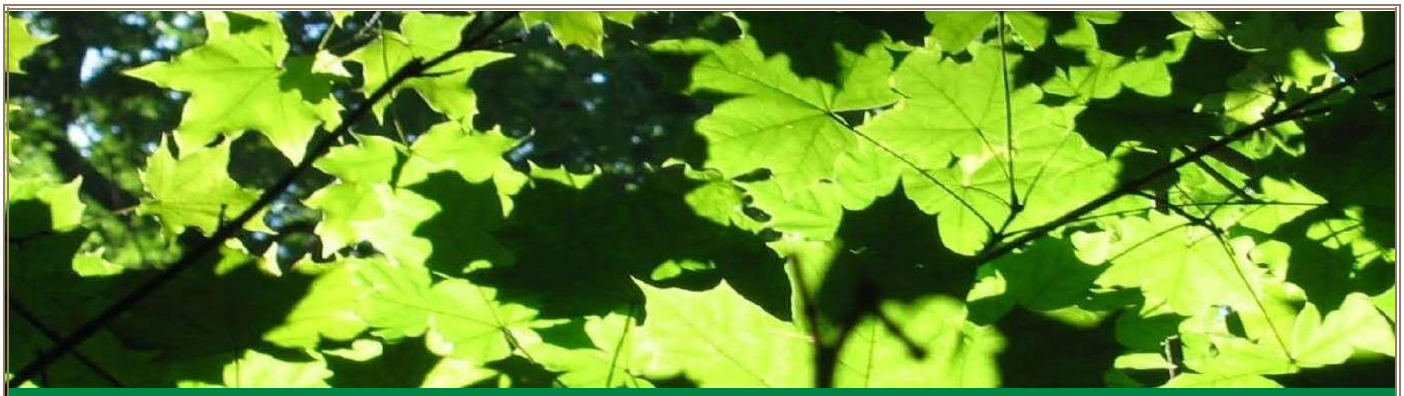

Tree Inventory Summary Report

City of Rock Hill, Missouri

April 2017

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Acknowledgments

The City of Rock Hill's vision to promote and preserve the urban forest and improve the management of public trees was a fundamental inspiration for this project. This vision will ensure canopy continuity, which will reduce stormwater runoff and improve air quality, public health, and aesthetic values.

Rock Hill is thankful for the grant funding it received from the Missouri Department of Conservation (MDC) in cooperation with the U.S. Forest Service through its Tree Resource Improvement and Maintenance (TRIM) cost-share program. The TRIM grant program is designed to encourage communities to create and support sustained and long-term urban and community forestry programs

Notice of Disclaimer: Inventory data provided by Davey Resource Group, a division of The Davey Tree Expert Company, are based on visual recording at the time of inspection. Visual records do not include individual testing or analysis, nor do they include aerial or subterranean inspection. Davey Resource Group is not responsible for the discovery or identification of hidden or otherwise non-observable hazards. Records may not remain accurate after inspection due to the variable deterioration of inventoried material. Davey Resource Group provides no warranty with respect to the fitness of the urban forest for any use or purpose whatsoever. Clients may choose to accept or disregard Davey Resource Group's recommendations or to seek additional advice. Important: know and understand that visual inspection is confined to the designated subject tree(s) and that the inspections for this project are performed in the interest of facts of the tree(s) without prejudice to or for any other service or any interested party.

Executive Summary

The City of Rock Hill commissioned an inventory and assessment of trees located within public street rights-of-way (ROW) and priority parks. Understanding an urban forest's structure, function, and value can promote management decisions that will improve public health and environmental quality. Davey Resource Group collected and analyzed the inventory data to understand species composition and tree condition and to generate maintenance recommendations. Tree values and benefits have been quantified using the i-Tree ECO benefits model (developed by the United States Department of Agriculture Forest Service in partnership with The Davey Tree Expert Company). In addition to providing the inventory results, this report will summarize benefits of the inventoried public tree population throughout Rock Hill.

Key Findings

- The structural value of the inventoried tree population is approximately $2.28 million.
- A total of 972 trees were inventoried, including 831 street trees and 141 park trees.
- The most common species are: *Acer rubrum* (red maple), 6%; *Pyrus calleryana* (Callery pear), 6%; *Quercus rubra* (northern red oak), 6%; *A. saccharinum* (silver maple), 5%; and *Cercis canadensis* (eastern redbud), 5%.
- The plurality (43%) of the urban forest is in the young, 0–8 inches diameter at breast height (DBH) class.
- The overall condition of the tree population is Good.
- Risk Ratings include: 942 Low Risk trees, 29 Moderate Risk trees, and 1 High Risk trees. There were 0 Extreme Risk trees.
- Primary Maintenance recommendations include: 815 Tree Cleans, 127 Young Tree Trains, and 30 Removals.
- Rock Hill's tree population provides approximately $7,260 in the following annual benefits:
    - *Air Quality*: 818 pounds of pollutants removed valued at $3,940 per year.
    - *Carbon Dioxide*: 10 tons valued at $1,360 per year.
    - *Stormwater:* 29,274 cubic feet valued at $1,960 per year.

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Section 1: Tree Inventory Assessment

Project Area

In March 2017, Davey Resource Group arborists assessed and inventoried trees along the public street rights-of-way (ROW) and in priority parks throughout the City of Rock Hill. See Appendix A for an overview of the site location methodology used in the inventory and assessment.

Species Diversity

Throughout Rock Hill, 972 trees were inventoried, including 831 street trees and 141 park trees. Figure 1 shows the composition of the most populous species compared to all inventoried species. The composition of a tree population should follow the 10-20-30 Rule for species diversity: a single species should represent no more than 10% of the urban forest, a single genus no more than 20%, and a single family no more than 30%.

