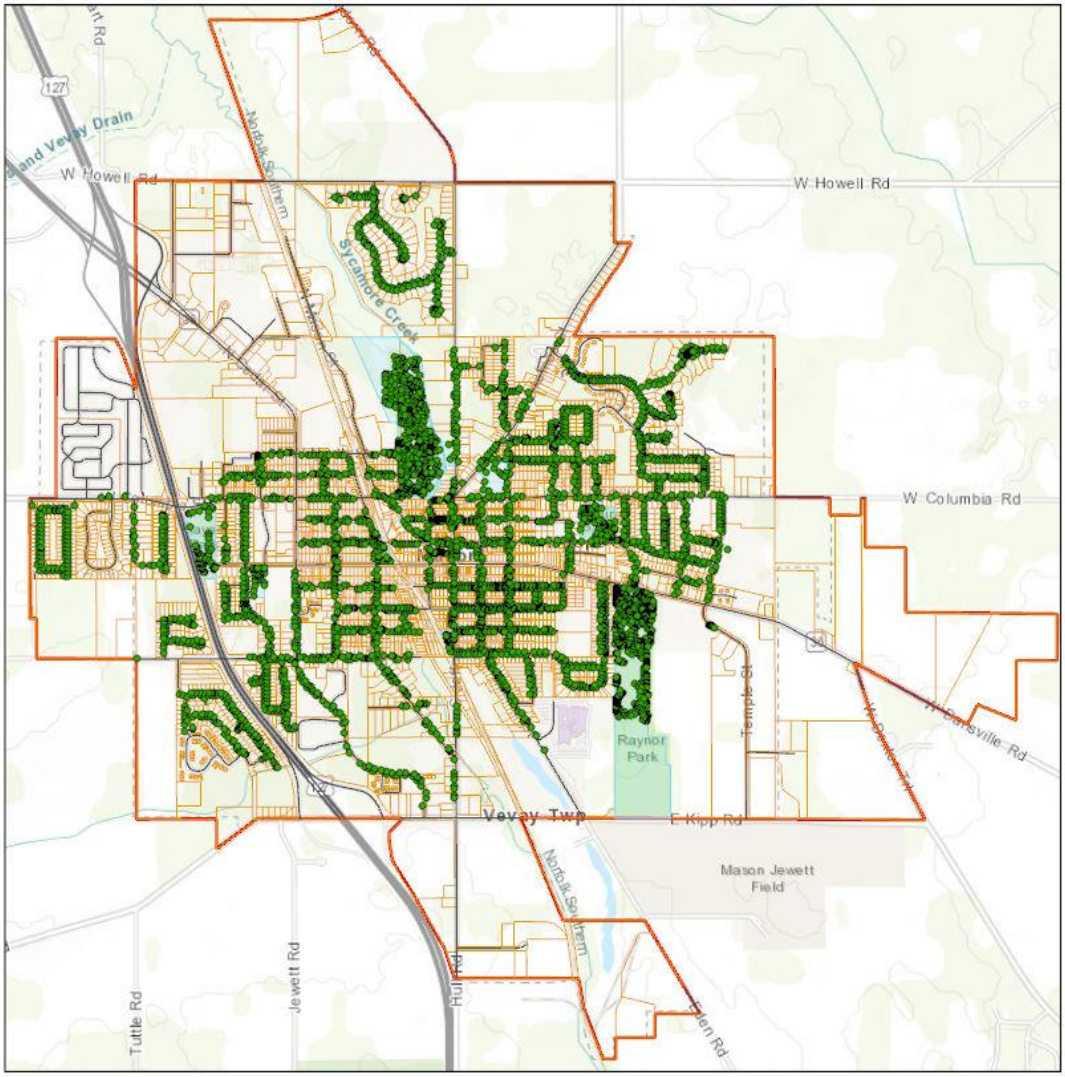
City of Mason, Michigan

Tree Inventory Summary Report

May 23, 2019



Prepared By:

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Yorba Linda, CA 92887

Report Summary

On March 30, 2019 ArborPro, Inc. began operations on a comprehensive GPS inventory of the trees along street rights-of-way (ROW) and in public parks in the City of Mason. ArborPro assigned an ISA Certified Arborist to collect detailed information on the condition, size, species, maintenance recommendations, etc. for all trees, stumps, and vacant sites in the survey area.

Significant Findings from the Inventory

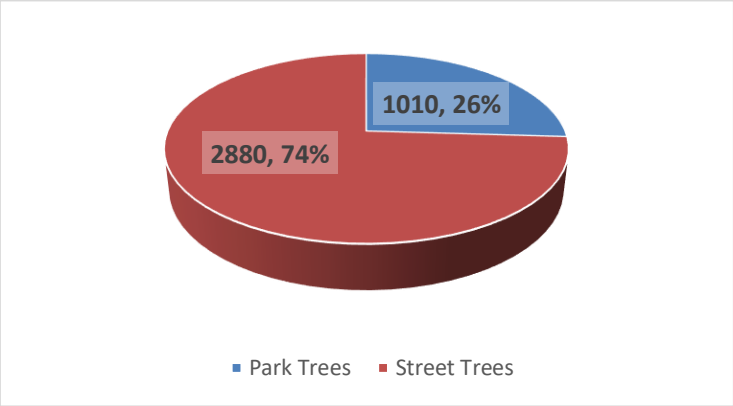
The inventory recorded a total of 3,890 sites, which included 3,600 trees (92.5%), 5 stumps (0.1%), and 285 vacant sites (7.4%). Of the inventoried sites, 2,880 (74.0%) are located along street ROWs and 1,010 (26.0%) are in City parks and open spaces. Analysis of the tree inventory found:

1. The five most common species found in Mason are: sugar maple (936 trees: 26.0%); Norway maple (790 trees: 21.9%); red maple (302 trees: 8.4%); ornamental pear (220 trees: 6.1%); and thornless honey locust (161 trees: 4.5%).
2. The three most common young trees (under 6" DBH) are: red maple (185 trees); sugar maple (131 trees); and ornamental pear (91 trees).
3. The three most common mature trees (over 25" DBH) are: sugar maple (391 trees); Norway maple (125 trees); and black walnut (25 trees).
4. The inventory recorded a total of 77 distinct species of trees.
5. 82.9% of Mason's tree population is in "fair" or better condition.
6. Trees provide approximately $550,221 in annual environmental benefits.
7. Total Environmental Benefits
    - Energy savings: $147,976/year.
    - Stormwater interception: valued at $194,930/year.
    - Carbon sequestration: valued at $19,026/year.
    - Improved air quality: $24,081/year.
    - Improved property value associated with aesthetics: $164,208.
8. Total replacement cost for all trees is $4,849,695.

