CITY OF COCOA
BREVARD COUNTY, FLORIDA
2021 CITY OF COCOA URBAN FOREST MANAGEMENT PLAN

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1.0   INTRODUCTION

In August through October of 2020, arborists from both Bayhead Ecological Solutions (BES) and Wiregrass Ecological Associates (WEA) assessed and inventoried trees and stumps within the City of Cocoa (The Client), Florida. Trees were inventoried within city Right-of-Way (ROW), as no residential trees were recorded. The city ROW included several parks and cemeteries, in addition to the trees found along the ROW of the streets of the City of Cocoa. A total of 8,340 trees were identified through the inventory, with 2,335 (28%) located in parks or cemeteries (public areas) and 6,005 (72%) along the streets.

When examining tree composition, it was noted that the public areas contained 83 tree species and the streets contained 128 tree species. To determine the most common species for each location, it was noted that the majority of the species present in both public areas and street were comprised of fourteen (14) (public areas) and 11 (streets) core species. These species met the criteria of each comprising greater than 1% of that location's total tree abundance. Trees located in both public areas and streets from this group included the Brazilian peppertree (*Schinus terebinthifolia*), crape myrtle (*Lagerstroemia* spp.), white mangrove (*Laguncularia racemosa*), laurel oak (*Quercus laurifolia*), live oak, (*Quercus virginiana*), sand live oak (*Quercus geminata*), cabbage palm (*Sabal palmetto*), and slash pine (*Pinus elliottii*). The additional most abundant species within public areas included cherry laurel (*Prunus caroliniana*), pignut hickory (*Carya glabra*), red mangrove (*Rhizophora mangle*), Australian pine (*Casuarina equisetifolia*), plum pine (*Podocarpus* spp.), and saw palmetto (*Serenoa repens*); the additional abundant species for the streets included queen palm (*Syagrus romanzoffiana*), Washingtonia palm (*Washingtonia* spp.), and sycamore (*Platanus occidentalis*).

Species diversity is an important factor in the analysis of an urban tree landscape. A high diversity of tree species is preferable to the health of the city's trees as a whole. If species diversity is low, with a few species dominating the overall city's tree population, diseases that may specialize in those certain species have a much easier time proliferating throughout the entire population and may cause widespread decimation. The diversity of trees within the city also can affect future planting goals, as species chosen for planting are based on the proportion already present in the population.

A rule of thumb within the urban arboriculture community is the 10% rule for species proposed by Santamour (1999), which indicates that no one species should compose more than 10% of an overall urban landscape. Adherence to this guideline helps to control the spread of certain diseases that could spread quickly through populations. In the public area tree population, only cabbage palm (24%) and live oak (15%), or 2 out of 83 species (2% of population) exceed this threshold; in the street population only live oak (24%) and cabbage palm (21%), or 2 out of 128 species (1.5% of population) exceed the threshold. As neither of these two species propagate serious diseases, it is anticipated that their high abundances will not adversely affect the City of Cocoa's urban forest. Additionally, 83% of public area trees and 91% of street trees each comprise less than 1% of their respective populations' abundances. These statistics point to a dramatic diversity within both the public area and street urban tree populations within the City of Cocoa.

Tree condition is an important metric used to express the health of a tree and any potential risks posed through it remaining on site. For this study, trees were rated, in decreasing level of health, either Excellent, Good, Fair, Poor, or Very Poor. When examining the condition of the trees throughout the City of Cocoa, an overwhelming majority of the trees collected were rated as being in "Excellent" in both the public (95%) and street (95%) designations. "Good" was the next highest percentage for both with 3.1% and 3.7%, respectively; the other designations differ less than 1% between the two tree locations and range from 0.12% to 0.81%. Based on these metrics, the overall tree populations in the public areas and streets of the City are deemed to be very healthy.

1.1 Tree Removal

While most of the City of Cocoa's 8,340 inventoried trees were in excellent health, 51 were rated as having an overall health rating as "Very Poor". In addition to the overall health rating, each tree was assigned a hazardous ranking scale of 1-10, with a ten being cause for immediate removal. These "Very Poor" trees were spread fairly evenly throughout the City and not located in any centralized patterns, which rules out the chance of a particular site having very unsuitable conditions for current trees or any future trees that would be planted. It is the recommendation of BES/WEA that these trees should be the first priority for tree removal within the City; within this group of compromised trees, the trees rated a 9 or 10 on the hazard scale as well as any located closest to any static (constantly occupied) or potentially occupied (periodic human usage) human targets should be the first priorities of removal. Such "high-traffic" areas with the City of Cocoa could be Riverfront Park, Lee Wenner Park, or various sidewalks especially throughout Cocoa Village. The trees located within Cocoa Village are an example of "wrong tree, wrong place" due to their propensity to injure pedestrians. These trees should receive first priority for removal among the "Very Poor" trees and replaced with trees appropriate for the location. Stumps and trunks were also grouped into the "Very Poor" health designation but may not have a high hazardous ranking; these items should eventually be removed due to safety concerns but should not be the first targeted for removal.