No species exceeds the rule for species diversity. Of the species found in Rock Hill, *Acer rubrum* (red maple), *Pyrus calleryana* (callery pear), and *Quercus rubra* (northern red oak) are nearest to the threshold, comprising individually 6% of the total inventoried population.

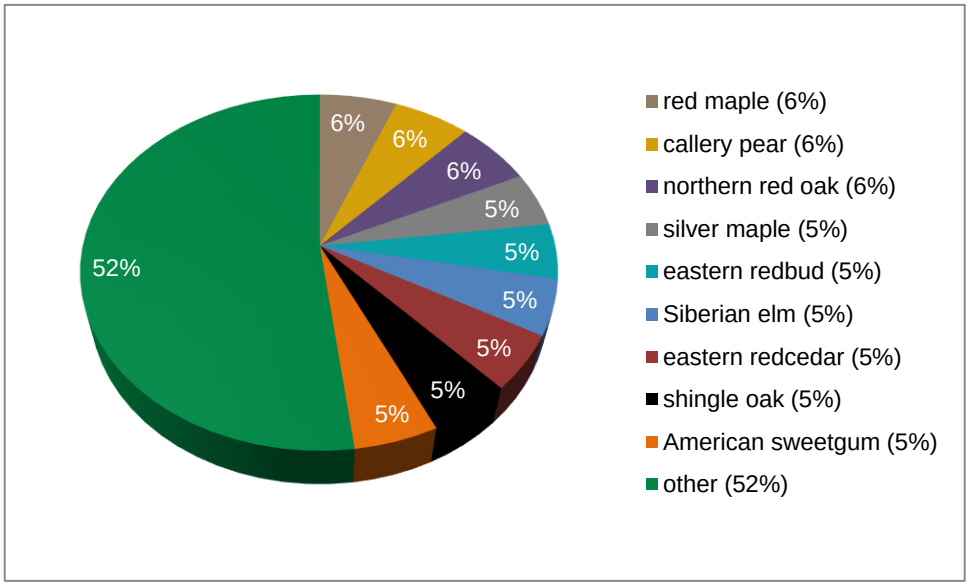
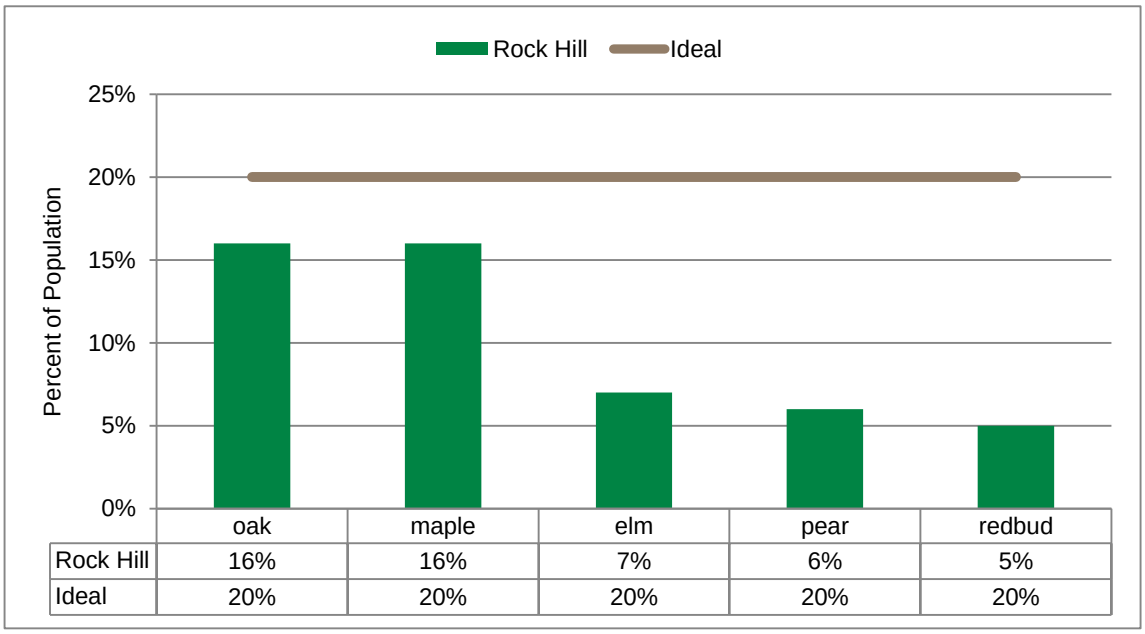


Figure 1. Tree species composition in Rock Hill, Missouri.

Figure 2 compares the percentages of the most common genera identified during the inventory to the 20% Rule. No genus exceeds the rule for genus diversity. Of the genera found in Rock Hill, *Quercus* (oak) and *Acer* (maple) are closest to the threshold. Oak and maple each represent 16% of the total inventoried population.



	oak	maple	elm	pear	redbud
Rock Hill	16%	16%	7%	6%	5%
Ideal	20%	20%	20%	20%	20%

Figure 2. Top five genera in Rock Hill, Missouri in relation to the 20% Rule.

Diameter Size Class Distribution

Analyzing the diameter size class distribution (measured as diameter at breast height [DBH]) provides an estimate of the relative age of a tree population and lends insight into maintenance practices and needs.