Distribution of Trees by Location

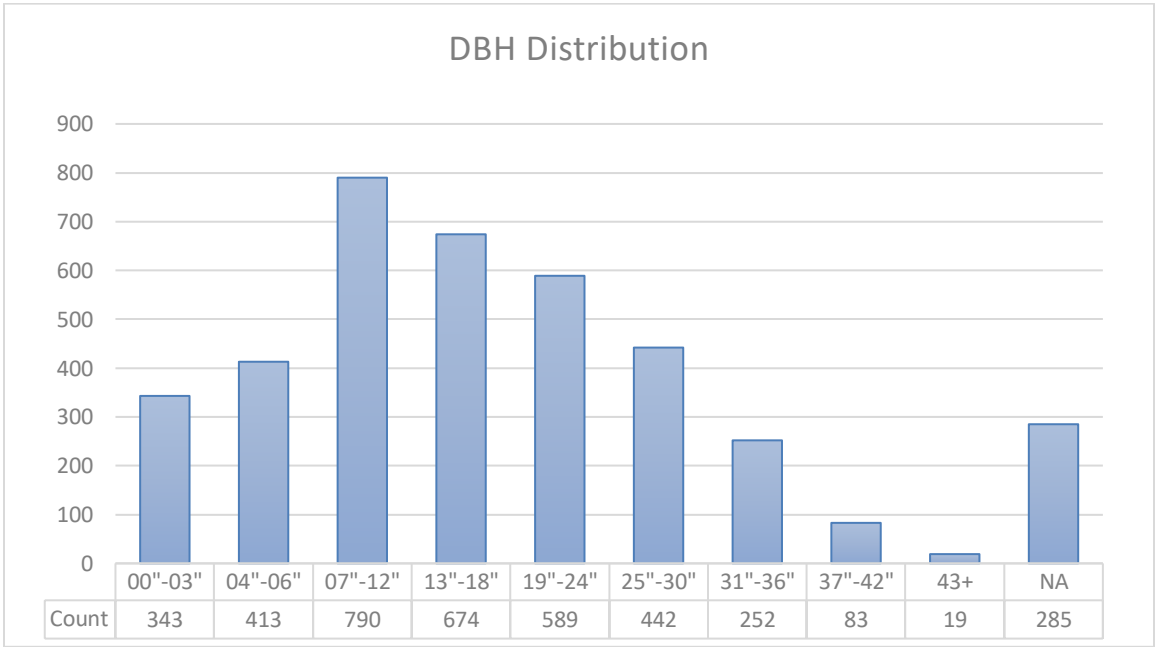
The table below provides a summary of the number of trees recorded in each park.

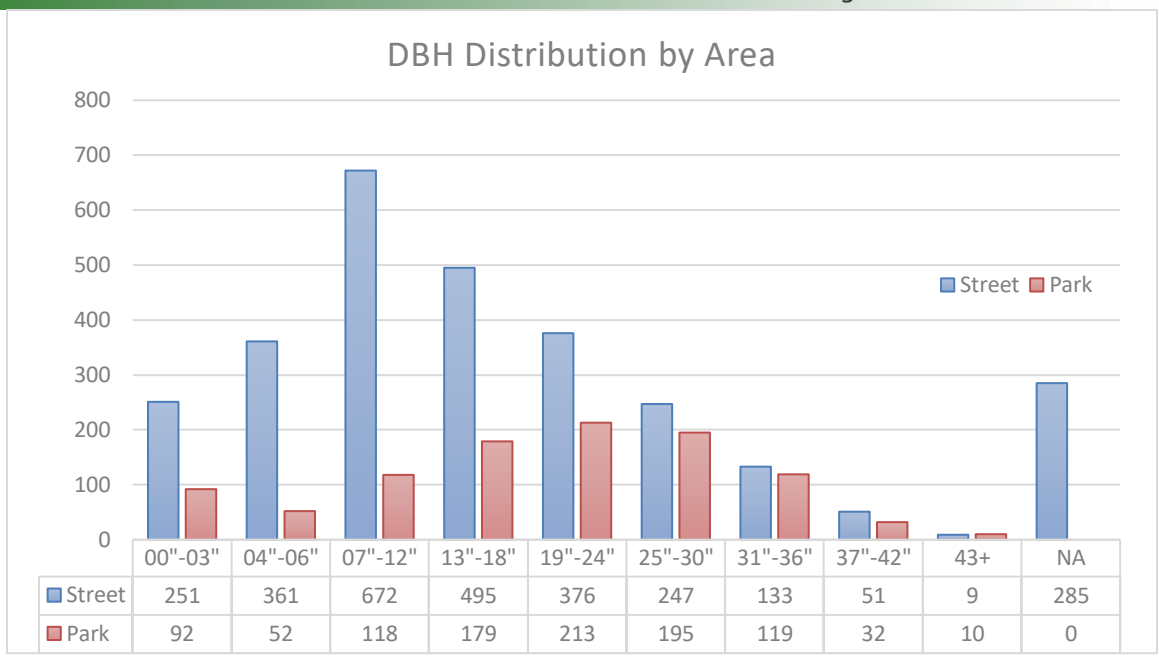
Park	Count	%
Bicentennial Park	29	2.9%
Bond Park	20	2.0%
Griffin Park	16	1.6%
Hayes Park	47	4.7%
Laylin Park	72	7.1%
Lee Austin Park	18	1.8%
Maple Grove Cemetery	391	38.7%
Rayner Park	417	41.3%
Total	**1,010**	



Size Characteristics

The general size of a tree provides insight into the age and value of the tree as well as the overall age of the urban forest. There are two industry-wide recognized size characteristics, height and diameter at breast height. Diameter at breast height (DBH) is determined by the diameter of the tree at 4.5 feet above grade. DBH range distribution can be used to analyze the relative age distribution of an urban forest. This allows a city to adjust their planting plans to ensure that there are enough young trees to replace aging and over-mature trees. It is important that all age classes are adequately represented throughout the urban forest to ensure a healthy, vibrant tree canopy for future generations.





	00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+	NA
Street	251	361	672	495	376	247	133	51	9	285
Park	92	52	118	179	213	195	119	32	10	0

Tree Condition

Good – The tree has no major structural problems; no significant damage from diseases or pests; no significant mechanical damage; a full, balanced crown, and normal twig condition and vigor for its species.

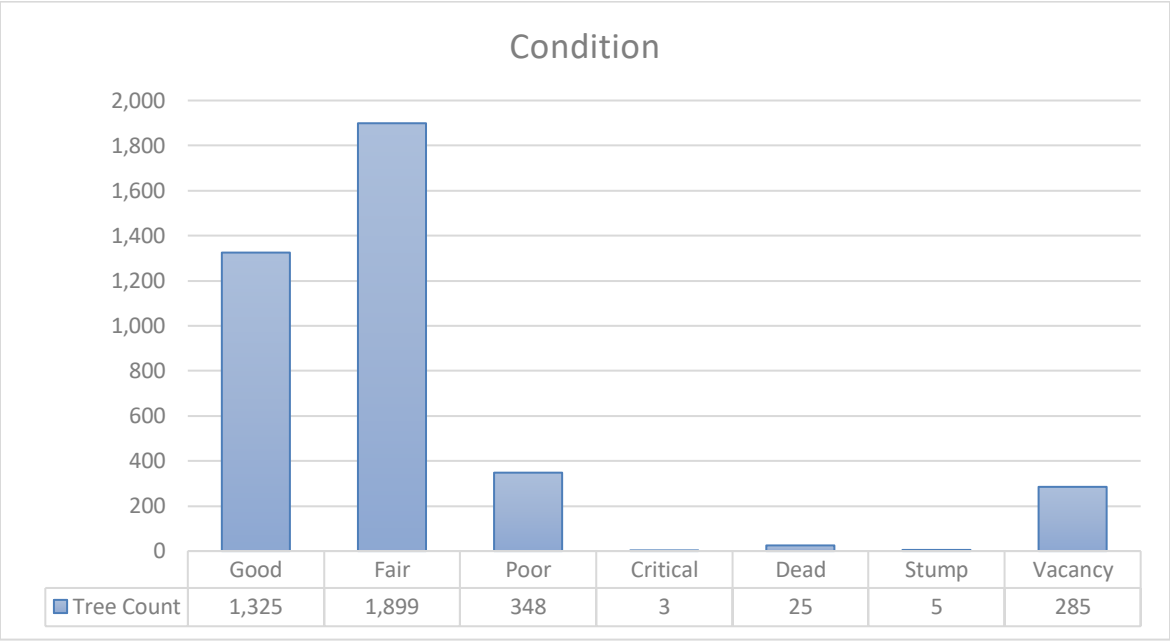
Tree Condition	Tree Count	%
Good	1,325	34.1%
Fair	1,899	48.8%
Poor	348	8.9%
Critical	3	0.1%
Dead	25	0.6%
Stump	5	0.1%
Vacancy	285	7.3%
Total	**3,890**	

