Tree Assessment Report - Centennial Park

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OVERVIEW

Redevelopment of properties is a complex process. It entails making decisions and considering interactions that have significant implications on the character and image of the property and the surrounding areas. Familiar landmarks, both natural and man-made, are often affected. The prospect of redevelopment understandably evokes strong reactions among community residents and stakeholders when considering the impact of a project on both the community itself and its resources.

Trees found on redevelopment sites pose challenges. An important community and natural resource, trees provide environmental and social benefits proven to improve our quality of life. The provision of these benefits grants trees an intrinsic value that generally increases as they mature. Yet the nature of demolition and construction activities inevitably impacts tree well-being, and those impacts are often not evident until several years after completion of the project. Because the Metropolitan Government of Nashville recognizes the important role trees serve within the community, they engaged Davey Resource Group, Inc. "DRG" to inventory, assess, and evaluate Centennial Park's trees and provide guidance about which park trees may be the best candidates for tree preservation should redevelopment occur.

SITE BACKGROUND

Centennial Park is Nashville's signature historic urban park and is home to the Parthenon Museum. The property was previously the grounds of the 1897 Tennessee Centennial Exposition and, before that, the state fairgrounds, a racetrack, and Cockrill land grant farm. The desire to convert the exposition grounds into Nashville's first major park prompted the creation of the Nashville Board of Parks & Recreation. Centennial Park opened to the public in 1903. The 132-acre site contains the Parthenon Museum, the world's most accurate replica of the ancient temple structure. The park also has Lake Watauga, the midcentury Bandshell, the Sunken Garden, the Great Lawn, Art Center, Performing Arts Studios, dog park, and miles of trails. In 2016, the first phase of the Centennial Park Master Plan implementation was complete and included Cockrill Spring and Musicians Corner. Contract negotiations are currently underway to launch Phase Two construction, which will include the Great Lawn, West End entrance, and Parthenon lighting.

METHODOLOGY

In May 2019, DRG performed a tree inventory throughout Centennial Park. A total of 2,374 trees were inventoried in the park. The inventory was based on the following specifications:

- Include all trees within the landscaped open space, regardless of size.
- Include trees of significant size within "natural areas" at the arborist's discretion.
- Measure trunk diameter, provide approximate height and canopy width, evaluate current tree condition and health status, provide a Priority Rating for preservation, and plot the location on an aerial map using a geographic information system (GIS).

A tree's health was rated to be in one of the following six Condition Rating categories based on the tree's wood, canopy, and overall condition: Excellent, Good, Fair, Poor, Critical, or Dead. The criteria listed below is the basis for placement of a tree in to a Condition Rating category:

- *Excellent* 100%–80% - The wood has no structural problems, no mechanical damage, no aesthetic damage from insect and disease, and shows very good vigor.
- *Good* 80%–60% - The wood has no major structural problems, no significant mechanical damage, may have only minor aesthetic damage from insect and disease, and is in good health.
- *Fair* 60%–40% - The tree may show the following characteristics: minor structural problems and/or mechanical damage, significant damage from non-fatal or disfiguring diseases. This condition also includes trees that have been topped but show reasonable vitality and no obvious signs of decay.
- *Poor* 40%–20% - The tree appears unhealthy and may have structural defects such as co-dominant stems, severe included bark, severed trunk, and/or decay. A tree in this category may also have severe mechanical damage or poor vigor threatening its ability to thrive. Trees in Poor condition may respond to proper maintenance procedures, although these procedures may be cost-prohibitive to undertake. The tree may also have a major structural problem that presents an unacceptable risk.
- *Critical* < 20% - The tree is dying and/or presents unacceptable defects which necessitates removal.
- *Dead* 0% - This category refers to dead trees.