Trees should also be justified for removal when corrective actions such as pruning are unable to create a safe, hazard-free environment, or if the cost of such pruning exercises would be cost-prohibitive to the maintenance of the City of Cocoa as a whole. Hazards in this case include not just humans but also electrical lines or other utility structures as well as homes/businesses. Therefore, it is possible that some trees listed as being in "Fair" or "Poor" overall health may still warrant removal if pruning cannot occur to improve their hazard level to the community.

1.2 Tree Stocking/Plantings

Stocking

Stocking is a traditional forestry term used to measure the density and distribution of trees. In determining how well an urban community is currently stocked with trees, it is important to investigate the total number of sites along the streets that are able to support trees. As the calculations for determining stocking density are dependent on linear feet of streets, park and other public property trees are excluded from this measurement.

The level of stocking present is a ratio of the number of street sites currently occupied by trees compared to the number of street sites that are suitable for trees to exist. As an example, if 250 trees existed in a section of street that had the capacity for 500 trees, that section of street would have a stocking level of 50%. To calculate a street's capacity for trees, it is the assumption that a gap of 50ft must be between each tree planted along the street's ROW; note that this applies to both sides of the street (McPherson et al. 2016). Therefore, a one-mile section of street ROW with trees able to grow on both street sides at 50-foot intervals would give the potential for 212 trees/mile (5,280ft/mile ÷ 50 ft between trees = 106 trees/mile on one side of street). When the estimated stocking level is determined using theoretical assumptions, the actual number of planting sites may be significantly less than estimated due to unknown growing space constraints, including inadequate growing space size, proximity of private trees, and utility conflicts. Typical examples of utility conflicts within the City of Cocoa could include aerial power lines, underground power lines, underground potable water lines, underground reclaimed water lines, underground storm and sanitary lines, underground fiber/telecommunication lines, and underground gas lines. An additional factor to consider in the planting process is the impact that a tree's root ball may have on surrounding sidewalks or driveways.

Looking at just those streets in the City of Cocoa where the inventory was conducted, the inventory covered 115 miles of linear street. Applying the available stocking rate of 212 trees/mile, the tree inventory area has the capacity for 24,380 trees; a total of 6,013 trees were inventoried within that area, giving a stocking rate of 25% and totaling 52 trees/mile and 6 trees per acre using an average 50-ft ROW width. In comparison with another Florida city nearby, Tampa has an average of 125 trees/acre. There is room for an additional 160 trees per mile to reach full stocking rate within the City's street ROW; however, 90% stocking capacity is recommended due to potential overcrowding. It should be noted that this 90% number may not be attainable due to the ROW width on certain streets, the types of land use occupying certain streets, or various other factors including utility conflicts.

Fully stocking the street ROW with trees is an excellent goal. Inadequate tree planting and maintenance budgets, along with tree mortality, will result in lower stocking levels. Nevertheless, working to attain a fully stocked street ROW is important to promote canopy continuity and environmental sustainability. Efforts can be made to move from the current stocking rate of 25% toward the goal of 90% stocking; this will entail a program of planting, care, and continued maintenance of the City's trees. With 16,560 available planting sites (115 miles X 160 additional trees/mile = 18,400 X 90% = 16,560 trees), there is ample room for the City to improve stocking rates using a metric of 40 trees planted a year (not including a mortality factor). If feasible for the City, this number would be a good starting point to making progress toward a goal of occupying the available planting spots with trees. Of course, it is a given that additional trees means additional cost to the City in maintain their health. It should be kept in mind that some of these "available" tree sites may not be available due to concrete parking lots, businesses, driveways, etc.