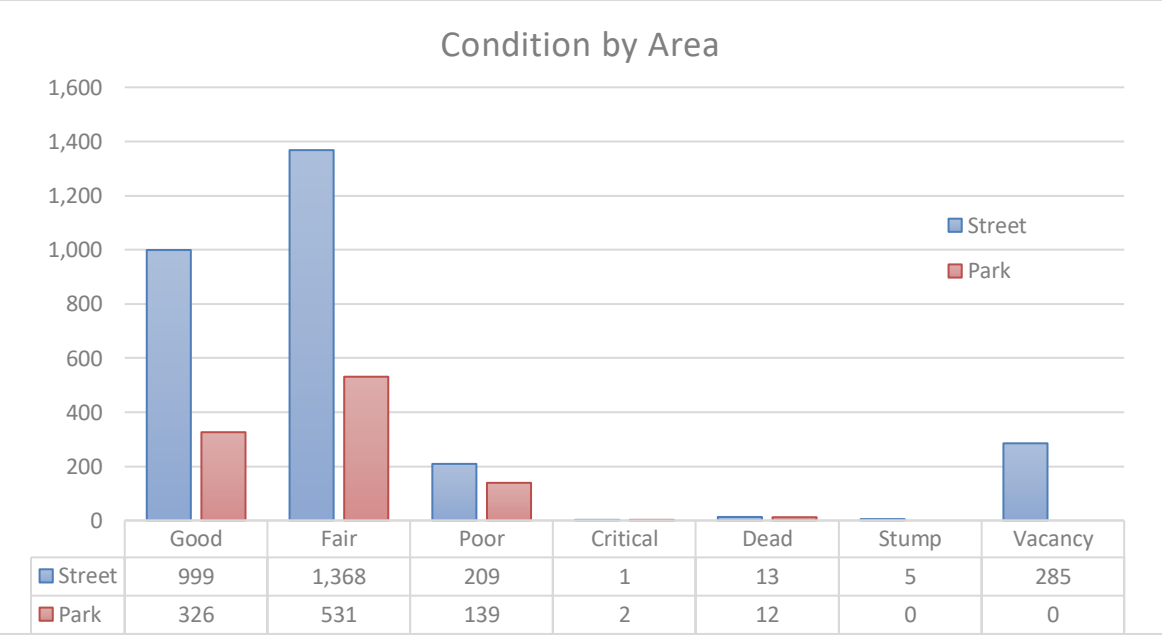
Fair – The tree may exhibit the following characteristics: minor structural problems and/or mechanical damage; significant damage from non-fatal or disfiguring diseases; minor crown imbalance or thin crown; minor structural imbalance; or stunted growth compared to adjacent trees.

Poor – The tree appears healthy but may have structural defects. This classification also includes healthy trees that have unbalanced structures or have been topped. Trees in this category may also have severe mechanical damage, decay, severe crown dieback or poor vigor/failure to thrive.

Critical – The tree is in a physical state that requires immediate attention. Generally, these trees are recommended for a Priority One Removal.

Dead – Trees in advanced states of decline are not included. This category refers only to dead trees.


Condition
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Good
Fair
Poor
Critical
Dead
Stump
Vacancy
Tree Count
1,325
1,899
348
3
25
5
285


Condition by Area
1,600
1,400
1,200
1,000
800
600
400
200
0
Street
Park
Good
Fair
Poor
Critical
Dead
Stump
Vacancy
Street
999
1,368
209
1
13
5
285
Park
326
531
139
2
12
0
0

Recommended Maintenance

Recommended Maintenance	Tree Count	%
Priority 1 Prune	93	2.4%
Priority 1 Removal	32	0.8%
Priority 2 Prune	423	10.9%
Priority 2 Removal	70	1.8%
Priority 3 Removal	30	0.8%
Routine Prune	2331	59.9%
Training Prune	621	16.0%
Stump Removal	5	0.1%
Plant Tree	285	7.3%
Total	**3,890**	

Priority 1 Prune - Trees that require priority one pruning are recommended for trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter.

Priority 1 Removal - Trees designated for removal have defects that cannot be cost- effectively or practically treated. The majority of the trees in this category will have a large percentage of dead crown and pose an elevated level of risk for failure. Any hazards that could be seen as potential dangers to persons or property and seen as potential liabilities would be in this category. Large dead and dying trees that are high liability risks are included in this category. These trees are the first ones that should be removed.

Priority 2 Prune - These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards.

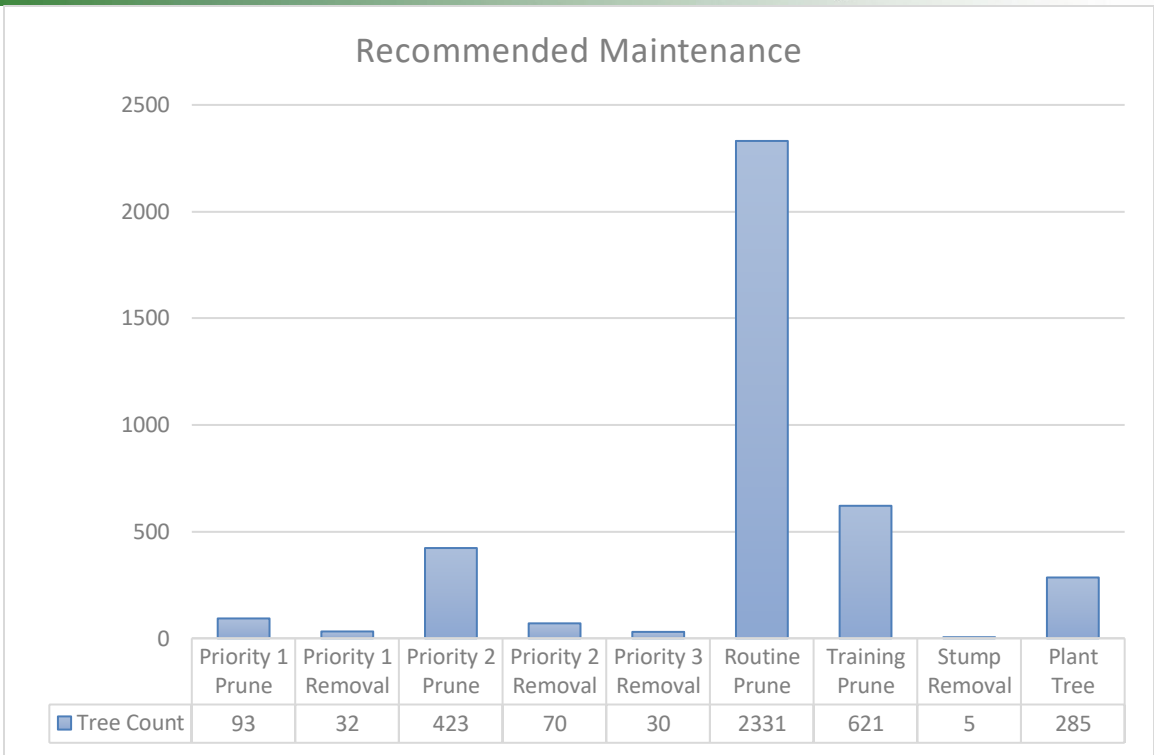
Priority 2 Removal - Trees that should be removed but do not pose a liability as great as the first priority will be identified here. This category would need attention as soon as "Priority One" trees are removed.