In order to capture the priority for preservation of a tree as it relates to development projects, DRG used a rating scale of one to four, with one being the highest priority for tree preservation and four meaning the tree is of least concern to save during redevelopment. The Condition Rating of a tree was an important part of the Priority rating; however, several other variables factored into the rating including species desirability, species longevity, species sensitivity to root loss and construction impacts, uniqueness, and aesthetics both of the tree itself and its relation to the site. It is

important to note that these are qualitative ratings based solely on the site, the individual tree, and existing conditions at the time of the inventory. Proposed development and construction plans were not considered when designating the Priority rating. The following criteria were the basis of tree placement into a Priority category for preservation:

- *Priority 1:* Highest priority for preservation (i.e., combination of a particularly Good condition, unique tree, etc.). This tree should be protected if site plans can accommodate its current location and protection costs are reasonable.
- *Priority 2:* A tree in Good condition and worth protecting though it may not be uniquely valuable. This category may include trees in Fair condition that can be considered uniquely valuable or otherwise score favorably across all categories of consideration.
- *Priority 3:* A Fair condition tree that will not be missed if it were gone and not worth any special protection measures.
- *Priority 4:* Trees that should be removed under most any circumstances such as an invasive or undesirable species, Poor condition or critical trees, or a tree causing a particularly high-risk situation.

If an existing tree, even a Priority 1 tree, conflicts with site plans, then a decision must be made if it is possible, desirable, and cost effective to save the tree. Due to the nature of construction and the negative effects construction typically has on trees, not all trees on a site can be saved. However, at all stages of development, efforts can be made to protect existing trees, though it is best to select trees for preservation during the planning stage and implement a tree protection plan during construction.

DRG Urban Foresters and International Society of Arboriculture (ISA) Certified Arborists James Rocke (Certification #KY-9842A), Allison Martin (Certification #IN-3554A), and Aren Flint (Certification #IN-3190AM) conducted the field inventory and health and condition assessment of Centennial Park's trees between May 2 and May 10, 2019. The tree inspections consisted solely of a visual inspection from the ground. While more thorough techniques are available for inspection and evaluation, they were neither requested nor deemed immediately necessary. More advanced evaluation techniques are generally recommended, as necessary, once a final group of candidates for preservation has been selected by site planners and designers.

Cary Hulse, Senior Urban Forester and ISA Certified Arborist (Certification #PD-1080A) with Wetland Studies and Solutions (WSSI), a Davey Company, utilized the field data to create a map of the inventory (Appendix A). Tree locations were derived using GIS and aerial maps. All mapped tree locations are approximate. The inventory map uses a color-coding scheme to denote preservation Priority Ratings for individual trees where Blue denotes Priority 1, Green denotes Priority 2, Yellow denotes Priority 3, and Red denotes Priority 4. The map also shows the Critical Root Zone (CRZ) and Structural Critical Root Zone (SCRZ) for each tree.

The data collected was also used to create the Tree Protection Action Key (TPAK). The TPAK has valuable information about park trees, particularly the Priority Rating, Condition Rating, or tree health, CRZ radius, and SCRZ radius. This information should be used when planning for site development or redevelopment. The TPAK (Appendix B) lists each tree individually and includes the following data fields:

- *Site ID/Tree #.* The unique identification number assigned to each inventoried tree.
- *Common Name.* Such as pin oak or sugar maple.
- Botanical Name. Such as *Quercus palustris* or *Acer saccharum*.
- *Canopy Radius* and *Height* (feet). Approximated in the field in 10-foot ranges.
- *Diameter at Breast Height (DBH*). Tree diameter measured at breast-height, which is defined as 4½ feet above ground level.
- *Number of Stems.* Or colloquially termed "trunks".
- *Condition Rating*. See Methodology.
- *Priority Rating.* See Methodology.
- *Primary Maintenance Need*. An overall maintenance recommendation and priority were recorded.
- *Secondary Maintenance Need*. The most significant secondary maintenance need was recorded, when appropriate. Trees that were recommended for removal did not have a secondary maintenance noted.
- *Further Inspection.* Notation used for trees needing more advanced assessment techniques.
- *Structural Critical Root Zone Radius* (feet). The SCRZ is the minimum root plate radius required for a given tree to remain structurally stable under typical conditions (Coder 1996a). Development plans should ensure that no root damage or impact occurs within this zone. Root damage/impact can occur from any disturbance to the natural state of the soil within the SCRZ, including the addition of fill soil to levels above existing grade. If root damage is expected within this zone, then the tree should be removed.
- *Critical Root Zone Radius* (feet). The CRZ represents the typical minimum rooting area required for tree health and survival. Minimal impact (25% or less) within this zone is typically acceptable for average to good condition trees with basic mitigation/stress reduction measures.
- *Biotic Observations*. A data field to record tree-specific general observations which factored into the tree condition and Priority Rating. Some observations recorded in this field include, but are not limited to, pests, insects, diseases, fungal fruiting bodies, and epicormic sprouts.
- *Abiotic Observations*. A data field to record tree-specific general observations which factored into the tree condition and Priority Rating. Observations recorded in this field include, but are not limited to, tree architecture, existing damage or decay, earlier pruning, and dead and dying parts.