Planting

In beginning to plant the City of Cocoa with trees, a few factors must be considered. As mentioned above in the data summary, the 10% rule of urban forestry states that if possible a certain species should not comprise more than 10% of tree abundance; this helps to assure diversity within the urban forest and helps prevent against the spread of disease and decay among similar species of families. At the current time, only live oak and cabbage palm exceed this percentage for both the public area and street tree populations. The Australian pine and slash pine are nearing 10% for the public areas (8.3% and 6.7%, respectively), while the crape myrtle and white mangrove (both 7%) are close in the street trees category. Although not a mandatory rule, this 10% stocking threshold should be avoided if possible.

Other factors to consider when planting include the exclusion of invasive species, selection of appropriate trees, consideration of species final height and its relation to surrounding utilities, the impact that planting may have on subsurface utility systems, and the spacing of trees of the same species. The Florida Invasive Species Council (FISC) invasive species list (https://floridainvasivespecies.org/plantlist.cfm) should be consulted prior to any plantings, as an invasive species could spread quickly and significantly harm its surrounding urban treescape. Also, trees that have a low incidence of species failure should be selected if possible when planting. In the current inventory, box elder (*Acer negundo*) stands out as a tree species found within the City that has a reputation for higher failure rates. In fact, the population along Michigan Avenue that was inventoried had an average hazard rating of 6 due to limb breakage and deadwood. When planting trees, care should be made to not plant too many of the same species in the same vicinity, as diseases that affect that particular species may spread quickly within too close of a proximity. Also, a tree's final height should be considered when planting to anticipate any issues with surrounding landscaping, above or underground utilities, sidewalks, or other factors. Planting only small-growing trees within 20 feet of overhead utilities, medium-size trees within 20–40 feet, and large-growing trees outside 40 feet will help improve future tree conditions, minimize future utility line conflicts, and reduce the costs of maintaining trees under utility lines (Davey 2019).

1.3   Tree Maintenance

Even with the overall condition of Cocoa's inventoried tree population being very healthy, maintenance practices should still be undertaken on a regular basis. These will help to ensure the continued health and success of the existing trees within the City and in the process prevent the need for costly removals or replantings in the future. Below are some recommendations based on our field findings as well as ANSI A300 recommendations for tree care:

- Dead trees should be removed because of their failed health and the hazard they pose; these trees will likely not recover, even with increased care. Dead tree removal should not be based solely on the results of this inventory, as dead trees should be removed as they are noted into the future.

- Younger trees rated in Fair or Poor condition may benefit from improvements in structure that may improve their health over time. Pruning should follow ANSI A300 (Part 1) (ANSI 2008).
- Proper tree care practices are needed for the long-term general health of the urban forest.

In order of maintenance importance, dead, hazardous trees that are present within the City are the top priority for treatment and removal. The next most hazardous trees with poor to moderate overall health, that require the most extensive pruning measures, should be tended to next; trees that are in good overall health and pose a small hazard risk are the last in line to have their pruning or other maintenance needs completed. Following this certain ranking of priorities within the City's treescape can begin to shift tree care activities from an as-needed system to a more proactive tree care program that over time will be preventative in dealing with tree care needs.

If staffing needs, certain efficiencies, and/or contract specifications allow for the completion of more or less tree work, or if the maintenance prescription requires modification to meet budgetary or other needs, then the tree care schedule should be adjusted accordingly to reflect these changing circumstances. Unforeseen situations such as hurricanes may arise and drastically change the City's treescape or the maintenance needs of its trees. Should conditions or maintenance needs change, budgets and equipment will need to be adjusted to meet the new demands.

2.0   HABITAT MANANGEMENT

2.1   Illustrate Management Plans Budgetary Impact

Proper maintenance and following through with removals and the subsequent replanting strategies is necessary in coastal communities such as the City of Cocoa. The City relies on established trees for water uptake during normal rain events, soil stabilization, and maintaining a healthy diversity within the tree population. In the event of a hurricane, flood, or other natural disaster that may occur in coastal communities, the tree community becomes part of the City's environmental infrastructure. The 2020 inventory shall be utilized as a catalyst to demonstrate funding needs in areas that are dire in a coastal tree community. Diversity, native recruitment, carbon uptake, water uptake, and oxygen production are all critical to coastal communities after a major natural disaster event. Therefore, using the 2020 tree inventory to prioritize yearly funding based on trees that are deemed to be dead or dying is a strategic tool to help mitigate the City's tree community needs in a positive direction to improve the tree community infrastructure. By removing a tree that is no longer an asset to the community and replacing it with the right tree in the appropriate location, the community is improved measurably, yearly. By utilizing the 2020 inventory the City can measure the success and growth of the tree community within the City over time through concentrated actions. Both maintenance and the protection of natural resources are a priority in coastal communities preparing ahead of time to mitigate hurricane or flood impacts.