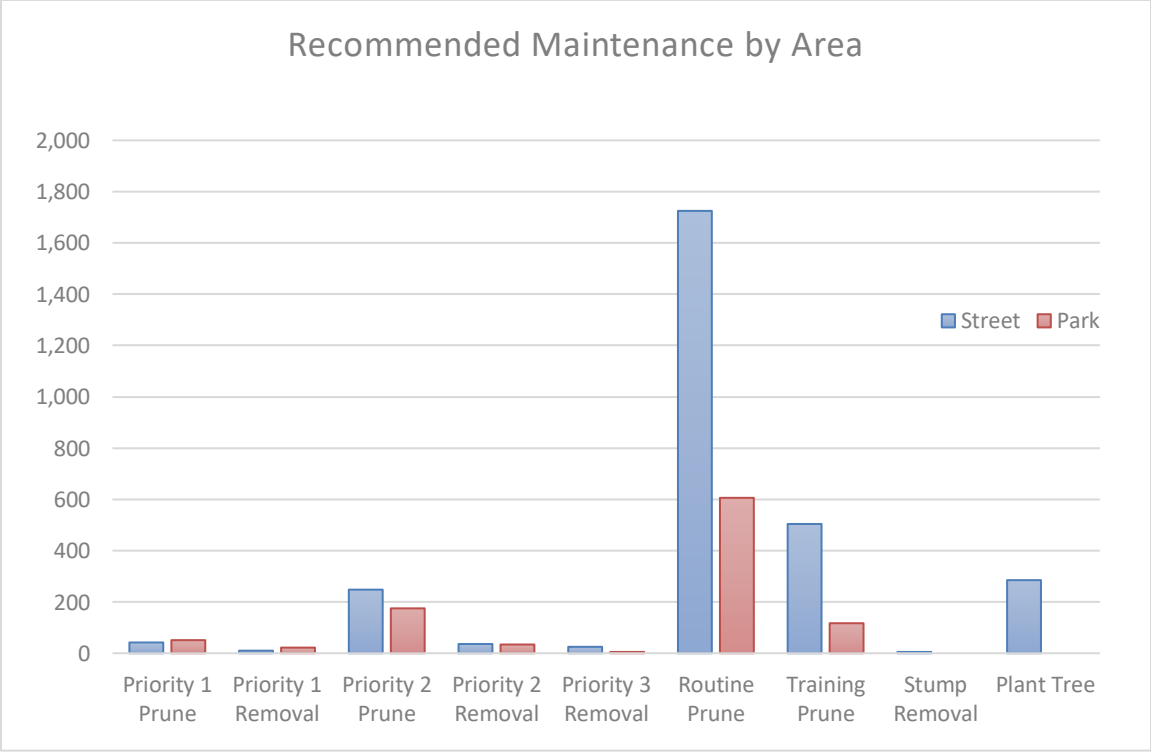
Priority 3 Removal – Trees that should be removed but pose little to no risk. These are typically new plantings that have died or trees in poor locations that are not a high priority removal.

Routine Prune - These trees require routine horticultural pruning to correct structural problems or growth patterns, which would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket truck access or manual climbing.

Training Prune - Young, large-growing trees that are still small must be pruned to correct or eliminate weak, interfering, or objectionable branches in order to minimize future maintenance requirements. These trees, up to 20 feet in height, can be worked with a pole-pruner by a person standing on the ground.

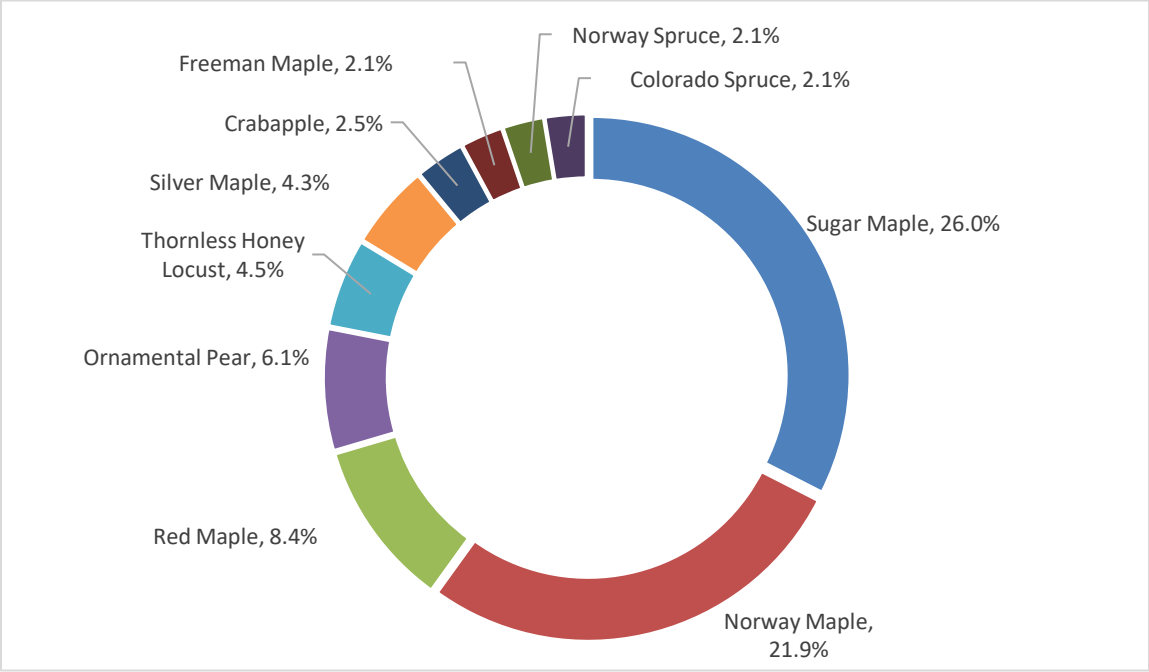
Stump Removal - This category indicates a stump that should be removed.