The inventoried trees were categorized into the following diameter size classes: young trees (0–8 inches DBH); established trees (9–17 inches DBH); maturing trees (18–24 inches DBH); and mature trees (greater than 24 inches DBH). These categories were chosen so that the population could be analyzed following Richards' ideal distribution (1983). Richards proposed an ideal diameter size class distribution for street trees based on observations of well-adapted trees in Syracuse, New York. Richards' ideal distribution suggests that the largest fraction of trees (approximately 40% of the population) should be young (less than 8 inches DBH), while a smaller fraction (approximately 10%) should fall in the large-diameter size class (greater than 24 inches DBH). A tree population with an ideal distribution would have an abundance of newly-planted and young trees, and lower numbers of established, maturing, and mature trees.

Figure 3 compares Rock Hill's inventoried public tree diameter size class distribution to the ideal proposed by Richards (1983). Rock Hill's distribution trends towards the ideal. Continued tree planting, care, and maintenance of the young and established tree population will help achieve a more sustainable size distribution of public trees in Rock Hill.

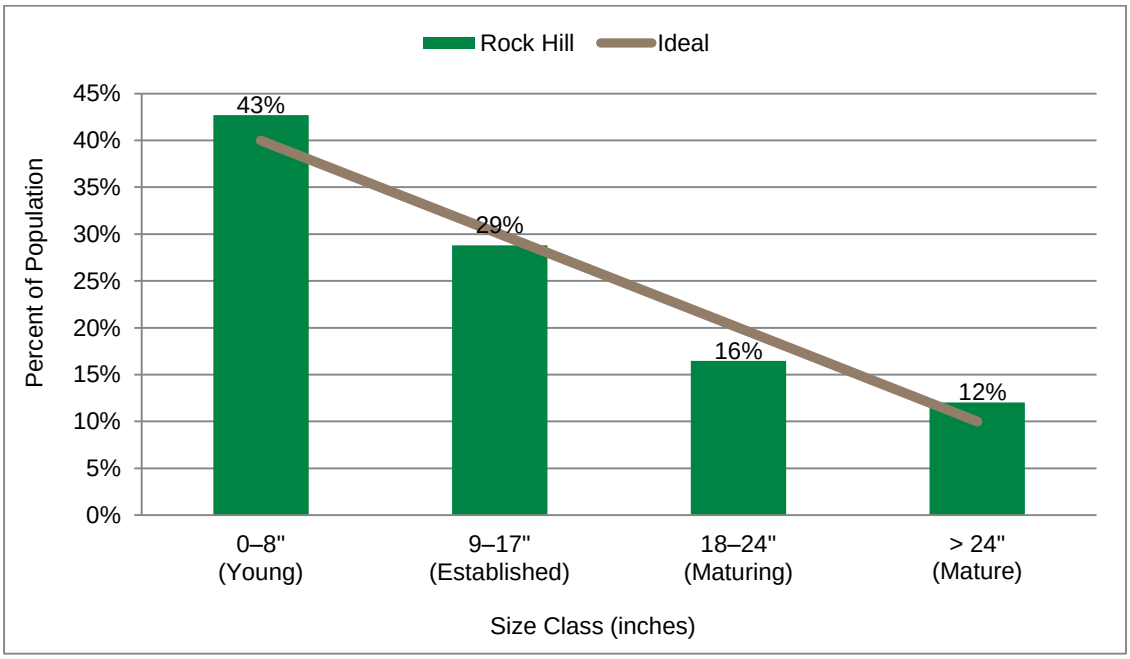


Figure 3. Age class distribution compared to Richards' (1983) ideal.

Condition

Several factors were considered for the condition of each tree, including: root characteristics, branch structure, trunk, canopy, foliage condition, and the presence of pests. The condition of each inventoried tree was rated Good, Fair, Poor, or Dead.

Most of the inventoried public trees were recorded to be in Good condition, 53% (Figure 4). Based on these data, the general health of the inventoried tree population is rated Good.

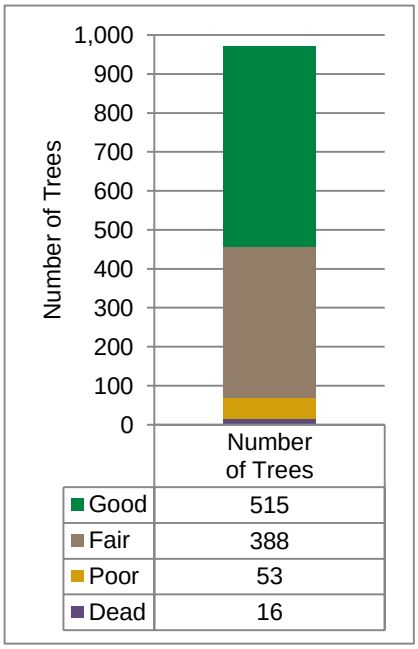


Figure 4. Overall condition of the inventoried population.

Figure 5 illustrates the general condition of the urban forest in relation to the relative age classes. The majority of young, established, and maturing were rated to be in Good condition. The majority of mature trees were rated to be in Poor or Dead condition. With proactive care and an established maintenance schedule, the city can improve the long-term health of its urban forest.