When determining budgetary impacts for the City, the action items with the greatest need are the removal of trees characterized through the 2020 Tree Inventory as hazardous, the replanting of these areas, the planting of new trees to raise the City of Cocoa's Urban Tree Canopy (UTC), and the maintenance (pruning) of existing trees to maintain their health. The largest amount of money

should be set aside to conduct hazardous tree removal; once that has occurred, the remaining action items should be prioritized equally. Additional funds should be allocated for the addition of 40 trees per each fiscal year, as mentioned above in Section 1.2.

2.2 Identify Priority Plantings Areas Preliminary Review

Planting should be used within the City to improve its overall tree cover or to replace trees that may require removal due to their condition or location within the city. The first location to examine potential tree removals and plantings is a City-owned public park or other public and common areas. Through a combination of field inventory data and desktop interpretation, most parks within the City are already well-covered with trees. The exception to this is Bracco Pond Park, and to a lesser degree Michigan Avenue and Rosa L. Jones Drive. Bracco Pond Park would be a great option, as it contains an ample amount of open green space that could support the planting of many varied trees of a variety of species. Sunlight is not a limiting factor at Bracco Pond Park, as the canopy cover is sparse. The surrounding land should be well-drained due to the presence of the multiple ponds and water penetrable surfaces. Once new trees replace these trees that are removed, proper irrigation should occur so that they receive the water needed for their growth.

In examining potential street sites for planting, many of the residential areas are fairly well-stocked with trees, especially those established neighborhoods with large mature trees. This observation makes sense, given the City's long history. Michigan Avenue, especially the western portion of the road where it veers to the South, seems to be able to support multiple young tree plantings. Some of Michigan Avenue has already been planted with young trees, which is excellent; those prior plantings should be continued on both sides of the road and in both directions if possible. Both Fiske Boulevard and King Street, two of the major roadways through Cocoa, as well as Rosa L. Jones Drive could also support additional plantings. While these are just a few suggestions for planting sites, the ultimate decision for where plantings occur rests on the City of Cocoa employees who are infinitely more familiar with the City's roads and needs. The above areas can be considered "priority planting areas", but they are not the only areas that need plantings or could be considered for priority planting. The City should use its budgetary requirements to analyze which sites could be properly planted.

In addition to public areas and new plantings on streets, it should be ensured that new plantings be ready to replace any trees that must be removed. As noted in this report, live oak and cabbage palm are currently exceeding the 10% rule in abundance throughout the City. While the 10% is not a mandatory guideline, if a cabbage palm or live oak were to be removed it would be a prudent idea to replace that tree with one of a different species to further promote diversity among the City's treescape. Also, it is important to consider planting the "right tree at the right place" (https://www.arborday.org/trees/bulletins/documents/004-summary.pdf), a goal that should precede the planting of any trees across the City. This may involve selecting smaller trees to occupy spots underneath utility lines, planting trees with smaller root balls to avoid underground utilities or sidewalk interactions, or as mentioned above diversifying a certain area of the City to include multiple different types or trees.

2.3 Canopy Goals

As mentioned above in the Tree Planting Measures section, the City of Cocoa is currently operating at 25% of its total possible stocking density. While the metric of stocking density is helpful in detailing a community's urban tree population, another metric known as urban tree canopy (UTC) is used to determine the percentage of all city land area, when viewed as an aerial image, that is occupied by tree crowns (Hilbert et al. 2019). A recent study of 43 cities in Florida using this metric revealed that the average UTC for Florida communities is 33.7%; Cocoa's neighbor directly to the South, Rockledge, was very close to average at 32.9%. Although UTC was not measured during this urban tree inventory, the similar habitat present within Rockledge, as well as its close proximity to Cocoa, combined with Cocoa's somewhat similar stocking density metric of 25%, could indicate that Cocoa's overall UTC falls near the average for the state.

Some key factors influencing this UTC metric are obviously the density of trees present, as well as the size and species present within the urban treescape. Mature trees of whatever species is present will have greater canopy coverage than young trees, so either ensuring that young trees reach maturity or planting mature trees instead of seedlings will help to increase the UTC for the City. When determining the effect of species on UTC, it should be noted that trees with a decurrent growth form (outward branching with a rounded crown) will provide greater canopy coverage than those with excurrent growth (Christmas tree shape) or a plantation tree growth form (palm trees). Some examples of trees with good decurrent growth already present within the treescape are live oaks, sand live oaks, laurel oaks, sycamores, and pignut hickory, among others.

