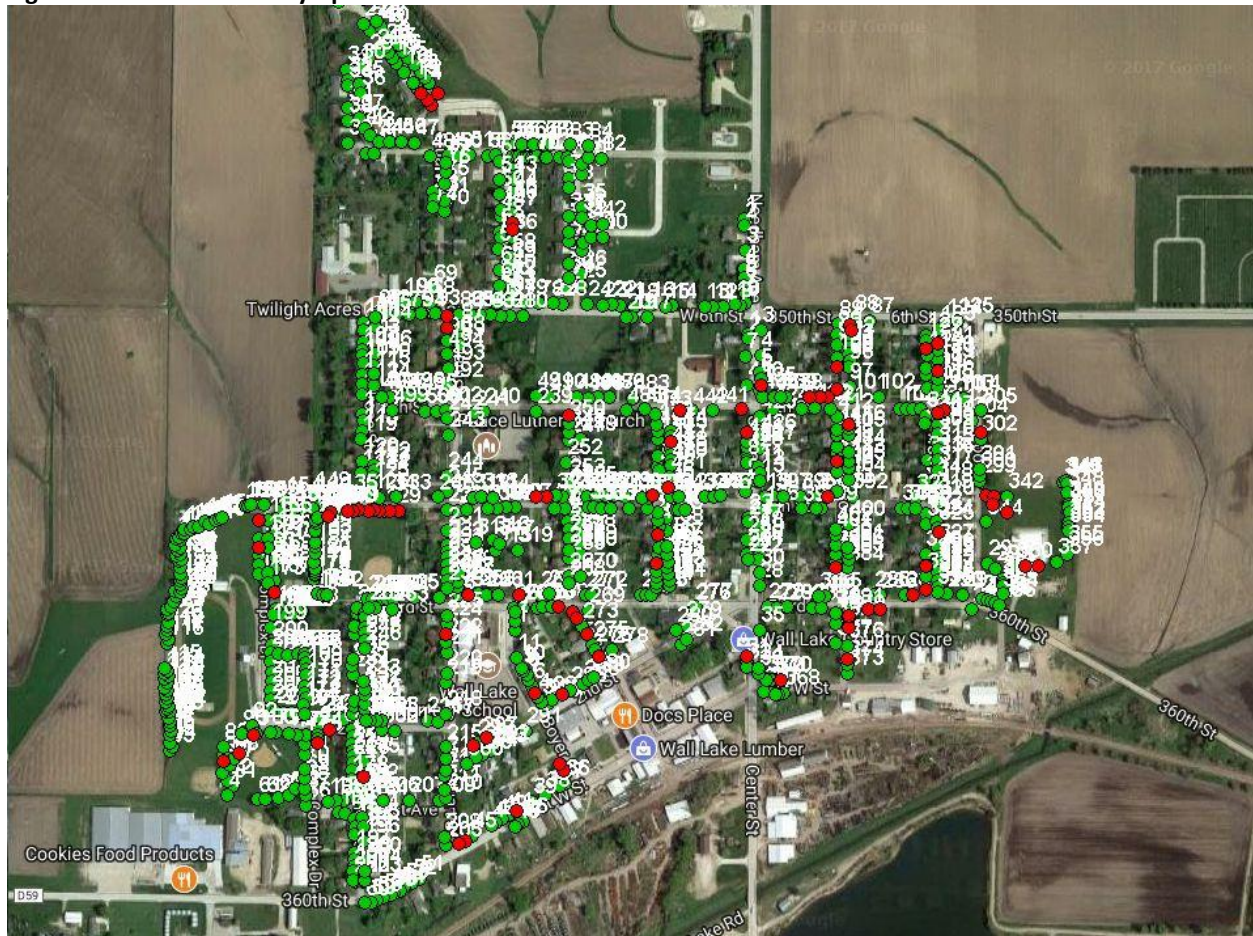


Figure 3: Location of Poor Condition Trees

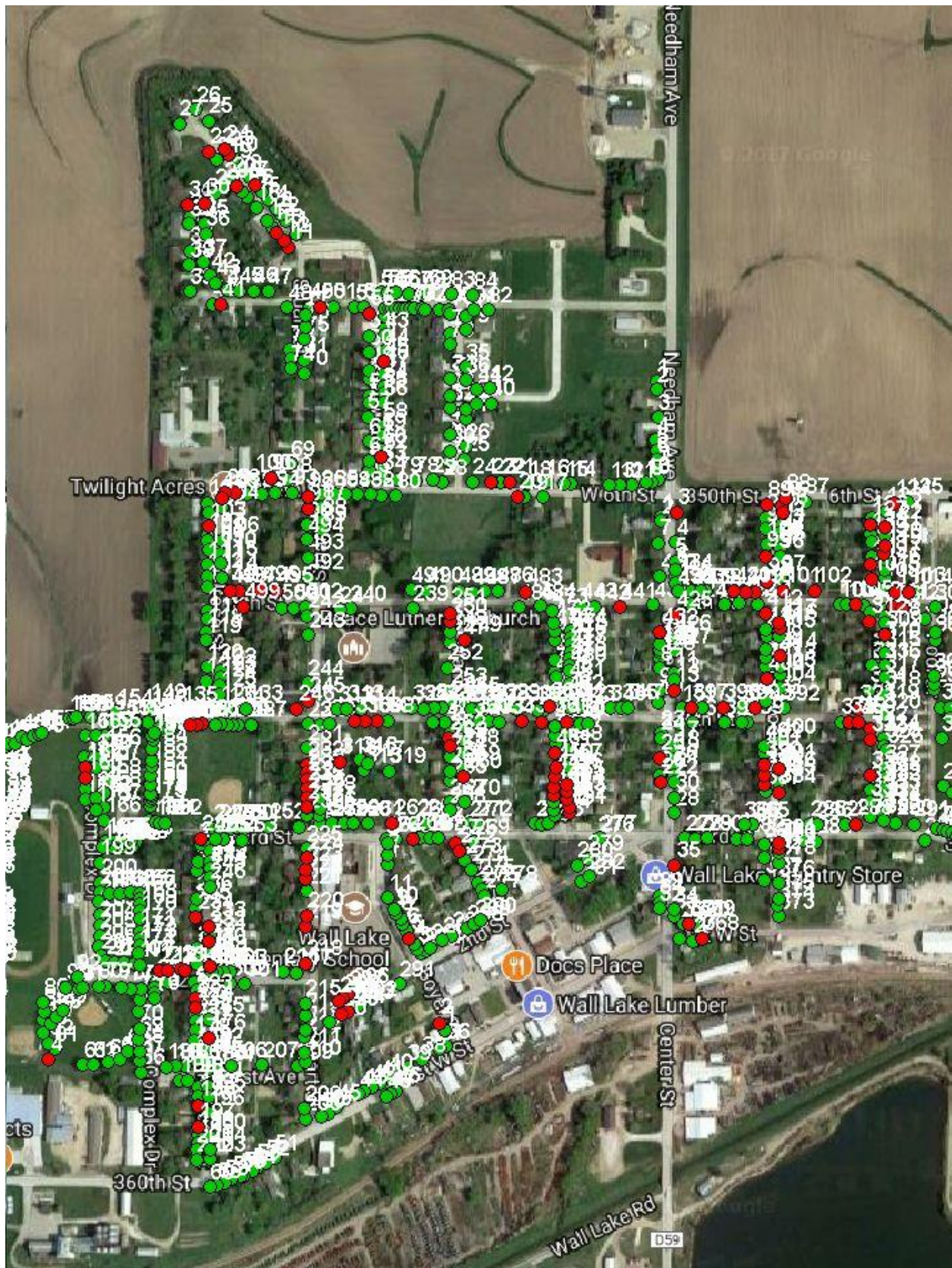


Figure 4: Location of Trees with Recommended Maintenance

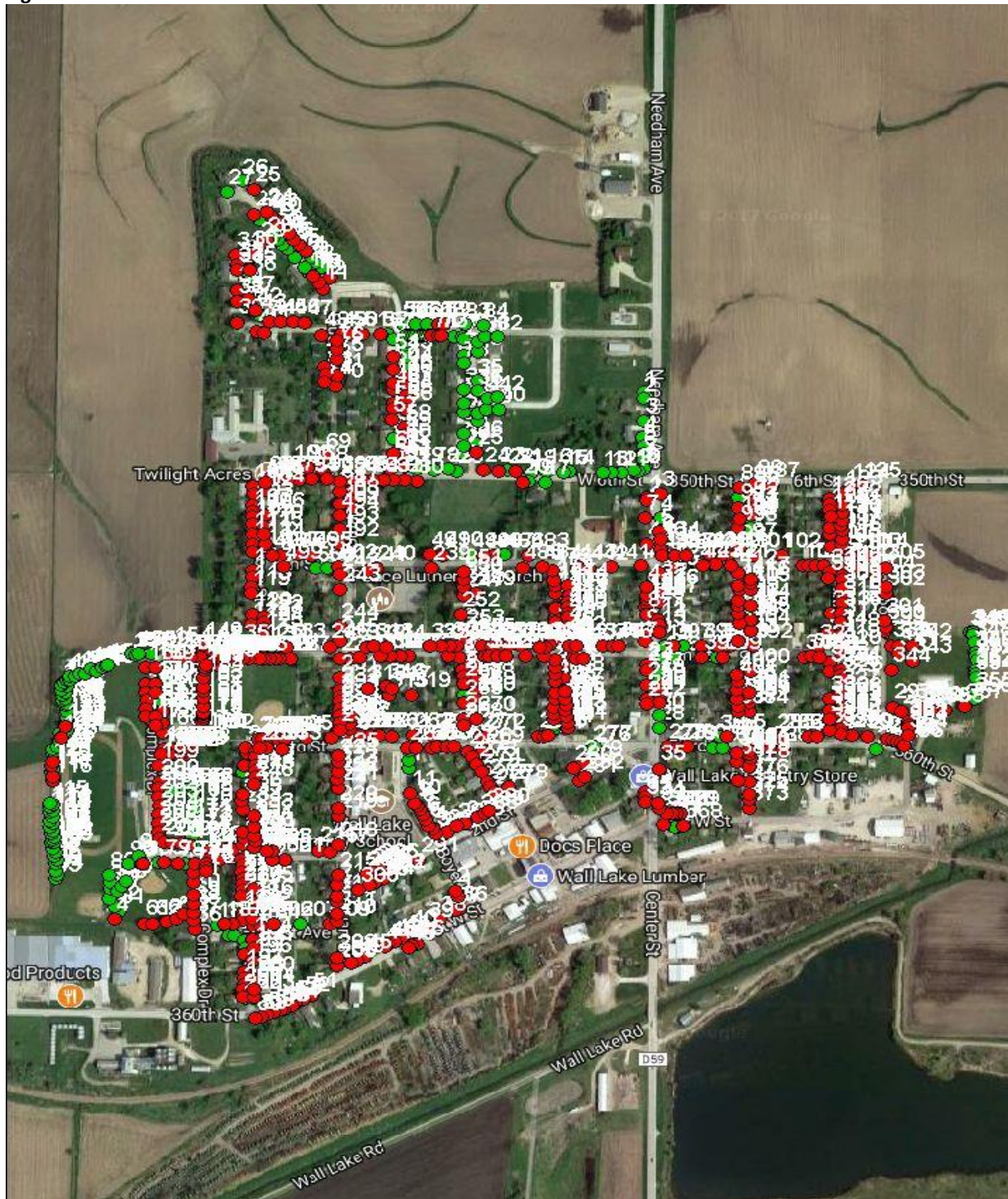
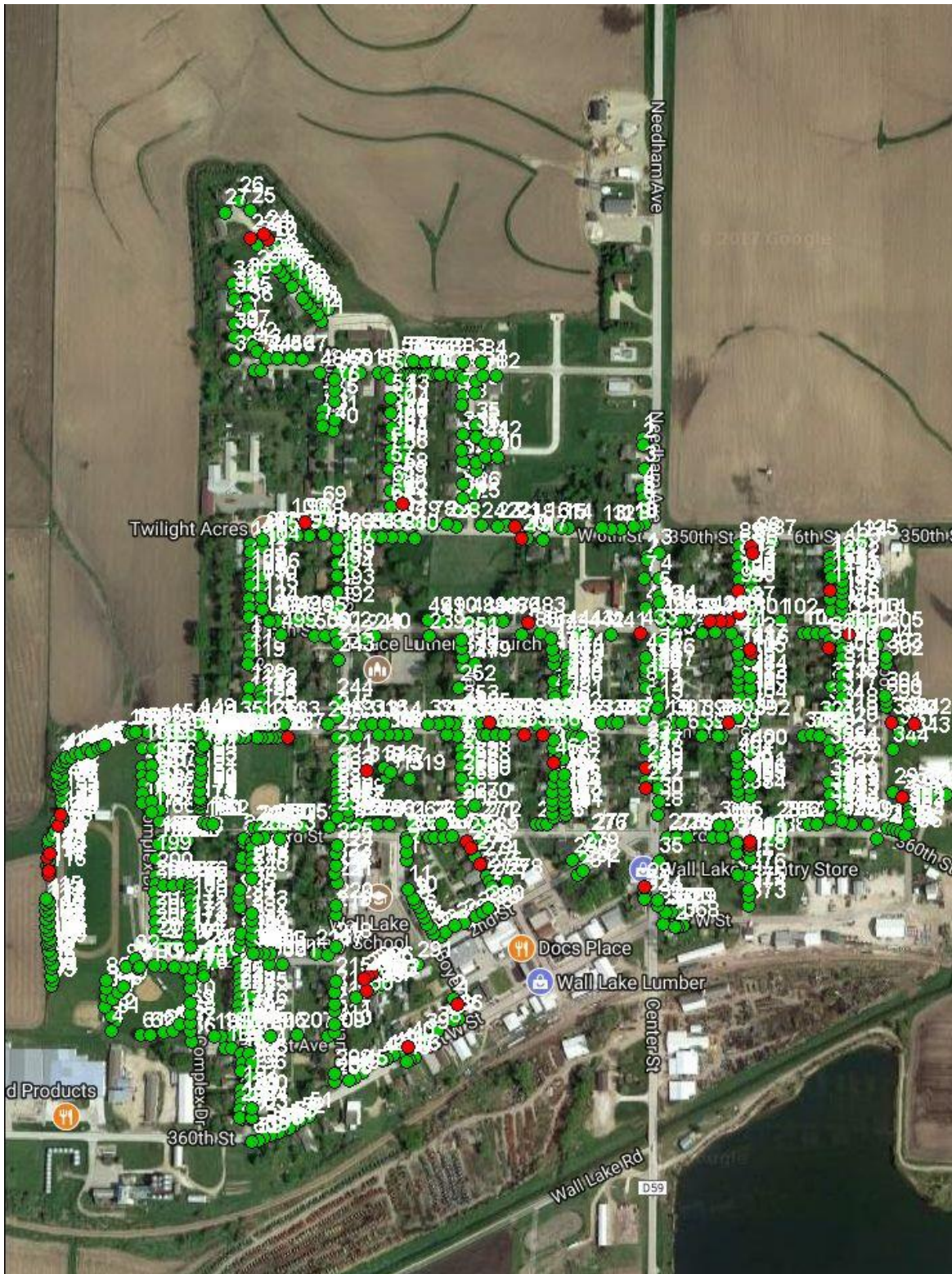


Figure 5: Removals *City ownership of the trees recommended for removal should be verified prior to any removal*



Appendix C: Wall Lake Tree Ordinances

URBAN FORESTRY ORDINANCE

6-6-10 MAINTENANCE OF PARKING OR TERRACE. It shall be the responsibility of the abutting property owner to maintain all property outside the lot and property lines and inside the curb lines upon the public streets, except that the abutting property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. Maintenance includes timely mowing, trimming trees and shrubs and picking up litter.

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

6-12-6 TRIMMING OF TREES. The Grantee or its successor shall be permitted to trim trees wherever necessary for the safe and efficient operation of said telephone system.