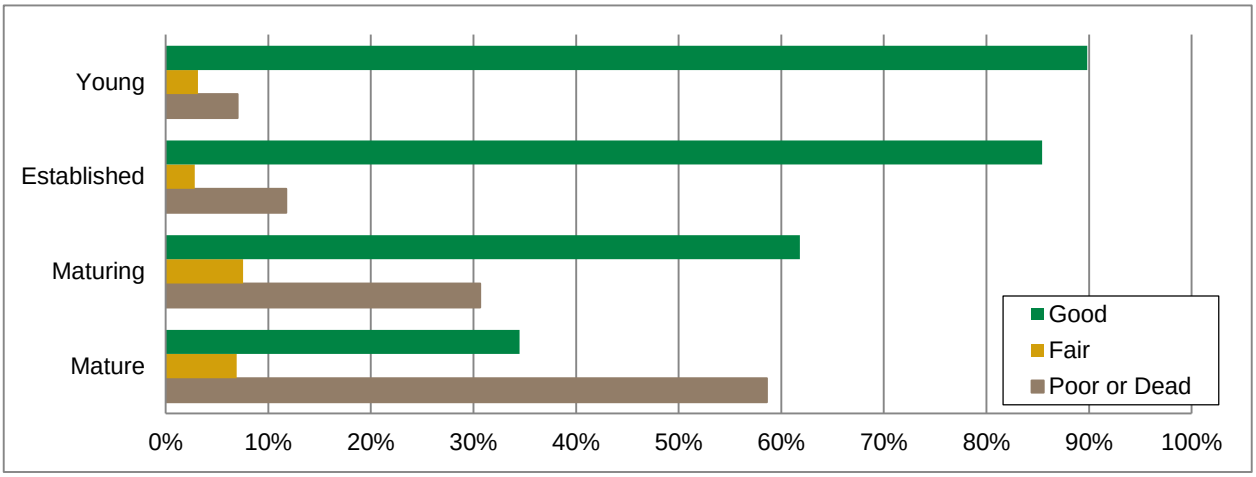


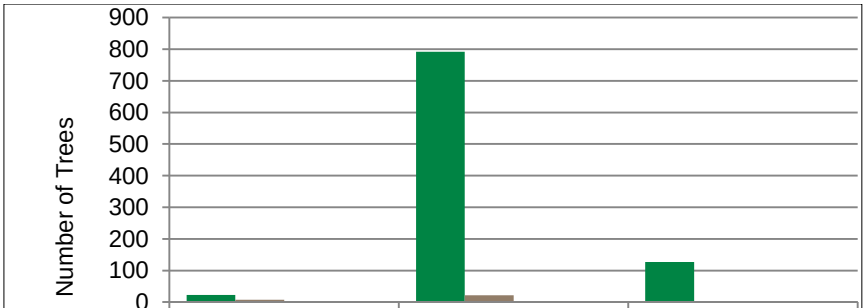
Figure 5. Tree condition by age class.

Primary Maintenance and Risk

Primary maintenance refers to the task identified for a tree or site: Removal, Tree Clean, or Young Tree Train. Risk is a graduated scale that measures potential tree-related hazardous conditions. A tree is considered hazardous when its potential risks exceed an acceptable level.

Davey Resource Group based the maintenance recommendations and risk values (Figure 6) on the evaluation of species, diameter class, condition, impact of hazard, and defects found in each individual tree. Identifying and ranking the maintenance needs of a tree population enable tree work to be assigned priority based on observed defects. Once prioritized, tree work can be systematically addressed to eliminate the greatest risk and liability first (Stamen 2011).

Based on the inventoried population in Rock Hill, the following maintenance recommendations should be implemented: 30 Removals, 815 Tree Cleans, and 127 Young Tree Trains. Figure 6 illustrates the risk values associated with each maintenance need.



	Removal	Tree Clean	Young Tree Train
Low	23	792	127
Moderate	7	22	0
High	0	1	0
Extreme	0	0	0

Figure 6. Maintenance needs by risk rating.

i-Tree Structure and Function Values

The i-Tree ECO application was used to assess the inventoried trees. This management and analysis tool uses tree inventory data to quantify the dollar value of a tree based on the cost of having to replace a tree with a similar tree. The tool also quantifies the annual environmental and aesthetic benefits provided by trees, including energy conservation, air quality improvement, carbon dioxide (CO_2) reduction, stormwater control, and increases in property value. The tool creates annual benefit reports that reflect the value public trees provide to a community.

The inventoried urban forest of Rock Hill provides a structural value of approximately $2.28 million and a total annual benefit of approximately $7,260 in overall air quality improvement, carbon dioxide removal, and stormwater reduction. More detailed information about annual benefit analysis reports can be found in Appendix B.

Table 1 provides a breakdown of the annual benefits provided to Rock Hill.

Table 1. Annual Benefits Provided by Inventoried Tree Population

Benefits	Annual Unit	Annual Value Total	Percent of Total
Air Quality	818 pounds	$3,940	54%
Carbon Dioxide	10 tons	$1,360	19%
Stormwater	29,274 cubic feet	$1,960	27%
Public Trees Total		**$7,260**	**100**

Conclusion and Recommendations

Managing trees in urban areas can be complicated. Navigating the recommendations of experts, the needs of residents, the pressures of local economics and politics, concerns for public safety and liability, physical components of trees, forces of nature and severe weather events, and the expectation that these issues are resolved all at once is a considerable challenge.

Rock Hill must carefully consider these challenges to fully understand the needs of maintaining an urban forest. By completing a tree inventory, the city has shown interest in preserving the urban forest, but also maintaining it for future generations. If the city successfully implements established planting and maintenance programs that include Tree and Stump Removal, Young Tree Training, Routine Pruning, Tree Cleaning, and public outreach, the health and safety of Rock Hill's trees and residents will be maintained for years to come.

Rock Hill's urban forest is in Good condition, has a structural value of $2.28 million, and provides approximately $7,260 in annual benefits. With continued dedication to its public tree resource, the city can improve the condition and diversity of its trees and increase the annual benefits they provide.