Recommended Maintenance
2500
2000
1500
1000
500
0
Priority 1 Prune
Priority 1 Removal
Priority 2 Prune
Priority 2 Removal
Priority 3 Removal
Routine Prune
Training Prune
Stump Removal
Plant Tree
Tree Count
93
32
423
70
30
2331
621
5
285


Recommended Maintenance by Area
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Street
Park
Priority 1 Prune
Priority 1 Removal
Priority 2 Prune
Priority 2 Removal
Priority 3 Removal
Routine Prune
Training Prune
Stump Removal
Plant Tree

Species and Distribution

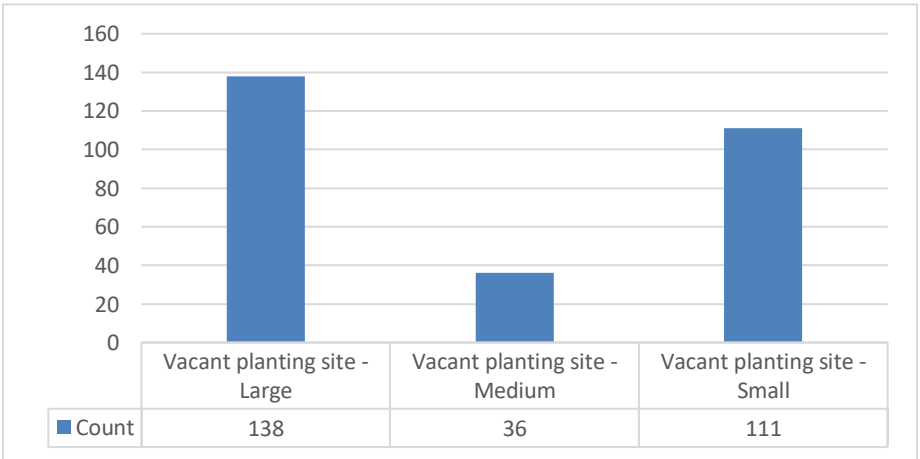
Below are the top 10 species for the City of Mason.



Vacant Sites

During the inventory, a total of 285 vacant sites were recorded in areas that were suitable for planting new trees. Vacant sites were broken down into three categories based on the size of planting space.

- Small Vacant Site – 4'to 6' planting space or any vacant site under electric utilities
- Medium Vacant Site – 6' to 8' planting space
- Large Vacant Site – 8'+ planting space



Benefits of a Healthy Urban Forest

Trees provide a host of environmental, social, and economic benefits in urban areas. When properly maintained, trees can reduce pollution, improve mental health, and lower energy costs. It is important to understand the benefits trees provide as they can offset the cost associated with tree maintenance. A properly implemented tree maintenance program will maximize tree benefits in the urban setting, allowing trees to provide benefits that meet or exceed the time and money invested in maintenance activities.

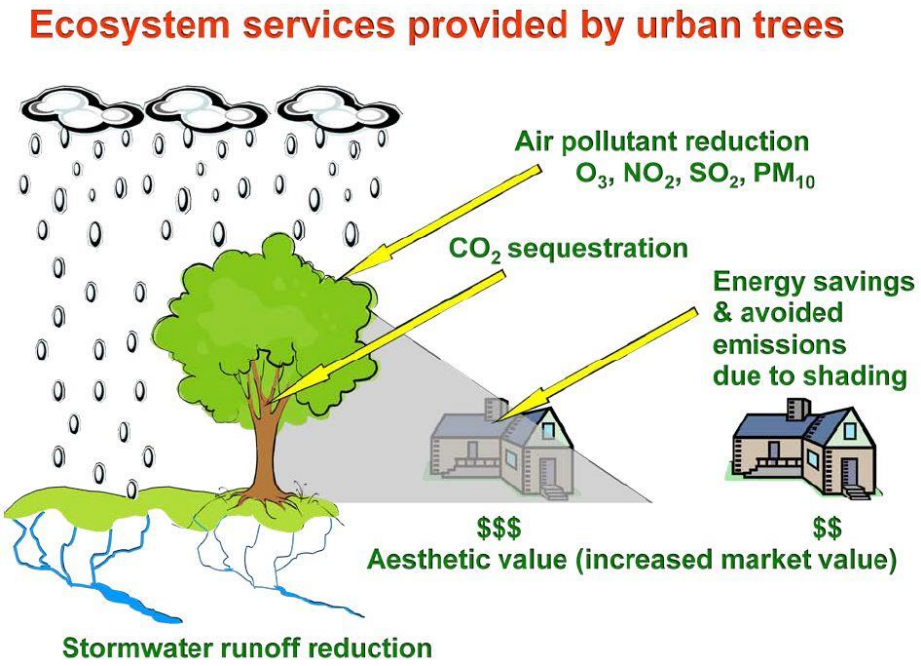
The i-Tree Streets application was used to quantify the benefits provided by New Orleans' trees. This application uses growth and benefit models designed around predominant urban trees to calculate the specific benefits that trees provide in dollar amounts. The benefits calculated by i-Tree Streets include energy conservation, air quality improvements, carbon dioxide (CO_2) reduction, stormwater control, and aesthetic/other. It creates annual benefit reports that demonstrate the value urban trees provide to the surrounding community.

The trees in Mason provide a total of **$550,221 in annual benefits**.

- **$370,276** in annual benefits are from **Street Trees**
- **$179,944** in annual benefits are from **Park Trees**

The total replacement cost for all trees is **$4,849,695.**

- **$3,160,159** is the replacement value for **Street Trees**
- **$1,689,536** is the replacement value for **Street Trees**



Energy Conservation

Public trees contribute to energy conservation by providing shade that reduces cooling costs in the summer and diverting wind to reduce heating costs in the winter. The savings in electricity and natural gas are converted into monetary values to illustrate the annual energy savings that trees provide. The trees in Mason account for a savings of $147,976 in energy consumption each year.

Zone	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Avg. $/Tree
Park Trees	223.45	16,959.85	30,837.16	30,220.42	47,180.27	46.71
Street Trees	477.69	36,256.95	65,856.31	64,539.18	100,796.13	38.92
Total	701.14	53,216.80	96,693.47	94,759.60	147,976.40	41.10

Air Quality

Trees improve air quality by removing a number of pollutants from the atmosphere, including ozone, nitrogen dioxide, and particulate matter. The estimated value of pollutants removed by the inventoried tree population each year is $24,081.

Zone	Total Deposition ($)	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Avg. $/tree
Park Trees	2,390.16	6,651.44	- 392.18	- 1,470.68	2,751.04	7,570.91	7.50
Street Trees	3,823.44	14,219.14	- 408.69	- 1,532.58	5,899.50	16,510.00	6.37
Citywide Total	6,213.59	20,870.58	- 800.87	- 3,003.26	8,650.54	24,080.91	6.69

Carbon Dioxide Sequestration

It is well known that trees absorb carbon dioxide and release oxygen into the atmosphere as a product of photosynthesis. Carbon absorbed during this process is ultimately stored in the wood of trees. The amount of carbon sequestered by the inventoried tree population is valued at $19,026 annually.