Appendix C was created for the Centennial Park Phase Two area. It lists the data collected about trees during the inventory for the Phase Two area.

Appendix D is a tabulation of the 2,374 trees in Centennial Park broken down by species, average DBH, condition rating, and sensitivity to construction and development activities.

SUMMARY

DRG found and assessed a total of 2,374 trees on the Centennial Park property, including the main park, sportsplex, dog park, and around several maintenance buildings. The Phase Two re-development site is located within the main park and is described as the Great Lawn, West End, Bandshell, and East Parking.

The following include general observations for Centennial Park overall, and then specifically the Phase Two Area and the dog park.

Centennial Park

- Fifty-eight percent (58%) of the 2,374 trees are rated to be in Excellent or Good condition.
- Common hackberry (*Celtis occidentalis*) accounts for 414 out of the 2,374 trees (17%); 122 out of the 414 (29%) trees are in Good condition.
- One hundred and eighty-seven (187) trees were recommended for removal with 7 being Priority 1 Removals and in need of immediate action. This recommendation is due to the size of defects, size of tree, location, problematic species, and feasibility to correct. Due to the risk associated with the Priority 1 Removal trees, when removing the tree use extreme care, proper safety measures, and conduct the work under the supervision of an ISA Certified Arborist.
- Fifty-four percent (54%) of the trees consist of species with an "Moderate" to "Intolerant" rating for the category "Tolerance to Construction-Related Activities." The ratings presented here are compiled from multiple sources of published research (Coder 1996b; Cook and VanDerZanden 2011; Matheny and Clark 1998). Species were evaluated based on their tolerance to typical types of construction.

  Construction damage to trees can be divided into two broad categories: direct impact and indirect impact. Direct damage is physical damage to the tree itself. Examples include root damage or severance, branch breakage, and trunk wounding. Examples of indirect damage include soil compaction, changes in drainage patterns or soil grade, and increased light exposure. The ratings provided in Appendix D should be considered a general guide, as relative tolerance can vary based on specific sites, climates, and individual tree health at the time of construction impact. In general, younger and healthier trees respond better to adverse stimuli than more mature, less healthy trees. The ratings are the best approximation of construction tolerance/sensitivity for a species within its native range. Where no rating is provided, it is due to lack of available published research for that species as it relates to construction damage tolerance/sensitivity.
- There are 31 ash (*Fraxinus*) trees in Centennial Park. Nineteen (19) of these trees were recommended for removal due to condition and the imminent area-wide decline in the ash tree population due to an invasive insect that has been ravaging ash trees throughout the United States, the emerald ash borer (EAB, *Agrilus planipennis*). Only ash trees in exceptional health and located a good

distance away from construction activities, or otherwise hold significant historical value, should be considered for preservation. None of those 19 ash trees found on the property qualify under those conditions. The remaining 12 were recommended to be kept due to overall condition, significance to the landscape, species less susceptible to the EAB, or currently being treated. If preservation of any of these ash trees is desired, for their survivability, bi-annual treatment with emamectin benzoate for the life of the trees is a necessity.