Glossary

Air Quality Report: The i-Tree Eco Air Quality Report quantifies the air pollutants (ozone [O_3], nitrogen dioxide [NO_2], sulfur dioxide [SO_2], coarse particulate matter less than 10 micrometers in diameter [PM_{10}]) deposited on tree surfaces, and reduced emissions from power plants (NO_2, PM_{10}, Volatile Oxygen Compounds [VOCs], SO_2) due to reduced electricity use measured in pounds (lbs.). Also reported are the potential negative effects of trees on air quality due to Biogenic Volatile Organic Compounds (BVOC) emissions.

arboriculture: The art, science, technology, and business of commercial, public, and utility tree care.

canopy: Branches and foliage that make up a tree's crown.

Carbon Dioxide Report: The i-Tree Eco Carbon Dioxide Report presents annual reductions in atmospheric CO_2 due to sequestration by trees and reduced emissions from power plants due to reduced energy use in pounds. The model accounts for CO_2 released as trees die and decompose and CO_2 released during the care and maintenance of trees.

community forest: see **urban forest**.

condition (data field): The general health assigned to each inventoried tree according to the following categories adapted from the International Society of Arboriculture's rating system: Good, Fair, Poor, Dead.

diameter at breast height (DBH): See **tree size**.

diameter: See **tree size**.

Extreme Risk tree: The Extreme Risk category applies in situations where tree failure is imminent and there is a high likelihood of impacting the target, and the consequences of the failure are "severe." In some cases, this may mean immediate restriction of access to the target zone area to avoid injury to people.

genus: A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature, the genus name is either used as a standalone term or is followed by a Latin adjective or epithet to form the name of a species.

High Risk tree: The High Risk category applies when consequences are "significant" and likelihood is "very likely" or "likely," or consequences are "severe" and likelihood is "likely." In a population of trees, the priority of High Risk trees is second only to Extreme Risk trees.

inventory: See **tree inventory**.

i-Tree Eco: i-Tree Eco is a tree management and analysis tool that uses tree inventory data to quantify the dollar value of annual environmental and aesthetic benefits: energy conservation, air quality improvement, CO_2 reduction, and stormwater control.

i-Tree Tools: State-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. The i-Tree Tools software helps communities of all sizes to strengthen their urban forest management and advocacy efforts by quantifying the structure of community trees and the environmental services that trees provide.

Low Risk tree: The Low Risk category applies when consequences are "negligible" and likelihood is "unlikely"; or consequences are "minor" and likelihood is "somewhat likely." Some trees with this level of risk may benefit from mitigation or maintenance measures, but immediate action is not usually required.

Moderate Risk tree: The Moderate Risk category applies when consequences are "minor" and likelihood is "very likely" or "likely"; or likelihood is "somewhat likely" and consequences are "significant" or "severe." In populations of trees, Moderate Risk trees represent a lower priority than High or Extreme Risk trees.

monoculture: A population dominated by one single species or very few species.

Primary Maintenance Need (data field): The type of tree work needed to reduce immediate risk.

pruning: The selective removal of plant parts to meet specific goals and objectives.

Removal (Primary Maintenance Need): Trees designated for removal have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category have a large percentage of dead crown. All trees with safety risks that could be seen as potential threats to persons or property and seen as potential liabilities to the client would be in this category. This category includes large dead and dying trees that are high-liability risks as well as those that pose minimal liability to persons or property (such as trees in poor locations or undesirable species).

right-of-way (ROW): See **street right-of-way**.

risk: Combination of the probability of an event occurring, along with its consequence.

risk assessment (data fields): Level 2 qualitative risk assessment will be performed based on the ANSI A300 (Part 9) and the companion publication Best Management Practices: Tree Risk Assessment, published by the International Society of Arboriculture (2011). Trees can have multiple failure modes with various risk ratings. One risk rating per tree will be assigned during the inventory. The failure mode having the greatest risk will serve as the overall tree risk rating.

risk rating: The overall risk rating of the tree determined by combining the likelihood of tree failure impacting a target and the consequence of failure.

species: Fundamental category of taxonomic classification, ranking below a genus or subgenus, and consisting of related organisms capable of interbreeding.

stem: A woody structure bearing buds and foliage, and giving rise to other stems.

Stored Carbon Report: The i-Tree Eco Stored Carbon Report tallies all of the Carbon (C) stored in the urban forest over the life of the trees as a result of sequestration measured in pounds as the CO_2 equivalent.

Stormwater Report: A report generated by i-Tree Eco that presents the reductions in annual stormwater runoff due to rainfall interception by trees, as measured in gallons (cubic feet).

Structural Value: The value of a tree bease on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree).

street name (data field): The name of a street right-of-way or road identified using posted signage or parcel information.

street right-of-way (ROW): A strip of land generally owned by a public entity over which facilities, such as highways, railroads, or power lines, are built.

street tree: A street tree is defined as a tree within the right-of-way.

structural defect: A feature, condition, or deformity of a tree or tree part that indicates weak structure and contributes to the likelihood of failure.

Sulfur Dioxide (SO_2): A strong-smelling, colorless gas that is formed by the combustion of fossil fuels. Sulfur dioxide contributes to the problem of acid rain.

tree: A tree is defined as a perennial woody plant that may grow more than 20 feet tall. A tree generally has one main stem, although many species may grow as multi-stemmed forms.

tree benefit: An economic, environmental, or social improvement that benefits the community and results mainly from the presence of a tree. A benefit contains real or intrinsic value.