Zone	Sequestered (lb)	Sequestered ($)	Decomposition Release(lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Avg. $/tree
Park Trees	464,022.84	3,480.17	- 44,484.57	- 2,664.70	- 353.62	374,808.19	2,811.06	791,681.77	5,937.61	5.88
Street Trees	1,022,149.29	7,666.12	- 73,219.97	- 5,094.23	- 587.36	801,268.95	6,009.52	1,745,104.05	13,088.28	5.05
Citywide Total	1,486,172.13	11,146.29	- 117,704.53	- 7,758.93	- 940.98	1,176,077.15	8,820.58	2,536,785.82	19,025.89	5.28

Stormwater Control

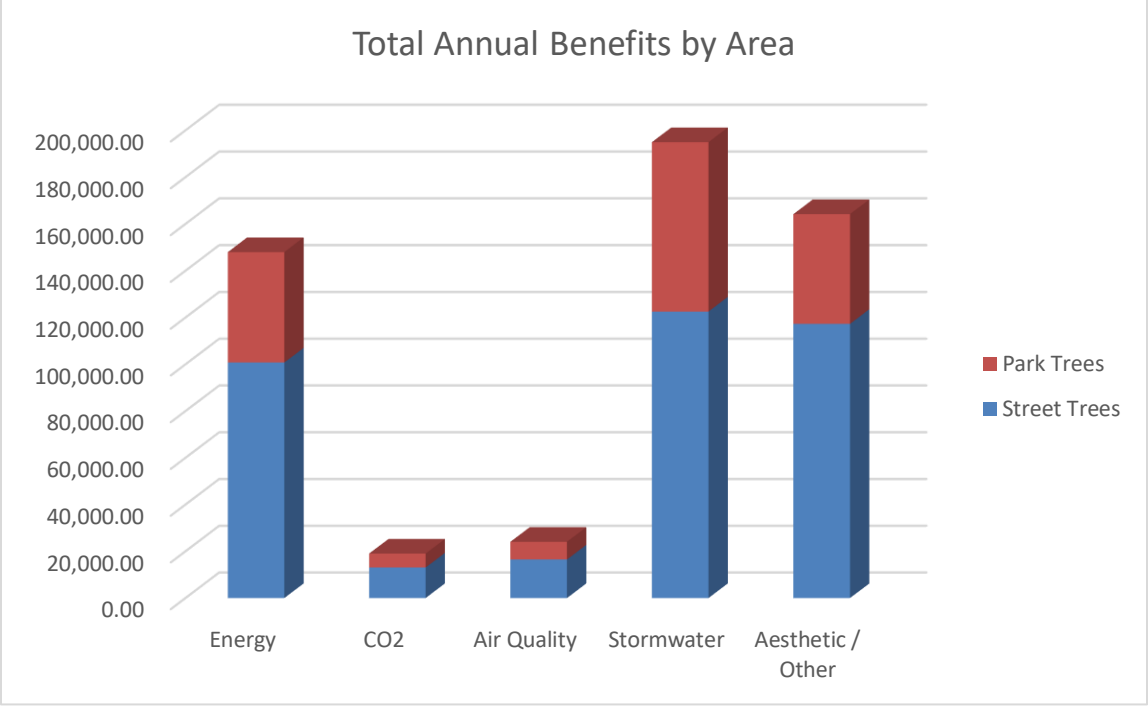
Trees reduce the costs associated with diverting stormwater by intercepting rainfall before it hits the ground and enters the storm runoff system. This greatly reduces the strain placed on public stormwater runoff systems and can represent a significant monetary savings by reducing the amount of infrastructure needed to divert stormwater throughout the city. The estimated savings for the City in the management of stormwater runoff is $194,930 annually.

Zone	Total rainfall interception(Gal)	Total ($)	Avg. $/tree
Park Trees	2,670,020.08	72,357.54	71.64
Street Trees	4,522,957.21	122,572.14	47.33
Citywide total	7,192,977.29	194,929.68	54.15

Aesthetic/Other

Trees provide many social and economic benefits that are classified as aesthetic/other in the i-Tree Streets application. The major economic benefit in this category is increased property values. Trees contribute to higher property values when compared to similar properties that do not have trees. The major social benefits provided by trees are lower crime rates, improved mental health, greater time spent in businesses with tree lined streets, and higher productivity in the workplace when a view of nature is available. The inventoried trees contribute $164,208 annually in aesthetic/other benefits.

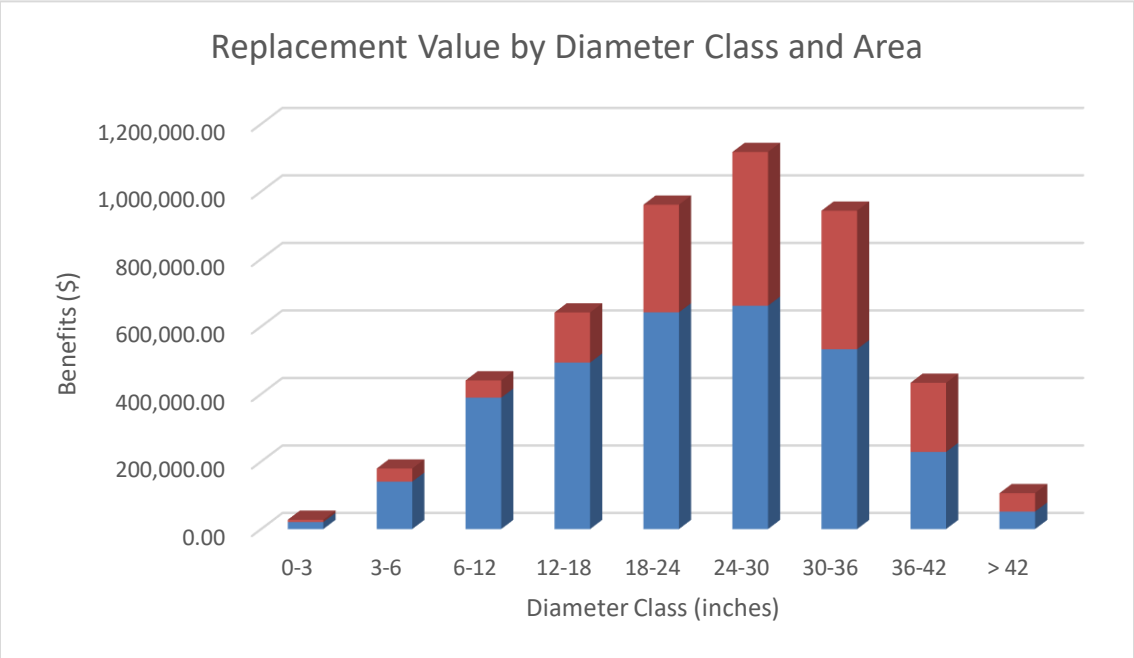
Zone	Total ($)	Avg $/tree
Park Trees	46,898.09	46.43
Street Trees	117,309.43	45.29
Citywide Total	164,207.52	45.61



Total Replacement Value

In addition to Environmental Benefits, the City can consider the Total Replacement Value for its urban forest. Total Replacement Value is the amount of money it would take to completely replace the existing urban forest with trees of the same size. While this is a scenario that will likely never happen, it gives the City a specific dollar value of its trees in their current state. Replacement value differs from Environmental Benefits in that it shows how much the trees are worth instead of the dollar values that they provide in benefits. For example, a mature sugar maple could provide $2,100 in environmental benefits by reducing stormwater runoff, improving air quality, etc. but the total cost of replacing an 18" DBH sugar maple would be $24,270. According to i-Tree Streets, the total replacement cost for Mason's trees is $4,849,695. The table below shows the breakdown of Replacement Value by Diameter Class.