- The wood decay fungi *Inonotus dryadeus*, commonly known as weeping conk or oak bracket fungus, was positively identified on one tree. Found on the buttress and roots of oak (*Quercus*) trees, *I. dryadeus* is a white-rot wood-decay fungi that breaks down the lignin in wood. Lignin provides the structural strength of trees and the mechanical support for stems. This fungal organism erodes the structural integrity of mature oak trees and dramatically increases tree susceptibility to wind-throw (i.e., uprooting during wind-loading events) or other significant loading events. Best practices recommend removal for trees found infected with *I. dryadeus* (Luley 2005).
- Priority 1 or 2 Removal is recommended for 187 (8%) inventoried trees. In addition to those 187 trees, there are 20 trees with a preservation rating of Priority 4, which comes with a recommendation of removal when re-development occurs.
- Trees with memorial tree tags were given preservation Priority 1, if their condition was considered worth protecting. The memorial tree directory should be utilized to confirm and further locate trees of significance to residents. Many of these trees are young; due to their small size, these trees would also be good candidates for relocation. If selected for relocation, it is recommended that it be performed under the supervision of an ISA Certified Arborist with tree relocation experience.
- There are two trees located in the middle of the playground next to the Centennial Performing Arts Studio that are strong candidates for preservation. The 25-inch southern magnolia (*Magnolia grandiflora*, Tree #304350) and a 44-inch willow oak (*Quercus phellos*, Tree #304347) which should be considered for preservation. Both provide significant aesthetic value and overall benefits due to their locations. Neither species is very tolerant of construction related activities. When trees are selected for preservation, it is highly recommended that an ISA Certified Arborist experienced in tree preservation techniques oversee all aspects of potential preservation planning and protection operations.
- There is a 62-inch DBH willow oak (Tree #302834) south of the Centennial Park Event Center Pavilion in the West End area. Due to its Good condition, aesthetic value, location, and the overall benefits that it provides, this tree would also be a good candidate for preservation. It must be cautioned that the tree has a significantly large CRZ proportionate to its diameter and is moderately tolerant of construction related activities.

- There is a 67-inch DBH willow oak (Tree #303964) south of the Centennial Performing Arts Studio in the West End area. Due to its Good condition, aesthetic value, location, and the overall benefits that it provides, this tree would be a good candidate for preservation. It must be cautioned that the tree has a significantly large CRZ proportionate to its diameter and is moderately tolerant of construction related activities.
- There are two pecan (*Carya illinoinensis*, Tree #303983 and Tree #303986) trees in the East Parking area. One is in Good condition and the other is in Fair condition with both measuring the same DBH of 35 inches. Given their species uniqueness to the property, they would be good candidates for preservation. Note of caution, pecan has only a moderate tolerance for construction related activities.

Phase Two Area

- The Phase Two area has 331 trees. Of those 331 trees, 25 have a Priority 1 rating for preservation.
- Fifty-seven percent (57%) of the 331 trees are rated to be in Excellent or Good condition.
- Oak is the most common genus with 61 (18%) individuals present.
- Priority Removal is recommended for 34 (10%) inventoried trees.
- There are seven recently planted trees 6-inches or less in DBH in the Phase Two area near the West Musicians Corner in Excellent or Good condition (Tree #303719, 303845, 303854, 303862, 303878, 303881, 303890). Trees of this size and condition make strong candidates for relocation, if development will impact their current locations. If moved, it is recommended that relocation be performed under the supervision of an ISA Certified Arborist with tree transplant experience.
- The following trees are noteworthy, and should be considered a high priority for preservation:
    - The eleven mature oaks in the Great Lawn southeast of the Parthenon are excellent candidates for preservation. This is attributed to their size, condition, and placement in the landscape.
    - There is a southern magnolia (*Magnolia grandiflora*, Tree #303852) found southeast of the Bandshell. It is in Good condition and has a DBH of 38 inches. Given the species uniqueness to the property, year-round green leaves, and large showy white flowers, southern magnolia are good candidates for preservation. Note of caution, they have only a moderate tolerance for construction related activities.

When trees are selected for preservation, it is highly recommended that an ISA Certified Arborist experienced in tree preservation techniques oversee all aspects of potential preservation planning and preservation operations.