Tree Clean (Primary Maintenance Need): These trees require selective removal of dead, diseased, dying, and/or broken wood, greater than 2 inches in diameter to minimize potential risk. Priority of work should be dependent upon the risk associated with the individual trees.

tree inventory: Comprehensive database containing information or records about individual trees typically collected by an arborist.

tree size (data field): A tree's diameter measured to the nearest inch in 1-inch size classes at 4.5 feet above ground, also known as diameter at breast height (DBH) or diameter.

urban forest: All of the trees within a municipality or a community. This can include the trees along streets or rights-of-way, in parks and greenspaces, in forests, and on private property.

Young Tree Train (Primary Maintenance Need): These are young trees that must be pruned to correct or eliminate weak, interfering, or objectionable branches in order to minimize future maintenance requirements. Generally, these trees may be up to 20 feet in height and can be worked with a pole pruner by a person standing on the ground.

References

American National Standards Institute. 2011. *ANSI A300 (Part 9)–2011, American National Standard for Tree Care Operations—Tree, Shrub, and Other Woody Plant Management Standard Practices (Tree Risk Assessment a. Tree Structure Assessment).* Londonderry: Tree Care Industry Association, Inc.

Richards, N.A. 1983. "Diversity and Stability in a Street Tree Population." *Urban Ecology* 7(2):159–171.

Stamen, R.S. "Understanding and Preventing Arboriculture Lawsuits." Presented at the Georgia Urban Forest Council Annual Meeting, Madison, Georgia, November 2–3, 2011.

Appendix A
Data Collection and Site Location Methods

Data Collection Methods

Davey Resource Group collected tree inventory data using a proprietary data collection program (Rover) loaded onto pen-based field computers equipped with geographic information system (GIS) and global positioning system (GPS) receivers. The knowledge and professional judgment of Davey Resource Group's arborists ensure the high quality of inventory data.

Data fields are defined in the glossary of the management plan. At each site, the following data fields were collected:

- aboveground utilities
- clearance requirements
- condition
- further inspection
- location
- primary maintenance needs
- mapping coordinates
- mapping coordinates
- notes
- risk assessment
- risk rating
- species
- tree size*

* measured in inches in diameter at 4.5 feet above ground (or diameter at breast height [DBH])

Maintenance needs are based on *ANSI A300 (Part 1)* (ANSI 2008). Risk assessment and risk rating are based on *Best Management Practices: Tree Risk Assessment* (International Society of Arboriculture [ISA] 2011).

The data collected were provided in an ESRI® shapefile, Access™ database, Microsoft Excel™ spreadsheet, and i-Tree ECO on a CD-ROM that accompanies this plan.

Site Location Methods

Equipment and Base Maps

Inventory arborists use CF-19 Panasonic Toughbook® unit(s) with built-in GPS receiver(s).

Base map layers were loaded onto these unit(s) to help locate sites during the inventory. Table 1 lists the base map layers, utilized along with source and format information for each layer.

Table 1. Base Map Layers Utilized for Inventory

Imagery/Data Source	Date	Projection
St. Louis County Open Data Clearinghouse http://data.stlouisco.com/datasets?page=3&t=open%20data	2016-2017	NAD 1983 Missouri, East, Feet

Street ROW Site Location

Individual street ROW trees were located using a methodology that identifies sites by *area, address number, street name, side,* and *block side*. This methodology was developed by Davey Resource Group to help ensure consistent assignment of location.

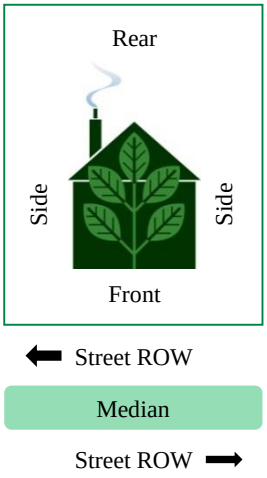


Figure 1. Side values for street ROW sites.

Address Number and Street Name

The *address number* was recorded based on visual observation by the arborist at the time of the inventory (the address number was posted on a building at the inventoried site). Where there was no posted address number on a building, or where the site was located by a vacant lot with no GIS parcel addressing data available, the arborist used his/her best judgment to assign an address number based on opposite or adjacent addresses. An "X" was then added to the number in the database to indicate that it was assigned (for example, "37X Choice Avenue").

Sites in medians or islands were assigned an address number using the address closest to the site. Each segment was numbered with an assigned address that was interpolated from addresses facing that median/island. If there were multiple median/islands between cross streets, each segment was assigned its own address.

The *street name* assigned to a site was determined by street ROW parcel information and posted street name signage.

Side Value and Site Number

Each site was assigned a *side value*. Side values include: *front*, *side*, and *median* (includes islands), or *rear* based on the site's location in relation to the lot's street frontage (Figure 1). The *front side* is the side that faces the address street. *Side* is the name of the street the arborist walks towards or walks away from while collecting data. *Median* indicates a median or island. The *rear* is the side of the lot opposite the front.

Block Side

Block side information for a site includes the *on street*.

- The *on street* is the street on which the site is located. The *on street* may not match the address street. A site may be physically located on a street that is different from its street address (i.e., a site located on a side street).

Park and/or Public Space Site Location

Park and/or public space site locations were collected using the same methodology as street ROW sites; however, the *area* would be the park and/or public space's name (Street ROW).

Site Location Examples

Figure 2. The tree trimming crew in the truck traveling westbound on E. Mac Arthur Street is trying to locate an inventoried tree with the following location information:

Address/Street Name:	226 E. Mac Arthur Street
Side:	Side To
On Street:	Davis Street

The tree site circled in red signifies the crew's target site. Because the tree is located on the side of the lot, the *on* street is Davis Street, even though it is addressed as 226 East Mac Arthur Street.

Figure 3. Location information collected for inventoried trees at Corner Lots A and B.