Knowing where the City of Cocoa falls on tree canopy cover, a main goal for canopy coverage is that it does not decrease over time. For this to occur, it should be ensured that if trees are removed or significantly pruned this loss will be compensated through the planting of additional trees to maintain or enhance the City's UTC. An additional measure could be to replace younger trees in poor health with healthy mature trees, both improving the City's treescape health as well as its UTC.

3.0 RECOMMENDATIONS

3.1 Tree Care Ordinance Changes to Promote Better Care and Management Using BMP's
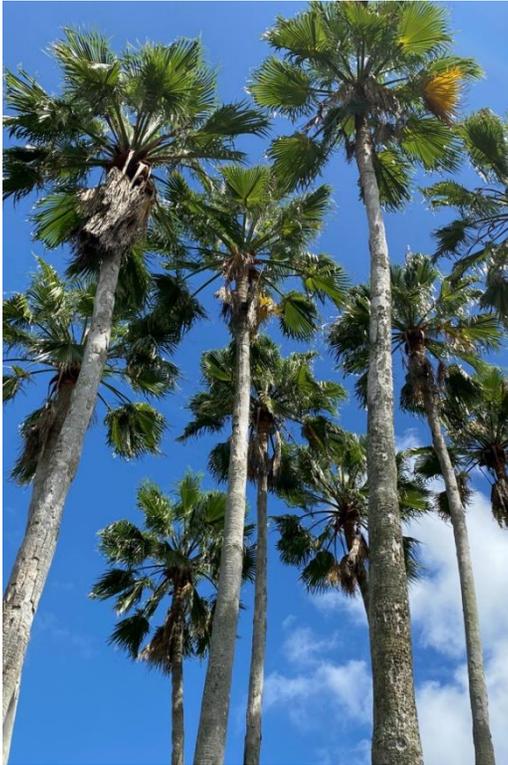
The current Tree Care Ordinance for the City of Cocoa was reviewed. Although the vast majority of the language was applicable and current, certain elements were highlighted in the document for their potential updating. Among these items for update were:

- Updating the City's Tree Ordinance with the most recent 2019 Florida Exotic Pest Plant Council's (FLEPPC) List of Invasive Plant Species will help crews to determine with is classified as native and as non-native plant species. For example, a bottlebrush (*Callistemon viminalis*) tree was a popular mid-story tree planted in Right-of Ways all over the southeast United States. Today the bottlebrush is listed on the 2019 FLEPPC

List as a Category II exotic species. Revising the Tree Care Ordinance to include the updated list of trees and then replacing those trees with a Florida #1 or greater quality tree with adequate caliper compensation would be useful in reestablishing the coastal native plant ecosystem diversity.

- Removal of dead trees can be problematic to wildlife in urban settings. Many birds use the hollows to forage for insects and to create nesting sites in urban areas. Where practical, consider revising the Tree Ordinance to leave some dead trees where risk to targets is low and only remove dead trees when the target area is a high risk to injury or property damage.

- Although oaks are a prominent tree within the City's Tree Community, all trees, involving the City's attention should be included under the review of the tree committee. Either mitigating or attaining the proper replacement tree in the most appropriate location should be the main object of the tree committee.

3.2 Public Education Brochure

Who We Are

About us

The Public Works Department accomplishes its mission by providing strategic planning, financial and budget management, resource coordination, guidance and leadership to its seven divisions:

- Streets
- Stormwater
- Beautification
- Facilities Maintenance
- Capital Projects
- Fleet Management
- Sanitation

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CITY OF COCOA PUBLIC WORKS

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Lee Wenner Park: Community Public Green Spaces..

Main Focus of Inventory and Management Strategies

Urban Forest Management Plan Summary:

- The importance to consider planting the "right tree at the right place" (https://www.arborday.org/ trees /bulletins/documents/004- summary.pdf)

- A goal that should precede the planting or replacement of any trees across the City of Cocoa.

2021 CITY OF COCOA URBAN FOREST MANAGEMENT PLAN

Plant the "Right tree, in the Right Place".

City of Cocoa Streets and Rights-of-Way

Mission

The mission of the Public Works Administration is to enhance Cocoa's quality of life through effective and efficient maintenance, construction, and operation of its physical environment.