Dog Park

- This area has 276 trees. No trees received a Priority 1 preservation in this area due to tree conditions. Forty-seven percent (47%) of the 276 trees are rated to be in Good condition. Unlike other areas of Centennial Park, no trees are in Excellent condition in this area.
- Hackberry is the dominant genus with 174 (63%) individuals recorded.
- September elm (*Ulmus serotina*) and chinkapin oak (*Quercus muehlenbergii*) were identified in this section. Most of these trees are in Good condition. These trees should be strong candidates for preservation. Chinkapin oak has a high tolerance for construction related activities.
- Priority tree removal was recommended for 26 (9%) inventoried trees. In addition to these 26 trees, there are 7 trees given a preservation rating of Priority 4, which comes with a recommendation of removal when redevelopment occurs.

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CONCLUSIONS

The suitability of a tree for preservation is a qualitative process based on the interaction of a variety of influencing factors. Healthy, vigorous trees better tolerate impacts from construction and more readily adapt to the new site conditions that exist after completion of development. Additionally, tolerance to impact from construction activities varies across species and sites. The percentage impact to the CRZ also greatly influences the suitability of a tree for preservation.

The renovation of Centennial Park will affect many park trees, most immediately those trees in the Phase Two area. To limit impacts to trees during redevelopment, use the findings of this report to understand the characteristics of site trees and to guide the selection of trees for preservation. To be most successful, all construction documents should reference this plan.

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APPENDIX A
TREE INVENTORY ASSESSMENT MAP

APPENDIX B
TREE PROTECTION ACTION KEY (TPAK)

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APPENDIX C
PHASE TWO AREA TREE INVENTORY

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APPENDIX D
CENTENNIAL PARK SPECIES TABULATION

Species	Count	Avg DBH	Excellent	Good	Fair	Poor*	Tolerance to Construction Impacts**
arborvitae	16	2	5	28			Tolerant
arborvitae, eastern	17	4	5	12			Tolerant
ash, blue	9	16			8	1	Tolerant
ash, green	6	12		1	4	1	Tolerant
ash, white	16	15	1	2	9	4	Moderate
baldcypress	23	11	13	10			Tolerant
beech, European	3	8		1	2		Intolerant
birch, river	8	8		5	2	1	Tolerant
blackgum	12	5	1	9	2		Tolerant
buckeye, Ohio	1	10		1			Intolerant
buckeye, red	1	3		1			Moderate
buckeye, yellow	1	28			1		Intolerant
catalpa, northern	42	24	2	7	13	20	Tolerant
catalpa, southern	4	23			2	2	Tolerant
chastetree	1	4			1		--
cherry, black	1	20				1	Moderate/Intolerant
cherry, ornamental	191	6		99	81	11	--
cottonwood	9	41		2	6	1	Tolerant
crabapple, flowering	17	9		4	13		Moderate
crapemyrtle, common	76	3		60	16		--
dawn redwood	21	8		19	2		--
dogwood, flowering	38	3		22	11	5	Moderate/Intolerant
dogwood, Kousa	15	6		8	5	2	--
dogwood, pagoda	14	2		7	1	6	Moderate
elm, American	11	22		8	3		Moderate/Tolerant
elm, Chinese	10	13		6	4		--
elm, English	14	31		5	8	1	--
elm, hybrid	15	6		14	1		--
elm, September	55	14		31	23	1	--
elm, Siberian	2	27		1	1		Moderate/Tolerant
elm, slippery	3	27			3		Moderate
elm, winged	7	4		1	6		Tolerant
falsecypress, Hinoki	1	2		1			--
fringetree, white	2	5		1	1		Moderate
ginkgo	19	10		12	7		Tolerant
goldenraintree	17	11		6	11		--
hackberry	414	20		122	240	52	Moderate
hawthorn	6	8		2	1	3	Moderate
hemlock, eastern	5	5		3	2		Intolerant
hickory, shellbark	1	3	1				--
holly, American	43	5		21	22		Tolerant