DBH (inches)	Replacement Value
00"-03"	$27,650
04"-06"	$179,344
07"-12"	$440,388
13"-18"	$641,640
19"-24"	$960,919
25"-30"	$1,117,070
31"-36"	$942,968
37"-42"	$433,239
43+	$106,477
Total	**$4,849,695**



Below is a species frequency report for the entire inventory:

Botanical Name	Common Name	Count	%
Abies concolor	White Fir	2	0.1%
Acer campestre	Hedge Maple	2	0.1%
Acer negundo	Box Elder	8	0.2%
Acer palmatum	Japanese Maple	3	0.1%
Acer plantanoides	Norway Maple	790	20.3%
Acer rubrum	Red Maple	302	7.8%
Acer saccharinum	Silver Maple	153	3.9%
Acer saccharum	Sugar Maple	936	24.1%
Acer x freemanii	Freeman Maple	77	2.0%
Aesculus hippocastanum	Common Horsechestnut	6	0.2%
Ailanthus altissima	Tree of Heaven	5	0.1%
Amelanchier canadensis	Canadian Serviceberry	5	0.1%
Betula nigra	River Birch	7	0.2%
Betula papyrifera	Paper Birch	1	0.0%
Carpinus caroliniana	American Hornbeam	4	0.1%
Carya cordiformis	Bitternut Hickory	1	0.0%
Carya ovata	Shagbark Hickory	2	0.1%
Catalpa speciosa	Western Catalpa	7	0.2%
Celtis occidentalis	Common Hackberry	1	0.0%
Cercidiphyllum japonicum	Katsura Tree	2	0.1%
Cercis canadensis	Eastern Redbud	13	0.3%
Cornus florida	Eastern Dogwood	1	0.0%
Cornus kousa	Kousa Dogwood	1	0.0%
Crataegus crus-galli	Cockspur Thorn	8	0.2%
Crataegus crus-galli inermis	Thornless Hawthorn	16	0.4%
Fagus grandifolia	American Beech	1	0.0%
Fraxinus americana	White Ash	14	0.4%
Fraxinus excelsior	European Ash	1	0.0%
Fraxinus pennsylvanica	Green Ash	6	0.2%
Ginkgo biloba	Maidenhair Tree	16	0.4%
Gleditsia triacanthos forma inermis	Thornless Honey Locust	161	4.1%
Gymnocladus dioica	Kentucky Coffee Tree	1	0.0%
Juglans cinerea	Butternut	1	0.0%
Juglans nigra	Black Walnut	60	1.5%
Juglans regia	English Walnut	2	0.1%
Juniperus virginiana	Eastern Red Cedar	12	0.3%

Liquidambar styraciflua	American Sweet Gum	16	0.4%
Liriodendron tulipifera	Tulip Tree	12	0.3%
Magnolia x soulangiana	Saucer Magnolia	1	0.0%
Malus floribunda	Crabapple	90	2.3%
Morus alba	White Mulberry	22	0.6%
Morus alba 'Pendula'	Weeping Mulberry	1	0.0%
Picea abies	Norway Spruce	75	1.9%
Picea glauca	White Spruce	6	0.2%
Picea pungens	Colorado Spruce	75	1.9%
Pinus nigra	Austrian Black Pine	43	1.1%
Pinus strobus	White Pine	13	0.3%
Pinus sylvestris	Scotch Pine	52	1.3%
Platanus occidentalis	American Sycamore	35	0.9%
Populus deltoides	Cottonwood	8	0.2%
Prunus cerasifera	Purple-Leaf Plum	7	0.2%
Prunus serotina	Eastern Black Cherry	17	0.4%
Prunus serrulata	Japanese Flowering Cherry	16	0.4%
Prunus subhirtella 'Pendula'	Weeping Flowering Cherry	1	0.0%
Pseudotsuga menziesii	Douglas Fir	5	0.1%
Pyrus calleryana	Ornamental Pear	220	5.7%
Quercus alba	White Oak	1	0.0%
Quercus bicolor	Swamp White Oak	3	0.1%
Quercus imbricaria	Shingle Oak	1	0.0%
Quercus macrocarpa	Bur Oak	19	0.5%
Quercus palustris	Pin Oak	9	0.2%
Quercus robur	English Oak	47	1.2%
Quercus rubra	Red Oak	40	1.0%
Robinia pseudoacacia	Black Locust	1	0.0%
Sassafras albidum	Sassafras	2	0.1%
Sorbus americana	American Mountain Ash	1	0.0%
Stump	Stump	5	0.1%
Styphnolobium japonicum	Japanese Pagoda Tree	23	0.6%
Syringa reticulata	Japanese Tree Lilac	6	0.2%
Taxodium distichum	Bald Cypress	1	0.0%
Thuja occidentalis	American Arborvitae	10	0.3%
Tilia americana	American Linden	9	0.2%
Tilia cordata	Little-Leaf Linden	43	1.1%
Tsuga canadensis	Eastern Hemlock	1	0.0%
Ulmus americana	American Elm	17	0.4%
Ulmus pumila	Siberian Elm	17	0.4%
Ulmus x species	Hybrid Elm	2	0.1%

Vacant planting site - Large	Vacant planting site - Large	138	3.5%
Vacant planting site - Medium	Vacant planting site - Medium	36	0.9%
Vacant planting site - Small	Vacant planting site - Small	111	2.9%
Zelkova serrata	Sawleaf Zelkova	4	0.1%

Methodology – Site Numbering

During the inventory, trees were given addressing attributes to make them easier to locate in the field. Each tree is associated with a parcel's address as defined by the GIS shapefile provided by the City. In cases that the address in the field did not match the GIS layer, the visible field address was used. In addition to addressing, the field 'Side' was used to indicate whether a tree is at the front, side, or rear of the property. For example, if a tree is located on Holt St but the property address is 335 E Elm St, the trees would be on the side of the property.

Site numbers were also recorded for each property and follow the flow of traffic. Site numbers always begin at 1 for each side of a property and increase sequentially with the flow of traffic. The picture below illustrates how site numbers were used throughout the inventory.