<u>Corner Lot A</u>

Address/Street Name:	205 Hoover St.
Side:	Side
On Street:	Taft St.
Address/Street Name:	205 Hoover St.
Side:	Side
On Street:	Taft St.
Address/Street Name:	205 Hoover St.
Side:	Side
On Street:	Taft St.
Address/Street Name:	205 Hoover St.
Side:	Front
On Street:	Hoover St.

.

<u>Corner Lot B</u>

Address/Street Name:	226 E Mac Arthur St.
Side:	Side
On Street:	Davis St.
Address/Street Name:	226 E Mac Arthur St.
Side:	Front
On Street:	E Mac Arthur St.
Address/Street Name:	226 E Mac Arthur St.
Side:	Front
On Street:	E Mac Arthur St.

Appendix B
i-Tree Eco Benefit Analysis Reports

Benefits Summary By Species

Location: Rock Hill, St. Louis, Missouri, United States of America
Project: City of Rock Hill, Series: Tree Inventory, Year: 2017
Generated: 4/7/2017

	Trees	Carbon Storage		Gross Carbon Sequestration		Avoided Runoff		Pollution Removal		Structural Value
Species	Number	Ton	$	Ton/Yr	$/yr	ft3/yr	$/yr	Ton/Yr	$/yr	$
Boxelder	3	1.93	250.64	0.04	4.72	114.13	7.63	0.00	15.36	3,753.14
Japanese maple	9	0.32	41.84	0.02	3.13	67.38	4.50	0.00	9.07	2,990.44
Norway maple	6	1.21	156.39	0.04	5.31	146.18	9.77	0.00	19.68	9,624.38
Red maple	63	8.33	1,080.39	0.35	45.94	1,050.21	70.20	0.01	141.38	67,066.47
Silver maple	53	43.90	5,695.18	0.80	104.34	2,904.72	194.17	0.04	391.03	136,252.28
Sugar maple	17	3.46	448.46	0.15	18.88	450.36	30.10	0.01	60.63	25,183.58
Ohio buckeye	1	0.11	14.12	0.01	0.79	29.52	1.97	0.00	3.97	894.45
Tree of heaven	2	0.91	118.58	0.03	3.79	75.93	5.08	0.00	10.22	2,643.22
Mimosa	1	0.02	1.98	0.00	0.25	5.81	0.39	0.00	0.78	138.84
River birch	12	0.98	126.64	0.06	7.52	132.22	8.84	0.00	17.80	7,862.63
Paper birch	2	0.03	3.91	0.00	0.51	8.22	0.55	0.00	1.11	277.61
European white birch	1	0.00	0.40	0.00	0.13	1.57	0.10	0.00	0.21	61.38
Gray birch	2	0.11	14.35	0.01	1.35	24.22	1.62	0.00	3.26	1,307.20
American hornbeam	18	0.49	63.36	0.04	4.85	157.81	10.55	0.00	21.24	4,424.37
Northern catalpa	6	4.03	522.74	0.07	9.01	147.54	9.86	0.00	19.86	5,930.73
Eastern redbud	52	1.94	251.94	0.14	18.63	451.16	30.16	0.01	60.73	16,442.16
Northern hackberry	19	4.53	587.60	0.19	24.83	652.68	43.63	0.01	87.86	35,539.64
false cypress spp	1	0.00	0.37	0.00	0.06	1.13	0.08	0.00	0.15	52.96
Yellowwood	1	0.00	0.37	0.00	0.12	2.96	0.20	0.00	0.40	53.07
Smoke tree	2	0.01	1.93	0.00	0.36	3.15	0.21	0.00	0.42	170.48
Flowering dogwood	19	0.59	76.06	0.05	6.78	154.61	10.33	0.00	20.81	5,611.89
Kousa dogwood	1	0.01	1.01	0.00	0.18	4.51	0.30	0.00	0.61	78.10
Common persimmon	4	0.65	83.68	0.03	3.63	87.86	5.87	0.00	11.83	4,142.24
White ash	35	19.26	2,498.32	0.47	61.26	1,136.40	75.96	0.02	152.98	93,296.04
Green ash	6	1.96	254.36	0.04	5.79	239.77	16.03	0.00	32.28	18,480.75
Ginkgo	6	1.17	151.33	0.05	6.60	104.82	7.01	0.00	14.11	10,816.20

Benefits Summary By Species

Location: Rock Hill, St. Louis, Missouri, United States of America
Project: City of Rock Hill, Series: Tree Inventory, Year: 2017
Generated: 4/7/2017