Responsibilities

The Public Works Department also has the responsibility for hurricane preparedness, pre-storm preparations, and post-storm event clean up.

But what is a tree and what is the measure of the beauty in one specimen compared to another?

Infrastructure and Perpetual Maintenance

Trees that were impacting sidewalks or were an infrastructure hazard should be prioritized for removal and potentially subsequent replanting.

The Beauty and Value of Trees

The primary objective of a tree is to capture light, without which it cannot live. In the pursuit of light, a tree never grows anything it does not need.

Mitigate Risk and Replace Trees Appropriately.

Tree City USA

The City of Cocoa has been recognized as a Tree City USA. The Tree City USA program has been greening up cities and towns across America since 1976. It is a nationwide movement that provides the framework necessary for communities to manage and expand their public trees.

4.0   METRIC TO MEASURE PROGRESS

Tree condition is an important metric used to express the health of a tree and any potential risks posed through it remaining on site. For this study, trees were rated, in decreasing level of health, either Excellent, Good, Fair, Poor, or Very Poor. When examining the condition of the trees throughout the City of Cocoa, an overwhelming majority of the trees collected were rated as being in "Excellent" in both the public (95%) and street (95%) designations. "Good" was the next highest percentage for both with 3.1% and 3.7%, respectively; the other designations differ less than 1% between the two tree locations and range from 0.12% to 0.81%. Based on these metrics, the overall tree populations in the public areas and streets of the City are deemed to be healthy.

Using the rating scale in the tree inventory of 0-10 is a reliable metric to gear maintenance and replanting justifications for yearly budgeting, especially for the immediate subsequent years following the 2020 inventory. This metric can be utilized to measure the success of routine maintenance and replacement of "Poor" and "Very Poor" designated trees. This immediately provides guidance that impacts the success of the tree community. Many of the dead trees found throughout the City were cherry laurel (*Prunus caroliniana*). Although these species is considered native, is not a tree that maintains well, so replacing those trees with a similar tree (mid-story) would go far in providing relief from maintenance while improving the health of the tree community. This pattern, of reducing a trouble (dead or hazardous) tree and replacing it with a tree that requires less attention from the City's maintenance division, is one metric to measure progress being made in the City's tree care system.

It was observed over the course of the inventory that the Drake elm (*Ulmas parvifolia*) and boxelder (*Acer negundo*) are planted through the city. Specifically, drake elms are planted throughout the Cocoa Village area in rights-of-way (ROW) that line the streets. The Drake elm is not considered native to Florida. In the field review, arborists observed many of these trees to be in "Poor" or "Very Poor" condition even though many of the trees were regularly irrigated and maintained. Replacing this mid-story non-native with a more salt tolerant native elm/other species is another metric for improving the tree community success. The boxelder, although native, was also observed as having low vigor, especially along the Michigan Avenue ROW. Although this tree is native, it is listed as a FACW species, which is usually a transitional tree buffering wetlands in native habitats. The box elder is not proliferating because its nature is grown in wet conditions for a portion of the year. Consider replacing these trees with a native upland tree with similar specifications in height and spread. These initiatives would allow the City to proactively manage its tree population before these problematic, unhealthy trees become a hazard to pedestrians.

Another way to determine the budget needs for the City and to measure progress is to evaluate the notes taken by the field arborists while conducting the inventory. Trees that were impacting sidewalks or were an infrastructure hazard should be prioritized for removal and potentially subsequent replanting. Examples of these impacts include sidewalk heaving, powerline intersections, or high traffic areas. The City may require additional funds to increase the current tree and canopy coverage each year in an attempt to raise its UTC percentage closer to similar cities within Florida. A metric of measuring the increase in tree canopy can simply be to plant

more trees than what are removed each year. By planting additional mid-story trees that require less area to proliferate, the City can greatly increase the tree canopy while adding diversity to the tree community and avoiding potential infrastructure damage that would be present with a tree with a large root system or height enough to impact overhead powerlines. Additional funds should be allocated each year to increase the tree canopy, not merely maintain it. With more infrastructure and development increasing each year, the amount of natural areas and tree-dominated locations become important to absorb rainwater that is deflected by impermeable surfaces as well, along with providing shade and lowering the utility payments of surrounding structures. A correlation from development project and tree plantings should be established to maintain a favorable balance that buffers natural disasters, floods, and environmental devastation in the future.

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