Park Maps

Bicentennial Park Map

0 0 0.01 0.02 0.02 0.03
Miles

ArborPro
URBAN FOREST MANAGEMENT

Bond Park Map

0 0.010.01 0.02 0.03 0.04
Miles

ArborPro URBAN FOREST MANAGEMENT

Griffin Park Map

ArborPro
URBAN FOREST MANAGEMENT

Hayes Park Map

0 0.010.01 0.03 0.04 0.06
Miles

ArborPro URBAN FOREST MANAGEMENT

Laylin Park Map

ArborPro
URBAN FOREST MANAGEMENT

Austin Park Map

0 0 0.01 0.01 0.01 0.02
Miles

ArborPro
URBAN FOREST MANAGEMENT

Maple Grove Cemetery
Map 1

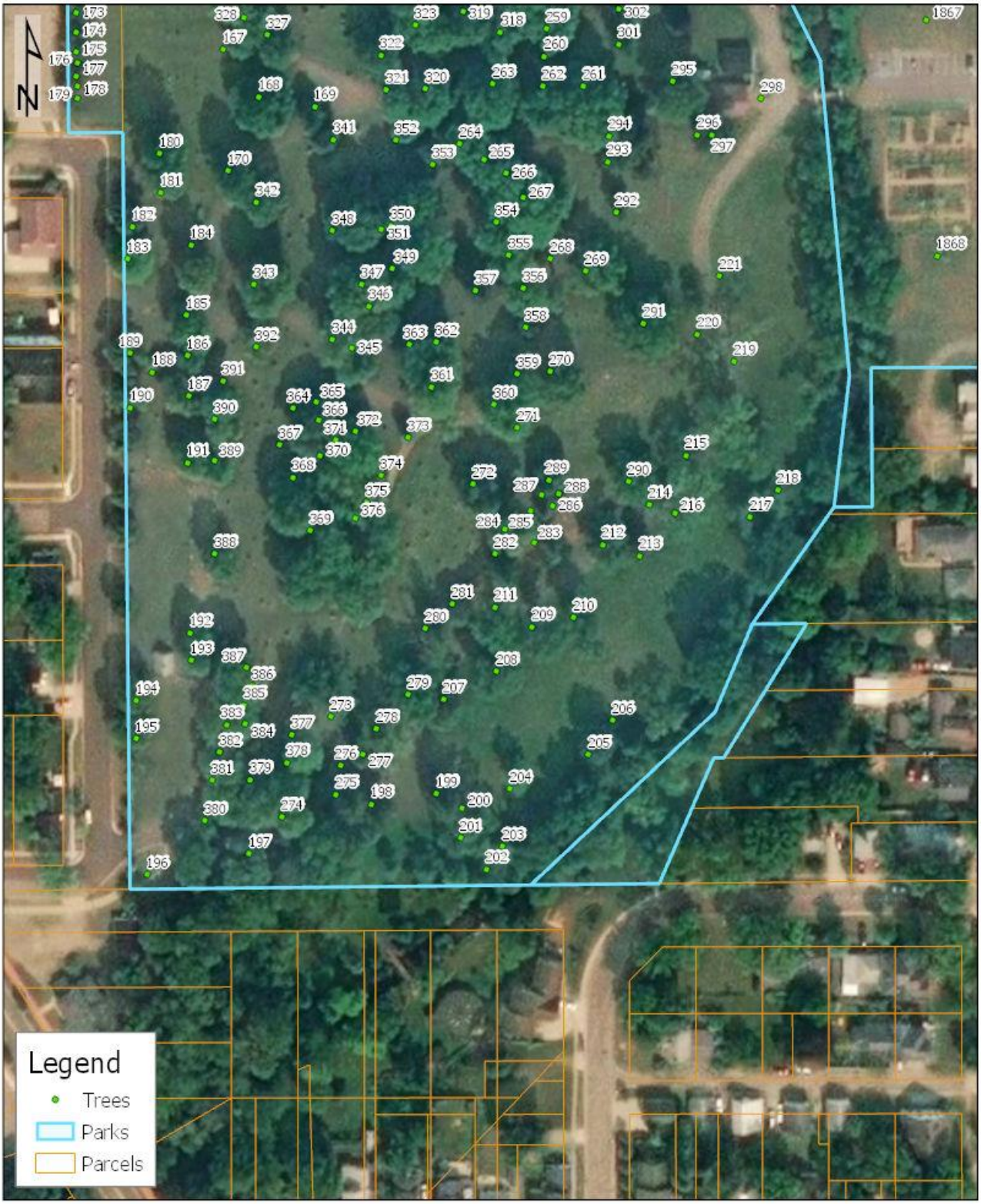
0 0.010.01 0.03 0.04 0.06
Miles

ArborPro
URBAN FOREST MANAGEMENT

Maple Grove Cemetery
Map 2

0 0.010.01 0.03 0.04 0.06
Miles

ArborPro
URBAN FOREST MANAGEMENT



Maple Grove Cemetery
Map 3

ArborPro URBAN FOREST MANAGEMENT

Rayner Park Map 1

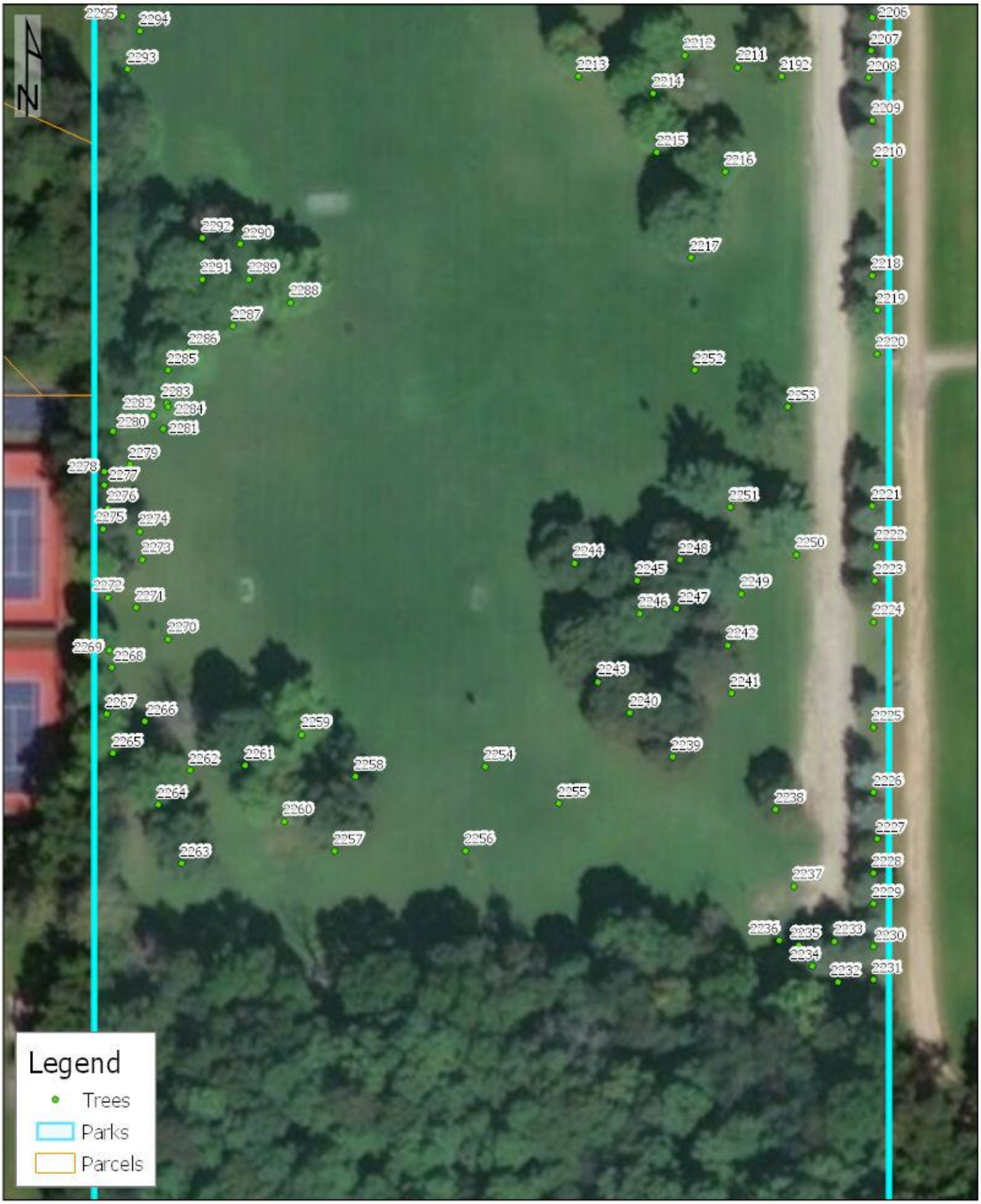
ArborPro
URBAN FOREST MANAGEMENT

Rayner Park Map 2

ArborPro URBAN FOREST MANAGEMENT

Rayner Park Map 3

ArborPro
URBAN FOREST MANAGEMENT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Legend
Trees
Parks
Parcels
Rayner Park Map 3
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Miles
ArborPro
URBAN FOREST MANAGEMENT