	Trees	Carbon Storage		Gross Carbon Sequestration		Avoided Runoff		Pollution Removal		Structural Value
Species	Number	Ton	$	Ton/Yr	$/yr	ft3/yr	$/yr	Ton/Yr	$/yr	$
Honeylocust	5	2.58	334.14	0.07	8.88	72.48	4.85	0.00	9.76	13,838.33
American holly	8	1.24	161.27	0.05	7.04	113.60	7.59	0.00	15.29	8,078.42
Black walnut	14	5.66	734.79	0.18	23.41	691.23	46.21	0.01	93.05	29,589.91
Eastern red cedar	50	3.94	510.80	0.14	18.29	815.22	54.49	0.01	109.74	37,607.11
Goldenrain tree	1	0.18	22.94	0.01	1.24	26.61	1.78	0.00	3.58	1,383.19
Sweetgum	47	30.49	3,955.33	0.59	77.03	2,149.73	143.70	0.03	289.39	305,374.96
Tulip tree	10	6.17	800.05	0.16	20.46	741.11	49.54	0.01	99.77	52,713.41
honeysuckle spp	1	0.02	3.19	0.00	0.33	4.09	0.27	0.00	0.55	216.93
apple spp	12	0.83	108.21	0.05	6.93	131.09	8.76	0.00	17.65	7,310.00
Amur maackia	1	0.02	1.98	0.00	0.25	5.91	0.40	0.00	0.80	138.84
Hardwood	4	2.66	345.20	0.01	1.04	104.37	6.98	0.00	14.05	1,597.22
Saucer magnolia	10	0.76	98.54	0.04	5.72	133.04	8.89	0.00	17.91	6,928.23
White mulberry	16	4.87	631.27	0.13	16.39	373.74	24.98	0.01	50.31	21,442.98
Black tupelo	4	0.21	26.81	0.02	1.98	64.14	4.29	0.00	8.63	2,676.84
Norway spruce	5	0.79	102.95	0.03	4.29	153.96	10.29	0.00	20.73	7,163.26
White spruce	3	0.07	9.44	0.01	0.87	15.99	1.07	0.00	2.15	922.78
Austrian pine	4	0.83	107.83	0.02	3.00	87.79	5.87	0.00	11.82	9,388.28
Blue spruce	9	0.58	75.61	0.03	3.93	94.74	6.33	0.00	12.75	6,877.39
Red pine	1	0.17	22.00	0.01	0.98	18.22	1.22	0.00	2.45	1,729.59
Eastern white pine	21	5.69	737.67	0.17	22.31	651.85	43.57	0.01	87.75	90,008.02
Virginia pine	1	0.28	35.82	0.01	1.07	40.06	2.68	0.00	5.39	3,403.51
American sycamore	29	52.00	6,746.45	0.97	125.52	2,828.38	189.07	0.04	380.75	181,470.83
Eastern cottonwood	15	17.16	2,226.44	0.31	40.19	1,233.87	82.48	0.02	166.10	36,636.92
plum spp	19	0.77	99.58	0.06	7.59	138.39	9.25	0.00	18.63	4,782.19
Black cherry	10	5.43	704.76	0.13	17.42	289.02	19.32	0.00	38.91	13,984.27
Callery pear	58	10.81	1,402.67	0.40	52.42	779.22	52.09	0.01	104.90	64,361.05

Benefits Summary By Species

Location: Rock Hill, St. Louis, Missouri, United States of America
Project: City of Rock Hill, Series: Tree Inventory, Year: 2017
Generated: 4/7/2017

Species	Trees	Carbon Storage		Gross Carbon Sequestration		Avoided Runoff		Pollution Removal		Structural Value
	Number	Ton	$	Ton/Yr	$/yr	ft3/yr	$/yr	Ton/Yr	$/yr	$
oak spp	3	1.52	197.61	0.01	0.88	93.65	6.26	0.00	12.61	1,251.54
Sawtooth oak	3	0.18	23.29	0.02	2.05	30.76	2.06	0.00	4.14	2,072.93
White oak	1	0.82	106.80	0.03	3.32	37.02	2.47	0.00	4.98	5,983.01
Swamp white oak	4	2.32	301.26	0.06	8.28	111.25	7.44	0.00	14.98	13,789.35
Scarlet oak	1	0.63	81.98	0.02	2.82	36.63	2.45	0.00	4.93	4,861.35
Shingle oak	49	31.59	4,098.06	0.85	110.80	1,526.63	102.05	0.02	205.51	140,732.08
Bur oak	4	5.14	667.31	0.11	14.31	202.19	13.52	0.00	27.22	31,312.61
Pin oak	35	43.81	5,683.63	0.96	124.58	1,464.86	97.92	0.02	197.20	225,128.80
Northern red oak	57	68.84	8,930.94	1.42	184.58	2,865.20	191.53	0.04	385.71	382,566.34
Black locust	2	0.28	36.96	0.01	1.84	43.64	2.92	0.00	5.88	1,234.13
Sassafras	3	0.19	24.60	0.01	1.06	27.80	1.86	0.00	3.74	1,007.06
yew spp	1	0.01	0.79	0.00	0.09	2.44	0.16	0.00	0.33	92.19
Baldcypress	6	0.60	78.03	0.03	3.42	141.88	9.48	0.00	19.10	10,266.51
red cedar spp	38	0.17	22.56	0.02	2.32	62.67	4.19	0.00	8.44	3,582.83
Northern white cedar	1	0.02	2.62	0.00	0.16	3.34	0.22	0.00	0.45	461.55
American elm	10	3.46	449.27	0.11	14.07	461.60	30.86	0.01	62.14	17,418.68
Siberian elm	51	29.45	3,820.06	0.59	76.67	2,182.60	145.90	0.03	293.82	72,421.35
Slippery elm	2	0.61	79.32	0.02	2.11	63.12	4.22	0.00	8.50	2,533.49
elm spp	1	0.01	0.83	0.00	0.17	4.34	0.29	0.00	0.58	81.79
Total	**972**	**439.83**	**57,057.64**	**10.49**	**1,360.86**	**29,274.34**	**1,956.87**	**0.41**	**3,940.85**	**2,279,516.29**

Carbon storage and gross carbon sequestration value is calculated based on the price of $129.73 per ton
Avoided runoff value is calculated by the price $0.067/ft³. The user-designated weather station reported 43.1 inches of total annual precipitation.
Pollution removal value is calculated based on the prices of $1,468.513 per ton (CO), $10,339.335 per ton (O3), $10,339.335 per ton (NO2), $2,531.238 per ton (SO2), $6,903.098 per ton (PM2.5)
Structural value is the compensatory value calculated based on the local cost of having to replace a tree with a similar tree.