Species	Count	Avg DBH	Excellent	Good	Fair	Poor*	Tolerance to Construction Impacts**
holly, Foster's	21	5		14	7		--
hornbean, American	10	8		8	2		Moderate
Japanese cryptomeria	7	4	1	6			--
katsura	1	15		1			Moderate/Intolerant
Kentucky coffeetree	4	10		3	1		Tolerant
larch, American	1	6		1			Moderate
lilac, japanese tree	1	4		1			--
lilac, Peking	1	9		1			--
linden, American	26	4	5	16	5		Intolerant
linden, littleleaf	6	9		4	2		--
linden, silver	2	33		1	1		--
magnolia, bigleaf	3	4		3			--
magnolia, saucer	7	4		5	2		--
magnolia, southern	103	12		71	29	3	Moderate
magnolia, star	18	3		11	7		--
magnolia, sweetbay	16	3	3	3	10		Tolerant
maple, Amur	3	5			2	1	--
maple, Freeman	10	9		3	6	1	--
maple, hedge	1	7		1			--
maple, Japanese	3	4		2	1		--
maple, Norway	1	7			1		Moderate/Tolerant
maple, red	37	10		20	13	4	Tolerant
maple, southern sugar	1	6		1			Moderate
maple, sugar	91	16	1	34	41	15	Intolerant
maple, trident	12	7		10	2		--
mountainash, American	1	3		1			Moderate
oak, blackjack	3	3		2	1		Tolerant
oak, bur	29	11	8	18	3		Moderate/Tolerant
oak, chestnut	1	12		1			Moderate/Tolerant
oak, chinkapin	27	22		21	6		Tolerant
oak, English	6	13		4	2		--
oak, hybrid	1	8		1			--
oak, northern red	36	16	9	20	6	1	Moderate
oak, Nuttal	1	3	1				--
oak, overcup	18	7	1	15	2		Tolerant
oak, pin	25	16	2	14	7	2	Moderate
oak, post	4	8	3	1			Tolerant
oak, sawtooth	4	9	1	3			--
oak, scarlet	30	9	5	19	6		Moderate
oak, shingle	1	35			1		Tolerant
oak, Shumard	17	4	7	7	2	1	Tolerant
oak, southern red	2	10		2			Tolerant
oak, swamp chestnut	2	16	2				Tolerant
oak, swamp white	40	9	12	25	3		Tolerant
oak, white	12	49	3	6	3		Moderate/Intolerant

Species	Count	Avg DBH	Excellent	Good	Fair	Poor*	Tolerance to Construction Impacts**
oak, willow	54	24	8	37	4	5	Moderate/Tolerant
osage-orange	13	27		4	8	1	--
pawpaw, common	18	3	1	14	3		Tolerant
peach, common	1	3				1	--
pecan	2	35		1	1		Moderate/Tolerant
persian parrotia	10	6		5	5		--
pine, eastern white	18	18	3	11	4		Moderate
pine, jack	7	10	1	5	1		Tolerant
pistache, Chinese	11	11		6	4	1	--
planetree, London	9	11	2	6	1		Moderate
privet, spp	3	3		3			--
redbud, eastern	141	5	5	68	60	8	Moderate
redcedar, eastern	40	6		38	2		Moderate
royal paulownia	1	13			1		Tolerant
serviceberry	26	2		25	1		Moderate
seven-son flower	1	3		1			--
smoketree, American	7	4			4	3	--
spruce, Colorado	3	10		3			Moderate
spruce, Norway	16	9	4	12			Moderate
sugarberry	1	43			1		Tolerant
sweetgum, American	40	9	1	23	14	2	Tolerant
sycamore, American	49	14	11	34	3	1	Tolerant
tree of heaven	2	26			1	1	--
tuliptree	30	11	3	21	6		Moderate/Intolerant
walnut, black	6	21	1	1	4		Intolerant
waxmyrtle, Southern	1	3		1			--
willow, weeping	9	15		2	3	4	Moderate/Tolerant
witchhazel, common	9	3		1	8		Moderate
yellowwood	15	5	1	8	5	1	Intolerant
zelkova, Japanese	18	12		15	3		--
Totals	**2374**	**-**	**133**	**1257**	**833**	**168**	

Notes:

*: Includes Critical, Poor, and Dead condition ratings

**Tolerance Ratings compiled from the following sources:

Coder, Kim D. 1996. *Relative Tolerance of Tree Species to Construction Damage.* Athens: The University of Georgia Cooperative Extension Service, Forest Services Unit.

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